,M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name :Advanced Communication Networks							**Course Code :** PCC-ETCME101		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	100
3	-	-	3	3	25	75	-	-	
IA- In-Semester Assessment - Paper Duration –**1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite:Under graduate subjects related to Communication									

Course Objective:

At the end of this course, students should be able to

- Explain advanced concepts in Communication Networking.
- Develop protocols for Communication Networks.
- Explain the mechanisms in Quality of Service in networking.
- Implements the NetworkDesign.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand advanced concepts in CommunicationNetworking.	Understand(U)
2	Design and develop protocols for Communication Networks.	Apply(A)
3	Describe the mechanisms in Quality of Service in networking.	Understand(U)
4	Optimize the Network Design.	Analyze (AN)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
Module 1	Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.	**08 hrs**	Understand (U)
Module 2	Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (int Serv). Resource reservation in Internet. RSVP; Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties.	**08 hrs**	Apply (A)
Module 3	Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic; Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.	**07 hrs**	Apply (A)
Module 4	IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producing and controlled prefix expansion algorithms.	**10 hrs**	Understand (U)
Module 5	Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.	**08 hrs**	Understand (U)
Module 6	IPV4, IPV6, IP tunneling, IP switching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS.	**07 hrs**	Understand (U)

Reference Books:

- Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2nd edition,2000.
- Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Veriag,2001.
- Zhang Wang, "Internet QoS", Morgan Kaufman,2001.
- Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach" , Morgan Kaufman Publishers,2004.
- George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers,2005.

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Sangeeta Mishra Subject Incharge	Aradhana Manekar M.E. Coordinator	Dr. Vinit Kumar Dongre Chairman Adhoc BOS	Dr. Lochan Jolly Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)								**SEM :** I
Course Name : Optical Network								**Course Code : PCC-ETCME102**
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**			
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**			
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite:Under graduate subjects related to Communication									

Course Objective:

At the end of this course, students should be able to

- Explain optical network and WDM network design.
- Design simple optical network and understand further technology developments for future enhanced network.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand optical network and WDM network.	Understand(U)
2	Analyze optical network and understand further technology developments.	Apply(A)
3	Describe various technology developments for future enhanced network.	Understand(U)
4	Apply advanced concepts in the areas of optical network and WDM network design.	Apply(AN)

Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
Module1	**Optical Network System Components:** Couplers, isolators, circulators, filters, fiber gratings, Fabry Perot filters, arrayed waveguide grating, switches and wavelength converters .	**08hrs**	Understand (U)
Module2	**WDM network elements:** optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.	**08hrs**	Understand (U)
Module3	**SONET/SDH:** optical transport network, IP, routing and forwarding, multiprotocol label switching.	**06hrs**	Understand (U)
Module 4	**Network Survivability**: protection in SONET/SDH & client layer, optical layer protection schemes	**06hrs**	Understand (U)
Module5	**Access networks:** Optical time division multiplexing, synchronization, header processing, buffering, Introduction to PON, GPON, AON.	**08hrs**	Understand (U)
Module 6	**Control and management:** network management functions, performance and fault management, configuration management, optical safety **Deployment Consideration:** Architectural choices for next generation transport Network, Designing the transmission Layer using SDM,TDM and WDM, Unidirectional versus bidirectional WDM Systems-Long haul networks case study, Long Haul Undersea Networks, Metro Networks, Metro Ring Case study	**12hrs**	Apply(A)

Reference Books:

- Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3 rd edition,2010.
- C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE,2001.

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Lochan Jolly	Ms.AradhanaManekar	Dr. Vinit Kumar Dongre	Dr. Lochan Jolly
Subject Incharge	M.E. Coordinator	Chairman Adhoc BOS	Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)								**SEM :** I
Course Name : Wireless and Mobile Communication								**Course Code :** PEC- ETCME1021
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**			
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**			
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite:Under graduate subjects related to Communication									

Course Objective:

At the end of this course, students should be able to

- Explain appropriate mobile communicationsystems.
- Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handofftechniques
- Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages anddisadvantages.
- Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system'sperformance.
- Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using thetechnology
- Understanding upcoming technologies like 3G, 4Getc.

