Rashtreeya Sikshana Samithi Trust

R. V. College of Engineering

(Autonomous Institution affiliated to VTU, Belagavi)

Department of Telecommunication Engineering

Master of Technology (M.Tech.)

Digital Communication Engineering

Scheme and Syllabus of
Autonomous System w.e.f 2016

R.V. College of Engineering, Bengaluru – 59

(Autonomous Institution affiliated to VTU, Belagavi)

Department of Telecommunication Engineering

Vision:

Imparting quality education in Electronics and Telecommunication Engineering through focus on fundamentals, research and innovation for sustainable development

Mission:

- Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.
- Create state-of-the–art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering Education
- Encourage students to be innovators to meet local and global needs with ethical practice
- Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Center of Excellence with focus on affordable innovation.
- Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.

Program Educational Objectives (PEO)

Graduates of M. Tech. in Digital Communication Engineering will be able to:

PEO 1: Analyze, evaluate, design and solve complex engineering problems in Electronic communication using modern tools.

PEO 2: Demonstrate the skills in the core areas like Applied Mathematics, Signal Processing, Networking and Wireless Communication.

PEO 3: Carry out research and innovation through lifelong learning adapting to technological changes

Program Outcomes (PO)

Graduates in Digital Communication Engineering will be able to:

PO 1: Scholarship of Knowledge: Acquire in-depth knowledge of Mathematics, Digital Communication with ability to evaluate, analyze and synthesize complex problems.

PO 2: Critical Thinking: Analyze complex engineering problems to make intellectual and/or creative advances for conducting research

PO 3: Problem Solving: Conceptualize and solve engineering problems, to arrive at optimal solutions, considering standards and safety, societal and environmental factors.

PO 4: Research Skill: Formulate research problem through literature survey, find the gap and apply appropriate research methodologies to solve and contribute to the development of

technological knowledge.

PO 5: Usage of modern tools: Learn and apply modern engineering tools to solve complex engineering problems like Matlab application tools, Advance Design Software (ADS), System View, Optisim etc.

PO 6: Collaborative and Multidisciplinary work: Contribute positively to collaborative-multidisciplinary scientific research, in order to achieve goals set.

PO 7: Project Management and Finance: Manage projects efficiently in Digital communication and allied disciplines keeping financial factors in mind.

PO 8: Communication: Communicate and present their work on complex engineering activities with the engineering community and share with peers confidently and effectively.

PO 9: Life-long Learning: Ability to engage in life-long learning independently, to improve knowledge and competency.

PO 10: Ethical Practices and Social Responsibility: Practice professional code of conduct, ethics in research with an understanding of responsibility so as to contribute to the community for sustainable development of society.

PO 11: Independent and Reflective Learning: Introspect critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

MASTER OF DIGITAL COMMUNICATION ENGINEERING - Program

Program Specific Criteria (PSC)

Lead Society: Institute of Electrical and Electronics Engineers

1. Curriculum:

The curriculum shall include Advanced mathematics applied to telecommunication system design; Engineering topics, including programming, necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components; Communication theory and systems. The curriculum must prepare graduates for design and operation of Telecommunication networks for services such as voice, data, image, and video transport.

2. Faculty

The professional competence of the faculty must be in Applied Mathematics, Engineering, Telecommunication System design and integration.

Program Specific Outcomes (PSO)

Graduates in M. Tech (Digital Communication Engineering) will be able to:

PSO 1: Analyze, design and implement emerging Digital communications systems using devices, sub-systems, propagation models, networking of Wireless and Wire line communication systems.

PSO 2: Exhibit Technical skills necessary to choose careers in the design, installation, testing, management and operation of Digital Communication systems.

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Department of Telecommunication Engineering

M. Tech. in Digital Communication Engineering

THIRD SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Experiential Learning S**	
1	16 MDC31/ 16MRM31	Wireless Communication (Theory and Practice)	TE	4	0	1	0	5
2	16MDC32x	Elective -5	TE	4	0	0	0	4
3	16MDC33x	Elective -6	TE	4	0	0	0	4
4	16MDC34x	Elective -7	TE	4	0	0	0	4
5	16MDC35	Internship / Industrial Training	TE	0	0	3	0	3
6	16MDC36	Technical Seminar	TE	0	0	2	0	2
		Total		**16**	**0**	**6**	**0**	**22**

Elective –5			
16MDC321	Modern Communication Systems	16MDC322	Multimedia Communication
Elective –6			
16MDC331	Network Security	16MDC332/16MRM332	Satellite Navigation Systems
Elective –7			
16MDC341	Short Range Wireless Communication	16 MDC342/16MRM342	Broadband networks