Course Outcomes:

At the end of this course, students will be able to:

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's taxonomy
1.	Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques	Apply (A)
2.	Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages	Apply (A)
3.	Analyze path loss and interference for wireless telephony and their influences on a mobile- communication system's performance.	Apply (A)
4.	Analyze need of equalizers in receivers in mobile communication	Understand (U)

	system.	
5.	Analyze CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology	Understand (U)
6.	Apply the concepts of 3G technologies of UMTS and CDMA 2000 and elaborate the principles of 3GPP LTE and VoLTE	Understand (U)

Module No.	**Topics**	**Hrs.**	**Cognitive levels as per Bloom's taxonomy**
Module 1	Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment.GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS),2.75 G Standards: EDGE.	**08hrs**	Apply (A)
Module 2	Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. **Wireless network planning (Link budget and power spectrum calculations)**	**08hrs**	Analyze (AN)
Module 3	Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.	**04hrs**	Apply (A)
Module 4	Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, frequency diversity, Interleaving.	**08hrs**	Understand (U)

Module 5	Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure.	**10hrs**	Understand (U)
Module 6	Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G.	**10hrs**	Understand (U)

Reference Books:

- V.K.Garg, J.E. Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition,2008.
- V.K. Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition,2009.
- T.S. Rappaport, "Wireless Communications Principles and Practice", 2nd edition,PHI, 2002.
- William C.Y. Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH,1995.
- Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London, 1997.

Prepared By:	Checked By:	Verified By:	Approved By:
Ms. Payel Saha **Subject Incharge**	**Aradhana Manekar** **M.E. Coordinator**	**Dr. Vinit Kumar Dongre** **Chairman Adhoc BOS**	**Dr. Lochan Jolly** **Mentor Dean**

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : RF and Microwave Circuit Design							**Course Code : PEC- ETCME1012**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	100
3	-	-	3	3	25	75	-	-	
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisites: Under graduate subjects related to Communication									

Course Objective:

At the end of this course, students shall be able to

- Understand the behavior of RF passive components and model active components.
- Perform transmission line analysis.
- Demonstrate use of Smith Chart for high frequency circuit design.
- Justify the choice/selection of components from the design aspects.
- Contribute in the areas of RF circuit design.

Course Outcome:

At the end of this course, students will be able to

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand the behavior of RF passive components and model active components.	Understand(U)
2	Perform transmission line analysis.	Analyze(An)
3	Demonstrate use of Smith Chart for high frequency circuit design.	Analyze(An)
4	Justify the choice/selection of components from the design aspects.	Evaluate (E)
5	Contribute in the areas of RF circuit design.	Create(C)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's
Module 1	Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.	**08hrs**	Analyze (AN)
Module 2	Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.	**08hrs**	Analyze (AN)
Module 3	Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.	**04hrs**	Understand (U)
Module 4	Nonlinearity And Time Variance Inter- symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.	**08hrs**	Analyze (AN)
Module 5	Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.	**10hrs**	Understand (U)
Module 6	Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.	**10hrs**	Create (C)

Reference Books:

- Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.
- D.M. Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.
- R. Ludwig and P. Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
- G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
- S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.

- Radmanesh, “RF and Microwave Electronics Illustrated” , Pearson Education, 2004.

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Vinit Kumar Dongre Subject Incharge	Aradhana Manekar M.E. Coordinator	Dr. Vinit Kumar Dongre Chairman Adhoc BOS	Dr. Lochan Jolly Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Computer Vision							**Course Code :** PEC- ETCME1016		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	100
3	-	-	3	3	25	75	-	-	
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

- The objective of the course is to deliver an understanding of fundamental concepts image formation and feature extraction techniques.
- The should also be able to identify and apply image segmentation and estimation schemes.
- The course also aims to enable students to develop small applications and detect objects in various applications.

Course Outcomes:

At the end of this course, students will be able to

SN	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Study the image formation models and feature extraction for computer vision	Understand (U)
2	Identify the segmentation and motion detection and estimation techniques	Analyze (AN)
3	Develop small applications and detect the objects in various applications	Apply (A)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	**Image Formation Models:** Monocular imaging system, Orthographic & Perspective Projection , Camera model and Camera calibration, Binocular imaging systems, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Stereo vision.	**08hrs**	Understand (U)
2	**Feature Extraction** Image representations (continuous and discrete), Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.	**08hrs**	Apply (A)
3	**Shape Representation and Segmentation** Deformable curves and surfaces, Snakes and active contours , Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation	**10hrs**	Apply(A)
4	**Motion Detection and Estimation** Regularization theory , Optical computation , Stereo Vision Motion estimation, Background Subtraction and Modelling, Optical Flow, KLT, Spatio- Temporal Analysis, Dynamic Stereo; Motion parameter estimation • Structure from motion, Motion Tracking in Video	**10hrs**	Apply (A)
5	**Object Recognition** Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition	**08hrs**	Apply (A)
6	**Applications of Computer Vision** Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing	**04 hrs**	Understand (U)

Reference Books:

- D. Forsyth and J. Ponce,"Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012.
- Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011.
- Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.
- K. Fukunaga, "Introduction to Statistical Pattern Recognition",2ndEdition, Morgan Kaufmann, 1990.
- Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
- B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986.
- E. R. Davies "Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Elsevier Inc, 2012.

Prepared By:	Checked By:	Verified By:	Approved By:
Mr. Sanjeev Ghosh Subject Incharge	Aradhana Manekar M.E. Coordinator	Dr. Vinit Kumar Dongre Chairman Adhoc BOS	Dr. Lochan Jolly Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Audio Video Coding & Compression							**Course Code : PEC- ETCME1026**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment – Paper Duration – **1.5 Hours** **ESE-** End Semester Examination – **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

At the end of this course, students should be able to

- Understand familiarity to lossy and lossless compression systems.
- Understand various video coding techniques andstandards.
- Understand various audio coding and multimedia synchronizationtechniques.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand lossy and lossless compression systems.	Understand(U)
2	Analyze various multimedia protocols for compression and processing of image ,audio and video	Analyze (AN)
3	Describe various audio video coding techniques andstandards.	Understand(U)
4	Apply advanced concepts in Audio Video Coding & Compression	Apply(A)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
Module 1	Introduction to Multimedia Systems and Processing, Lossless Image Compression Systems Image Compression Systems, Huffman Coding, Arithmetic and Lempel-Ziv Coding	**08hrs**	Understand(U)
Module 2	Lossy Image Compression Systems, Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms, Multi-Resolution Analysis, Theory of Wavelets, Discrete Wavelet Transforms, Still Image Compression Standards: JBIG and JPEG.	**08hrs**	Understand(U)
Module 3	Video Coding and Motion Estimation: Basic Building Blocks & Temporal Redundancy, Block based motion estimation algorithms, Other fast search motion estimation algorithms.	**10hrs**	Understand(U)
Module 4	Video Coding Standards MPEG-1 standards, MPEG-2 Standard, MPEG-4 Standard, H.261, H.263 Standards, H.264 standard.	**08 hrs**	Understand(U)
Module 5	Audio Coding, Basic of Audio Coding, Audio Coding, Transform and Filter banks, Polyphase filter implementation , Audio Coding, Format and encoding, Psychoacoustic Models	**08hrs**	Understand(U)
Module 6	Multimedia Synchronization, Basic definitions and requirements, References Model and Specification, Time stamping and pack architecture, Packet architectures and audio-video interleaving, Multimedia Synchronization, Playback continuity, Video Indexing And Retrieval: Basics of content based image retrieval, Video Content Representation, Video Sequence Query Processing.	**04 hrs**	Understand(U)

Reference Books:

- Iain E.G. Richardson, "H.264 and MPEG-4 Video Compression", Wiley,2003.
- Khalid Sayood, "Introduction to Data Compression", 4th Edition, Morgan Kaufmann, 2012.
- Mohammed Ghanbari, "Standard Codecs: Image Compression to Advanced Video Coding", 3rd Edition, The Institution of Engineering and Technology,2011.
- Julius O. Smith III, "Spectral Audio Signal Processing", W3K Publishing,2011.
- Nicolas Moreau, "Tools for Signal Compression: Applications to Speech and Audio Coding", Wiley,2011.