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Department of Telecommunication Engineering

M. Tech. in Digital Communication Engineering

FOURTH SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Experiential Learning S**	
1	16MDC41	Major Project	TE	0	0	26	0	26
2	16MDC42	Seminar	TE	0	0	2	0	2
		Total		**0**	**0**	**28**	**0**	**28**

III SEMESTER

WIRELESS COMMUNICATION						
Course Code	:	**16MDC31/ 16MRM31**		**CIE Marks**	:	**100+50**
Hrs/Week	:	**L:T:P:S:**	**4:0:1:0**	**SEE Marks**	:	**100+50**
Credits	:	**5**		**SEE Duration**	:	**3 + 3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. To describe physical modeling for wireless channel, diversity techniques and capacity of wireless channel.
2. To explain the Space diversity in MIMO system, MIMO channel modeling and multiplexing capability of MIMO channels
3. To analyze the antenna considerations in MIMO Channels, Modeling of MIMO fading channels.
4. To identify and justify MIMO in wireless communication applications.

Unit – I	**10Hrs**

Wireless channel: physical modeling for wireless channels, input/output model of wireless channel, time and frequency response.

Point to point communication: detection in Rayleigh fading channel, time diversity, antenna diversity, frequency diversity

Unit – II	**10Hrs**

Diversity: Introduction, Micro diversity, Macro diversity and simulcast, Combination of Signals, Error Probability in fading channels with diversity Reception, transmit diversity.

Unit – III	**10Hrs**

Capacity of wireless channels: AWGN channel capacity, resources of AWGN channel, Linear time invariant Gaussian channels, capacity of fading channels.

Unit – IV	**10Hrs**

MIMO Systems: Introduction, Space Diversity and Systems Based on Space Diversity, Smart antenna system and MIMO, MIMO based System architecture, MIMO exploits multipath, Space time Processing, Antenna considerations for MIMO, MIMO channel Modeling, MIMO Channel measurement, MIMO Channel capacity, Space Time Coding, Advantages and Applications of MIMO, MIMO applications in 3G

Unit – V	**10Hrs**

Spatial multiplexing and channel modeling: multiplexing capability of MIMO channels, physical modeling of MIMO channels, modeling MIMO fading channels.

Laboratory Component

MATLAB, Aero hive simulator, System vue, Qualnet.

1. Implementation of an adaptive equalizer based on LMS algorithm and studies the effect of step size on MSE.
2. Determination of error probabilities for orthogonal signaling using MATLAB employing (i) Hard Decision (ii) Soft decision decoding.
3. Simulation and analysis of the performance of a QPSK digital radio link in a Rayleigh fading environment.
4. Comparison of Digital modulation schemes over AWGN and flat fading channels.
5. Setup and analyse WiMax, UMTS, 2G, Wireless senor networks with different energy models

and VoIP
6. Case Study: Link Budget Calculation in WPAN using the AeroHive Simulator**.**

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Describe physical modeling for wireless channel and diversity techniques.
CO2: Analyze the Modeling of MIMO fading channels.
CO3: Evaluate diversity techniques and multiplexing capability of MIMO channels.
CO4: Design a MIMO system with smart antennas in wireless communication applications

Reference Books:

1.	David Tse, P. Viswanath, "Fundamentals of wireless communication", Cambridge, 2006.ISBN 0-521-68749-7
2.	Andreas Molisch, "Wireless communications", John Wiley & Sons , 2012
3.	Upen Dalal, "Wireless communication", Oxford university Press, 2009

Scheme of Continuous Internal Evaluation (CIE) for Theory
CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Continuous Internal Evaluation (CIE) for Practical
CIE for the practical courses will be based on the performance of the student in the laboratory, every week. The laboratory records will be evaluated for 40 marks. One test will be conducted for 10 marks. The total marks for CIE (Practical) will be for 50 marks.

Scheme of Semester End Examination (SEE) for Theory
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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE) for Practical
SEE for the practical courses will be based on conducting the experiments and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	---	L	L	---	---	---	---	---
CO2	M	H	H	M	H	---	---	---	---	---	---
CO3	---	H	---	---	H	H	---	H	H	---	---
CO4	---	H	---	M	H	---	---	H	H	---	---

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	L
CO2	H	M
CO3	M	L
CO4	H	H

MODERN COMMUNICATION SYSTEMS						
Course Code	:	**16MDC32**		**CIE Marks**	:	**100**
Hrs/Week	:	**L:T:P:S:**	**4:0:0:0**	**SEE Marks**	:	**100**
Credits	:	**4**		**SEE Duration**	:	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Understand the basics of broadband access networks & various Passive optical network architectures.
2. Describe optical technologies in PONs.
3. Analyze the system requirements & Transceivers of PON.
4. Appreciate the importance of Ranging, Dynamic Bandwidth Allocation & its requirements.

Unit – I	**10Hrs**

Introduction & Review of PON architectures: Digital Subscriber Line, Cable Modem, Fiber Access Systems, Ethernet, WDM in optical access networks, FTTx Overview, TDM-PON vs WDM PON, Wavelength division duplex, Power splitting strategies in TDM-PON, Standard Commercial TDM-PON Infrastructure: OLT & ONU structures, Burst mode operation & ranging.

Unit – II	**10Hrs**

APON/BPON, GPON, EPON : ATM-PON & ITU-T G.983, Collision resolution & wavelength overlay in APON/GPON, GPON & ITU-T G.984, APON/GPON protection switching, Ethernet layering architecture & EPON, EPON PMD layer, Ethernet framing, MultiPoint Control Protocol (MPCP), GPON & EPON comparison.

Unit – III	**10Hrs**

WDM-PON, Optical technologies in Passive optical access networks: Advantages & challenges of WDM-PON, AWG Router, Broadcast Emulation & point to point operation, WDM on WDM, Wavelength specific ONUs, Colorless ONUs, Source free ONUs.

Unit – IV	**10Hrs**

Transceivers for PON: Introduction, PON system requirements: Power budgets & specifications, physical layer specifications, Burst mode timing requirements, Transceiver technologies: Building blocks, Transmit & Receive devices, BOSA, PON Transceiver modules, Burst Mode electronics.

Unit – V	**10Hrs**

Ranging & Dynamic Bandwidth Allocation: Ranging: Purpose, Ranging procedures, Ranging protocol of G-PON & EPON**,** Dynamic Bandwidth allocation**:** Overview, Target service, Requirements**,** Traffic control fundamentals, IPACT & its variants, Improved DBA.

Course Outcomes:

After going through this course the student will be able to

CO1: Understand the basics of PON architectures, APON/BPON, GPON, EPON standards, components/subsystems & Traffic modeling.

CO2: Apply the knowledge of architectures, components, standards, networking & traffic modeling of PON, GPON,EPON for developing PON.

CO3: Analyze various merits & demerits of all types of passive optical networks.

CO4: Evaluate the performance of various Passive Optical Networks.

Reference Books:	
1.	Cedric Lam, "Passive Optical Networks: Principles and Practice", Elsevier publications, 2007.
2.	Glen Kramer, "Ethernet Passive Optical Networks", Mc-Graw-Hill publications, 2005
3.	D. Hood, Elmar Trojer, "Gigabit-capable Passive Optical Networks", John- Wiley Publications, 2012.

Scheme of Continuous Internal Evaluation (CIE)
CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)
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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	L	M	-	L	-	-	H	L	-
CO2	H	M	M	M	-	M	-	-	H	L	-
CO3	H	H	M	M	-	L	-	-	H	M	M
CO4	H	M	H	M	-	L	-	-	H	M	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

CO/PSO	PSO1	PSO2
CO1	H	M
CO2	H	M
CO3	H	H
CO4	M	H

MULTIMEDIA COMMUNICATION						
Course Code	**:**	**16MDC322**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S :**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Explain data representation, define QoS parameters
2. Describe the multimedia communication standards and compression techniques
3. Analyze and apply internet protocols for multimedia transport.
4. Apply multimedia communication across networks.

Unit – I	**10Hrs**

Multimedia Communications: Review of Multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.

Unit – II	**10Hrs**

Video compression: Video compression principles, video compression standards: H.261, H.263, MPEG 1, MPEG 2, and MPEG 4, DivX, Flash Video, Avi, WMV.

Unit – III	**10Hrs**

Standards and Protocols: JPEG 2000 compression standard – development process, features, architecture, bit stream, MPEG – 21 multimedia framework,
Protocols - RTP, RTCP, RTSP, RSVP, DVMRP

Unit – IV	**10Hrs**

Multimedia Entertainment Networks: Introduction, Cable TV networks, Satellite TV networks, Terrestrial TV networks, High speed PSTN access Technologies.

Unit – V	**10Hrs**

Multimedia Communication Across Networks: Layered video coding, error resilient video coding techniques, multimedia transport across IP networks. Multimedia across wireless, multimedia in mobile networks.