Prepared By:	Checked By:	Verified By:	Approved By:
Aradhana Manekar	Aradhana Manekar	Dr. Vinit Kumar Dongre	Dr. Lochan Jolly
Subject Incharge	M.E. Coordinator	Chairman Adhoc BOS	Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Research Methodology & IPR							**Course Code :** MC-ETCME101		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
2	-	-	2	2	15	35	-	-	
IA- In-Semester Assessment – Paper Duration – **1.5 Hours** **ESE-** End Semester Examination – **3 Hours**									
Prerequisite: Basics of Statistics									

Course Objective:

At the end of this course, students should be able to

- Understand research problem formulation
- Analyze research related information
- Analyze today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
- Apply knowledge in IPR and realize IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

Course Outcomes:

At the end of this course, students will be able to

S. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand research problem formulation.	Understand (U)
2	Analyze research related information	Analyze (AN)
3	Follow research ethics	Apply(A)
4	Understand that today's world is controlled by Computer,	

	Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	Understand (U)
5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.	Understand (U)
6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	Understand (U)

Module No.	**Topics**	**Hrs.**	**Cognitive levels as per Bloom's Taxonomy**
Module 1	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	4	Understand (U)
Module 2	Effective literature studies approaches, analysis Plagiarism, Research ethics,	4	Analyze (An)
Module 3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	4	Apply (A)
Module 4	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	4	Understand (U)
Module 5	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	4	Understand (U)

Module 6	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	4	Apply (A)

Reference Books:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Prepared By:	Checked By:	Verified By:	Approved By:
Dr. Harshali Patil Subject Incharge	Aradhana Manekar M.E. Coordinator	Dr. Vinit Kumar Dongre Chairman Adhoc BOS	Dr. Lochan Jolly Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Value Education							**Course Code :** AC- ETCME004		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

IA- In-Semester Assessment - Paper Duration – **1.5 Hours**
ESE- End Semester Examination - **3 Hours**
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Assignment (40%) and Attendance (20%)

Course Objective :

Students should be able to

- Understand value of education and self- development
- Understand the importance of character
- Imbibe good values in students

Course Outcomes:

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Understand value of education and self- development	Understand (U)
2	Understand the importance of character	Understand (U)
3	Imbibe good values in students creating good human beings	Apply (A)

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
Module 1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments	**6hrs**	Understand (U)
Module 2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline	**6hrs**	Apply (A)
Module 3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	**6hrs**	Apply (A)
Module 4	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	**6hrs**	Apply (A)

Reference Books:

- Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi **.**

Prepared By:	Checked By:	Verified By:	Approved By:
Mr.Vikas Kaul Subject Incharge	Aradhana Manekar M.E. Coordinator	Dr. Vinit Kumar Dongre Chairman Adhoc BOS	Dr. Lochan Jolly Mentor Dean

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)								**SEM :** I
Course Name : Wireless Sensor Networks								**Course Code :** PEC- ETCME1011
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**			
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**			
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	100
3	-	-	3	3	25	75	-	-	
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Principles **of** Communication, Digital Communication, Computer Network, Fiber Optic **Communication**, Satellite Communication									

Course Objective:

At the end of this course, students should be able to

- Explain wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

Course Outcomes:

At the end of this course, students will be able to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network-based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

Module 1	Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.	08 hrs
Module 2	Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS	08 hrs
Module 3	Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)	07 hrs
Module 4	Overview of sensor network protocols (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.	10 hrs
Module 5	Data dissemination and processing; differences compared with other database management systems, data storage; query processing.	08 hrs
Module 6	Specialized features: Energy preservation and efficiency; security challenges; fault- tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.	07 hrs

Reference Books:

- H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India,2012.
- C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1stIndian reprint,2010.
- F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint,2013.
- YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology,2008.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Statistical Information Processing							**Course Code : PEC- ETCME1013**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisites: Undergraduate subjects related to Communication									

Course Objective:

At the end of this course, students shall be able to

- Analyze and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
- Develop mathematical modeling and problem solving using such models.
- Analyze results from this course for applications to signal processing, communications systems.
- Understand frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

Course Outcomes:

At the end of this course, students will be able to

- Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
- Demonstrate mathematical modeling and problem solving using such models.
- Comparatively evolve key results developed in this course for applications to signal processing, communications systems.
- Develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

Module 1	Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.	**08hrs**
Module 2	Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input, Forward and Backward Predictions, Levinson Durbin Algorithm.	**07hrs**
Module 3	Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate, Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.	**06hrs**
Module 4	Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.	**09hrs**
Module 5	Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon Fano, Arithmetic, Adaptive coding, RLE, LZW Data compaction, LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.	**08hrs**
Module 6	Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements, Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes & Decoder, Reed-Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.	**11 hrs**

Reference Books:

- Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes",4th Edition, McGraw-Hill,2002.
- D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill,2000.
- Mourad Barkat , "Signal Detection and Estimation", Artech House, 2nd Edition,2005.
- R G. Gallager, "Information theoryand reliable communication", Wiley, 1st edition, 1968.
- F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland,1977.
- Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition,2010.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Cognitive Radio							**Course Code : PEC- ETCME1022**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Communication									

Course Objective:

At the end of this course, students should be able to

- Explain the fundamental concepts of cognitive radio networks.
- Explain the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Explain efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
- Explain issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.

Course Outcomes:

At the end of this course, students will be able to

- Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation

Module 1	Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.	**08hrs**
Module 2	Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).	**07hrs**
Module 3	Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.	**05hrs**
Module 4	Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.	**08hrs**
Module 5	Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).	**09hrs**
Module 6	Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross- layer design for cognitive radio networks.	**11 hrs**

Reference Books:

- Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press,2009.
- Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd.,2009.
- Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition,2009.
- Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer,2007.
- Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer,2009.
- Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press,2009.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

<table>
<tr><td colspan="8">ME (Electronics and Telecommunication Engineering)</td><td colspan="2">SEM : I</td></tr>
<tr><td colspan="8">Course Name : DSP Architecture(Communication)</td><td colspan="2">Course Code : PEC- ETCME1023</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA- In-Semester Assessment - Paper Duration – 1.5 Hours
ESE- End Semester Examination - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisites: Undergraduate subjects related to Communication</td></tr>
</table>

Course Objective:

At the end of this course, students shall be able to

- Understand architectural level characterization of P-DSP hardware
- Acquire knowledge to design, programming (assembly and C), and testing code using Code Composer Studio environment
- Acquire knowledge of DSP hardware for Control, Audio and Video Signal processing applications
- To know about major areas and challenges in DSP based embedded systems

Course Outcome:

At the end of this course, students will be able to

- Identify and formalize architectural level characterization of P-DSP hardware
- Ability to design, programming (assembly and C), and testing code using Code Composer Studio environment
- Deployment of DSP hardware for Control, Audio and Video Signal processing applications
- Understanding of major areas and challenges in DSP based embedded systems

Module 1	Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.	**08hrs**
Module 2	Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors:TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding	**08hrs**
Module 3	VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed Cand Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.	**04hrs**
Module 4	Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –OpenMP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem)..	**08hrs**
Module 5	FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.	**10hrs**
Module 6	High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.	**10hrs**

Reference Books:

•M. Sasikumar, D. Shikhare, Ravi Prakash, “Introduction to Parallel Processing”, 1st Edition, PHI, 2006.

•Fayez Gebali, “Algorithms and Parallel Computing”,1st Edition, John Wiley & Sons, 2011

•Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,“Parallel Programming in OpenMP”, 1st Edition, Morgan Kaufman,2000.

•Ann Melnichuk,Long Talk, “Multicore Embedded systems”, 1st Edition, CRC Press,2010.

•Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.

•E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands, 2007.

M.E. Semester –I
Choice Based Credit Grading Scheme(CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : DSP Architecture(Signal Processing)							**Course Code :** PEC- ETCME1014		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

At the end of this course, students should be able to

- Understand, identify and formalize architectural level characterization of P-DSP hardware
- Design, programming (assembly and C), and testing code using Code Composer Studio environment
- Apply DSP hardware for Control, Audio and Video Signal processing applications
- Understand major areas and challenges in DSP based embedded systems

Course Outcomes:

At the end of this course, students will be able to

- Explain, identify and formalize architectural level characterization of P-DSP hardware
- Create, program (assembly and C), and test code using Code Composer Studio environment
- Demonstrate application of DSP hardware for Control, Audio and Video Signal processing applications
- Explain major areas and challenges in DSP based embedded systems

Module 1	Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point, Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.	**08hrs**
Module 2	Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 – Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.	**08hrs**
Module 3	VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.	**10hrs**
Module 4	Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –Open MP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).	**10hrs**
Module 5	FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.	**08hrs**
Module 6	High Performance Computing using P-DSP: Preliminaries of HPC, MPI, Open MP, multicore DSP as HPC infrastructure.	**04 hrs**

Reference Books:

- M. Sasikumar, D. Shikhare, Ravi Prakash, “Introduction to Parallel Processing”, 1st Edition, PHI, 2006.
- Fayez Gebali, “Algorithms and Parallel Computing”,1st Edition, John Wiley & Sons, 2011.
- Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,“Parallel Programming in OpenMP”, 1st Edition, Morgan Kaufman,2000.