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Explain multimedia information representation, networks and compression techniques.
CO2: Analyze applications like interpersonal communication, interactive communication over the internet and entertainment networks.
CO3: Apply various coding methods and compression techniques.
CO4: Analyze and apply internet protocols for multimedia transport.

Reference Books:

1.	Fred Halsall, "Multimedia Communications", Pearson education, 2001
2.	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004
3.	Raif Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002

Scheme of Continuous Internal Evaluation (CIE)
CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)
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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	---	---	---	---	---	---	---	---	---
CO2	H	L	---	---	---	---	---	---	---	---	---
CO3	H	H	---	M	---	---	---	---	M	---	H
CO4	H	H	H	M	H	---	---	---	M	---	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	L
CO2	M	L
CO3	H	H
CO4	H	H

NETWORK SECURITY						
Course Code	**:**	**16MDC331**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S:**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Understand the basic concepts of Cryptography and network security.
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
3. Identify the security issues in the network and resolve it.
4. Understand the various methods to maintain E-mail security ,and web security.
5. Understand the security technology like firewall and Intrusion Detection and Prevention System.

Unit – I	**10Hrs**

Introduction: OSI Security Architecture , Classical Encryption techniques: Symmetric Cipher Model, Substitution Techniques, Transportation Techniques,
Block Ciphers and Data Encryption Standards, AES Origin, AES Structure, AES Round Functions, AES Key Expansion.

Unit – II	**10Hrs**

Public Key Cryptography: Key Management - Diffie-Hellman key Exchange, Elliptic Curve Architecture and Cryptography , Confidentiality
using Symmetric Encryption,- Public Key Cryptography and RSA.

Unit – III	**10Hrs**

Authentication and HASH Function: Authentication requirements -
Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm – SHA3352, Security of MAC- HMAC, Digital Signatures.

Unit – IV	**10Hrs**

Authentication Applications: Kerberos X.509 Authentication Service , Electronic Mail Security : PGP - S/MIME, IP Security, Web Security.

Unit – V	**10Hrs**

SYSTEM LEVEL SECURITY: Intrusion detection , password management , Viruses and related Threats , Virus Counter measures , Firewall Design Principles , Trusted Systems.

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Describe the issues addressed by Network Security and understand the concepts of cryptography and Network security.

CO2: Apply cryptographic techniques and algorithms to provide security to the transmitted information..

CO3: Analyze the concepts of Authentication and Hash functions.

CO4: Understand and analyze System level security issues.

Reference Books:	
1.	William Stallings, "Cryptography And Network Security - Principles and Practices", Prentice Hall of India, Third Edition, 2003.
2.	Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.
3.	Walter j Woralski, "ADSL and DSL Technologies", McGraw Hill computer Communication series, 1998.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	---	M	---	M	---	L	H	L	L
CO2	M	H	---	M	---	M	---	L	M	L	L
CO3	M	M	---	M	---	M	---	L	M	L	L
CO4	---	M	---	---	---	M	---	L	M	L	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	M
CO2	M	M
CO3	M	M
CO4	M	M

SATELLITE NAVIGATION SYSTEMS						
Course Code	**:**	**16MDC332**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Understand basic concepts of radar components and apply these concepts in the Communication to extract information.
2. Analyze the Radar signal in presence of noise and clutter.
3. Describe Signal Structure, Characteristics, and Information Utilization and Antenna Characteristics required for Satellite Navigation System.
4. Describe and analyze data errors in Satellite Navigation System.

Unit – I **10Hrs**

An Introduction to Radar:

Basic Radar, The simple form of the Radar Equation, Radar Block Diagram, Radar Frequencies, Application of radar, Types of Radars.

The Radar Equation:

Introduction, Detection of signals in Noise, Receiver Noise and the Signal-to Noise Ratio, Probability of Detection and False alarm, Integration of radar Pulses, Radar Cross Section of the targets, Radar Cross sections of Fluctuations, Transmitter power, Pulse repetition Frequency, Antenna Parameters, System Losses.

Fundamentals of Pulse Compression Waveforms:

Range Resolution, Straddle Loss, Pulse Compression Waveforms, Pulse Compression Gain, Linear Frequency Modulation Waveform, Matched filter implementations, Sidelobe reductions in an LFM waveforms, Ambiguity Function, Phased Coded waveforms, Biphase codes, Polyphase codes.

Unit – II **10Hrs**

Information Available from Radar Signals:

Basic Radar measurement, Theoretical Accuracy of Radar Measurement, Ambiguity Function, Pulse Compression, Target reorganization.

Radar Antenna

Reflector antennas, Electronically steered phased array antennas, Phased shifters, Low side lobes antennas

MTI and Pulse Doppler Radar:

Introduction to Doppler and MTI Radar, Delay-Line Cancellers, Staggered Pulse Repetition frequencies, Doppler Filter Banks, Digital MTI processing, Moving Target detector, Limitations to MTI Platform, Pulse Doppler Radar.

Unit – III **10Hrs**

Terrestrial Network based positioning and navigation :

Fundamentals, positioning in cellular networks, positioning in WLANs, Positioning in Wireless sensor networks, Ranging and Navigation in RADAR systems-Radar equation, clutter, Digital MTI, Tracking.

Unit – IV **10Hrs**

Orbits and Reference Systems:

Basics of satellite orbits and reference systems, two body problem, orbit elements, timer system and timer transfer using GPS, coordinate systems, GPS orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris, Tracking problems.

Unit – V	10Hrs

Satellite-based navigation systems:
Global Navigation satellite systems (GNSS), GNSS receivers, Augmented systems and assisted GNSS.

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Applying radar concepts to extract information form the radar signal.
CO2: Explain the basic principles, Signal structure and performance parameters, Signal Acquisition and Tracking, Data Errors of the satellite navigation System.
CO3: Compute the user position, velocity and system parameters in Satellite Navigation System
CO4: Analyze the signal acquisition and tracking system and design of Satellite Navigation Receiver Components/System.

Reference Books:

1.	M. L Skolnik, "Introduction to RADAR Systems", TATA Mcgraw-Hill, 2001.
2.	Mark A Richards, James A Scheer, William A Holam, "Principles of Modern Radar Basic Principles", Yes Dee Publishing Pvt Ltd, 2012
3.	Mohinder S Grewal, Angus P. Andrews ,Chris G. Bartone "Global Navigation Satellite Systems, Inertial Navigation, And Integration " 3rd Edition, John Wiley and Sons , 2013, ISBN 978-1-118-44700-0
4.	B. Hoffman, Wellenhof, H. Lichtenegger and J. Collins, "GPS - Theory and Practice", 5th revised edition, Springer, NewYork, 2001.
5.	Davide dardari, Emanuela Falletti, Marco Luise, " Satellite and Terrestrial Radio Positioning techniques- A signal processing perspective", Elsevier Academic Press, 1st Edition, 2012

Scheme of Continuous Internal Evaluation (CIE)
CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)
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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	---	---	---	---	---	L	---	---
CO2	H	L	L	---	---	---	---	---	L	---	---
CO3	H	M	H	---	---	---	---	---	L	---	---
CO4	H	H	M	---	---	---	---	---	L	---	---

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	--
CO2	L	--
CO3	M	--
CO4	M	L

SHORT RANGE WIRELESS COMMUNICATION						
Course Code	**:**	**16MDC342**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Cover state-of-the-art communications technologies and standards, including Bluetooth, Wireless LANs, and cellular networks.
2. Review various channel estimation techniques and evaluate the performance of Short range wireless communication systems (SWC).
3. Identify various PHY layer design issues of high rate systems.
4. Understand the technical challenges and emerging concepts in SWC

Unit – I	**10Hrs**

Introduction to Short Range Wireless Communication (SWC): Growth of standards, Market, Wireless architecture, wireless parameters, Enabling factors, Design rules for SRC, Short-range vs medium/long range communications., High rate vs Low rate communications, Review of frequency regulations and available frequency bands, State of the Art SWC systems: WLAN, Bluetooth, ZigBee, NFC, UWB, BAN, 60GHz, LiFi, and VLC.

Unit – II	**10Hrs**

Channel Estimation for high-rate systems: High rate UWB and 60GHz communications - Overview and Application Scenario's, ECMA-368 High rate UWB standard, ECMA-387 Millimeter wave radio standard, IEEE 802.15.3C, Channel models for high rate systems, Review of channel estimation techniques, Impact on channel estimation error on performance.

Unit – III	**10Hrs**

Adaptive Modulation and coding for high rate systems: Adaptive modulation and coding, AMC in MB-OFDM systems, WPAN link architecture in ECMS-368, Packet level model for UWB channels with shadowing, WPAN link performance analysis, AMC in 60GHz millimeter wave radio systems, modulation techniques and system architectures for multi-Gb/s, RF Packaging and Antenna design issues.

Unit – IV	**10Hrs**

PHY Layer Design Issues for High Data Rate (Gbps) communication: Principles of MIMO systems, MIMO for UWB systems, Adaptive Antenna Array Systems Design, active phased array based on analog beam-forming, PAPR Reduction for Discrete-time OFDM Signals, Soft Iterative Equalization for Clipped and Filtered COFDM Signals, power-amplifier utilization - significantly improved by clipping and filtering; matching receive algorithm for equalization of in-band distortion noise.

Unit – V	**10Hrs**

Low rate systems & Emerging concepts in Short Range communications: ZigBee networks and low rate UWB communications - Overview and application examples, ZigBee, Impulse radio based UWB (IEEE 802.15.4a), Low latency MAC for WPANs (IEEE 802.15.4e), Active RFID (IEEE 802.15.4f), Smart utility Networks (IEEE 802.15.4g), Energy efficiency in Low rate systems- Background, Energy saving MACs.

UROOF' (UWB radio-over-optical-fibre), UROOF - user applications and basic system configuration, Fundamentals of UROOF Technologies, Link Analysis of UROOF Systems, Analysis of UWB Technologies for UROOF, Visible Light Communications, Discrete Multitone

Modulation, Potential applications of VLC, Technical challenges of implementing VLC.

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Explain the architectures and operations of state-of-the-art short range wireless networking standards.
CO2: Analyze the error performance of short range communication systems in presence of noise and other interferences.
CO3: Gain in-depth knowledge about multicarrier and multiantenna techniques and their applications in current and emerging communication systems.
CO4: Identify various technical challenges on low rate systems and short range communication systems.

Reference Books:

1. Guvenc et al. Reliable Communications for Short-Range Wireless Systems. Cambridge University Press, 2011.
2. Hunn, Nick, "Essentials of short-range wireless**",** Cambridge University Press, 2010.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	---	---	M	---	---	---	H	---	---	---
CO2	M	M	M	H	H	M	---	H	M	---	H
CO3	L	M	M	M	M	M	---	H	L	---	H
CO4	---	M	---	M	M	H	---	H	L	H	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	M
CO2	H	H
CO3	H	H
CO4	L	M

BROADBAND NETWORKS						
Course Code	**:**	**16 MDC342/ 16MRM342**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

This course will enable student to:

1. Analyze the transmission mechanism in the physical layer.
2. Apply QoS Mechanism in MAC layer design
3. Design a WiMAX system with Radio considerations

Unit – I	**10Hrs**

Review Of Access Technologies: Phone Line modem, cable access, ISDN, Emerging Broad band Technologies: Cable DSL, Fiber and Wireless.

Digital Subscriber Lines: Asymmetric Digital subscriber lines (ADSL) ,Rate Adaptive subscriber line (RADSL),ISDN Digital subscriber line (IDSL) ,High bit rate DSL (HDSL),Single line DSL (SDSL),very high bit rate DSL (VDSL), Standards for XDSL & Comparison.

Unit – II	**10Hrs**

Cable Modem: Cable Modem, DOCSIS- Physical Cabling, Dual Modem Operation, Hub Restriction, Upstream Operation, Downstream operation ,Access control, framing Security sub layer, Data link layer, LLC & Higher layers, ATM centric VS IP, centric cable modem.

Unit – III	**10Hrs**

Fiber Access Technologies: Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison.

Unit – IV	**10Hrs**

Introduction to Broadband Wireless Access : The Need for Wireless Data Transmission, Wireless Networks and Broadband Wireless Access (BWA), Applications of BWA, History of BWA Technologies

3G Networks : Evolution from GSM, 3G Services and Applications - UMTS network structure - Protocol stack

4G – LTE: Overview of LTE Networks - Need for LTE- LTE Architecture, Radio Protocol stack , Interfaces, Security Protocols.

Unit – V	**10Hrs**

802.11n: Introduction, Channel Structure and Layout ,802.11n Speed, Mandatory PHY Features, Mandatory MAC Features, Network Architecture for 802.11n, 802.11n Hardware Coverage and Capacity Planning ,Network Management Design and Implementation issues

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Understand the framework of broad band access technologies.
CO2: Analyze the architectures of broad band access technologies.
CO3: Compare the functionalities, protocols and architectures of broad band access technologies.
CO4: Design broad band access systems.

Reference Books:	
1.	Niel Ransom and Albert A. Azzam, "Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS", McGraw Hill, 1999.
2.	Gilbert Held, "Next Generation Modems: A Professional Guide to DSL and cable modems", John Wiley & sons.
3.	Walter j Woralski, "ADSL and DSL Technologies", McGraw Hill computer Communication series, 1998.
4.	Matthew S. Gast," 802.11n: A Survival Guide", O'Reilly Media, 2012.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study component will be for 20 marks and the students are supposed to share orally in the class and submit optimized solution after discussions to faculty in-charge. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	---	---	---	---	L	---	---	---	---	M
CO2	H	H	H	---	---	L	---	---	---	---	M
CO3	H	---	H	H	M	L	L	M	L	L	M
CO4	H	---	H	H	M	L	L	M	L	L	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	L
CO2	M	L
CO3	M	M
CO4	H	H

INTERNSHIP / INDUSTRIAL TRAINING						
Course Code	**:**	**16MDC35**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:6:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**3**		**SEE Duration**	**:**	**30 min**

GUIDELINES FOR INTERNSHIP

Course Learning Objectives (CLO):

This course will enable student 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 use ICT tools such as Skype to report their progress and submission of periodic progress reports to the faculty members.
5. Every student has to write and submit his/her own internship report to the designated faculty.
6. 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.
7. 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.
8. 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.

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%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	M	H	M	---	M	---	---	---	L	---
CO2	---	---	---	H	M	M	---	L	---	---	---
CO3	---	---	---	---	L	---	M	H	H	---	---
CO4	---	---	---	---	L	---	H	---	---	M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	---
CO2	L	L
CO3	---	M
CO4	M	H

GUIDELINES FOR INDUSTRIAL TRAINING

Course Learning Objectives (CLO):

This course will enable student to:

1. Understand the process of applying engineering knowledge to industrial products & processes
2. Explain the importance of skilling, training and resource management.
3. Comprehend the importance of team work, communication and sustainable solutions.
4. Imbibe values, professional ethics for lifelong learning.

1. The duration of industrial training must be for a minimum of 1 week and maximum of 8 weeks on full time basis.
2. Industrial Training in which students pays a fee to the organization / industry will not be considered.
3. He/she can undergo training in one or more industry /organization.
4. The student must submit letters from the industry clearly specifying his / her name and the duration of the training provided by the company with authorized signatures.
5. Industrial training must be related to the field of specialization or the M.Tech program in which the student has enrolled.
6. Students undergoing industrial training are advised to use ICT tools such as Skype to report their progress and submission of periodic progress reports to the faculty members.
7. Every student has to write and submit his/her own industrial training report to the designated faculty.
8. Students have to make a presentation on their industrial training in front of the departmental cmmittee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.
9. 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.
10. The broad format of the industrial training report shall be as follows
    - Cover Page
    - Certificate from College
    - Training Certificate from Industry / Organization
    - Acknowledgement
    - Executive Summary
    - Table of Contents
    - Chapter 1 - Profile of the Organization –Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 2 – Details of the Training Modules
    - Chapter 3 – Reflections – Highlight specific technical and soft skills that you acquired

    References & Annexure

Course Outcomes:

After going through the industrial training the student will be able to:

CO1: Understand the process of applying engineering knowledge to solve industrial problems

CO2: Develop skills through training relevant to industrial requirement

CO3: Communicate effectively and work in teams

CO4: Imbibe ethical practices and develop it as life skill.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of 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 on the application of engineering knowledge 25%
(2) Ability to comprehend the importance of skilling and training 25%
(3) Importance of communication, professional ethics, sustainability 20%
(4) Oral Presentation and Report 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	M	H	M	---	M	---	---	---	L	---
CO2	---	---	---	H	M	M	---	L	---	---	---
CO3	---	---	---	---	L	---	M	H	H	---	---
CO4	---	---	---	---	L	---	H	---	---	M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	---
CO2	L	L
CO3	---	M
CO4	M	H

GUIDELINES FOR INDUSTRIAL VISITS

Course Learning Objectives (CLO):

This course will enable student to:

1. Understand the role of industries and service organization in meeting the demands of the society.
2. Explain the working of different industries and organizations with an engineering perspective
3. Comprehend the importance of team work, communication and sustainable solutions.
4. Imbibe values, professional ethics for lifelong learning.

1. Student must visit a minimum of THREE organizations/industry. The duration of the visit per organization must be for ONE full day, during which he/she must comprehend the importance of organization structure, function of various departments, application of engineering knowledge, resource management, and importance to environment and safety, professional ethics.
2. It is mandatory to visit ONE private multi-national company or public sector industry / organization, ONE medium-small enterprise and ONE rural based or NG organization.
3. The student must submit letter from the industry clearly specifying his / her name and the date of visit to the industry with authorized signatures.
4. Industrial visit must be related to the field of specialization or the M.Tech program in which the student has enrolled.
5. Every student has to write and submit his/her own report on each industrial visit and submit the report to the designated faculty advisor for evaluation.
6. A photograph outside the industry with the name and logo of the industry in the background along with the students and faculty members could be included in the report.
7. Students have to make a presentation on their industrial visit 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 final report.
8. 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.
9. The broad format of the industrial visit report shall be as follows
    - Cover Page
    - Certificate from College
    - Acknowledgement
    - Synopsis / Executive Summary
    - Table of Contents
    - Chapter 1 - Profile of the PSU or MNC – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 2 – Profile of the SME – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 3 - Profile of the NGO – must include Organizational structure, services, Manpower, Societal Concerns, Professional Practices

- Chapter 4 – Comparative Analysis of PSU/MNC – SME – NGO
- References & Annexure (Permission letters from the organizations for the visit & photographs)

Course Outcomes:

After going through this course the student will be able to:

CO1: Classify the role of different industries and organization in addressing the needs of the society.

CO2: Explain the process of applying engineering knowledge in industries and organizations.

CO3: Describe the importance of communication and team work

CO4: Recognize the importance of practicing professional ethics and need for life skills.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of 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 25%
(2) Ability to comprehend the functioning of the organization/ departments 30%
(3) Importance of resource management, environment and sustainability 20%
(4) Presentation Skills and Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	M	H	M	---	M	---	---	---	L	---
CO2	---	---	---	H	M	M	---	L	---	---	---
CO3	---	---	---	---	L	---	M	H	H	---	---
CO4	---	---	---	---	L	---	H	---	---	M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	---
CO2	L	L
CO3	---	M
CO4	M	H

TECHNICAL SEMINAR						
Course Code	**:**	**16MDC36**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**	**:**	**50**
Credits	**:**	**2**		**SEE Duration**	**:**	**30 min**

Course Learning Objectives (CLO):

This course will enable student 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):

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.

Rubrics for Evaluation:

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

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	H	M	M	L	H	H	---	---	---	M
CO2	L	M	---	---	---	---	---	---	---	H	---
CO3	---	---	---	---	---	---	L	M	H	---	---
CO4	---	L	M	---	H	H	---	---	---	---	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	M	H
CO3	M	L
CO4	H	L

IV SEMESTER

MAJOR PROJECT						
Course Code	**:**	**16MDC41**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:52:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**26**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

This course will enable student 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 number of projects that a faculty can guide would be limited to three.
5. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
6. 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.
7. 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
I 5^{th} week	Synopsis, Preliminary report for the approval of selected topic along with literature survey, objectives and methodology.	20%
II	Mid-term progress review shall check the compliance with the	

10th week	objectives and methodology presented in Phase I, review the work performed.	40%
III 15th week	Oral presentation, demonstration and submission of project report. After this presentation, the student will have one week time to correct / modify his report to address the issues raised by the committee members.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic & formulation of objectives 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%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	M	L	M	L	---	---	---	---
CO2	---	---	---	L	---	---	---	M	H	---	---
CO3	---	---	---	---	L	M	M	---	---	H	---
CO4	---	---	---	---	L	M	H	M	---	---	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	L	H
CO3	M	H
CO4	H	H

SEMINAR						
Course Code	**:**	**16MDC42**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**		**50**
Credits	**:**	**2**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

This course will enable student 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, societal concerns and project management.
4. Improve his/her verbal presentation and 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 topic.
4. Topics could be in multidisciplinary areas and strongly address the technical design issues.
5. The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
6. The students must mandatorily address legal, ethical issues as related to the topic of study.
7. The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study.
8. 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 in the present context of the world and relate it to sustainability and societal relevance.

CO2: Perform literature/market/product survey and analyse information to the field of study.

CO3: Enhance presentation and report writing skills.

CO4: Develop creative thinking abilities.

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of TWO senior faculty members. 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.

Rubrics for Evaluation:

- Topic – Technical Relevance, Sustainability and Societal Concerns 15%
- Literature Review 25%

- Presentation Skills 35%
- Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	---	H	M	M	L	H	H	---	---	---	M
CO2	L	M	---	---	---	---	---	---	---	H	---
CO3	---	---	---	---	---	---	L	M	H	---	---
CO4	---	L	M	---	H	H	---	---	---	---	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	M	H
CO3	M	L
CO4	H	L