- Wayne Wolf, “High Performance Embedded Computing: Architectures, Applications and Methodologies”, 1st Edition, Morgan Kaufman, 2006.
- E.S.Gopi, “Algorithmic Collections for Digital Signal Processing Applications Using MATLAB”, 1st Edition, Springer Netherlands, 2007.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Remote Sensing							**Course Code** : PEC- ETCME1015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

At the end of this course, students should be able to

- Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;
- Understand different applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Course Outcomes:

At the end of this course, students will be able to

- Explain basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;
- Demonstrate applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Module 1	Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.	**07hrs**

Module 2	Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned space craft's–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.	**09hrs**
Module 3	Photographic products, B/W, color, color IR film and their characteristics – resolving power of lens and film - Opt mechanical electro optical sensors – across track and along track scanners- multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.	**04hrs**
Module 4	Scattering System: Microwave scatterometry, types of RADAR –SLAR – resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave imagestopographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.	**09hrs**
Module 5	Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy- imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.	**10hrs**
Module 6	Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping.	**09 hrs**

Reference Books:

- Lillesand.T.M. and Kiefer.R.W,"Remote Sensing and Image interpretation", 6thEdition, John Wiley & Sons, 2000.
- John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, Prentice Hall,1995.
- Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis",5th Edition, Springer-Verlag Berlin Heidelberg, 2013.
- Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.
- Charles Elachi, Jakob J. van Zyl, "Introduction to The Physicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.
- Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W.H.Freeman& Co, 1978

M.E. Semester –I
Choice Based Credit Grading Scheme(CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Joint Time Frequency Analysis & Multi Resolution Analysis							**Course Code : PEC- ETCME1024**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objectives:

At the end of this course, students will be able to:

- Understand Transforms in signal processing
- Understand Time -Frequency Analysis & Multi-resolution Analysis
- Understand Wavelets and its Applications

Course Outcomes:

At the end of this course, students will be able to explain:

- Transforms in signal processing
- Time -Frequency Analysis & Multi-resolution Analysis
- Wavelets and its Applications

Module 1	Introduction: Review of Fourier Transform, Parseval Theorem and need for joint time-frequency Analysis. Concept of non-stationary signals, Short-time Fourier transforms (STFT), Uncertainty Principle, and Localization/Isolation in time and frequency, Hilbert Spaces, Banach Spaces, and Fundamentals of Hilbert Transform.	**08hrs**
Module 2	Bases for Time-Frequency Analysis: Wavelet Bases and filter Banks, Tilings of Wavelet Packet and Local Cosine Bases, Wavelet Transform, Real Wavelets, Analytic Wavelets, Discrete Wavelets, Instantaneous Frequency, Quadratic time-frequency energy, Wavelet Frames, Dyadic wavelet Transform, Construction of Haar and Roof scaling function using dilation equation and graphical method.	**07hrs**

Module 3	Multiresolution Analysis: Haar Multiresolution Analysis, MRA Axioms, Spanning Linear Subspaces, nested subspaces, Orthogonal Wavelets Bases, Scaling Functions, Conjugate Mirror Filters, Haar 2-band filter Banks, Study of up samplers and down samplers, Conditions for alias cancellation and perfect reconstruction, Discrete wavelet transform and relationship with filter Banks, Frequency analysis of Haar 2-band filter banks, scaling and wavelet dilation equations in time and frequency domains, case study of decomposition and reconstruction of given signal using orthogonal framework of Haar 2band filter bank.	**05hrs**
Module 4	Wavelets: Daubechies Wavelet Bases, Daubechies compactly supported family of wavelets; Daubechies filter coefficient calculations, Case study of Daub-4 filter design, Connection between Haar and Daub-4, Concept of Regularity, Vanishing moments. Other classes of wavelets like Shannon, Meyer, and Battle-Lamarie.	**08hrs**
Module 5	Bi-orthogonal wavelets and Applications: Construction and design. Case studies of bi-orthogonal 5/3 tap design and its use in JPEG 2000. Wavelet Packet Trees, Time-frequency localization, compactly supported wavelet packets, case study of Walsh wavelet packet bases generated using Haar conjugate mirror filters till depth level 3. Lifting schemes for generating orthogonal bases of second generation wavelets.	**09hrs**
Module 6	JTFA Applications: Riesz Bases, Scalograms, Time-Frequency distributions: fundamental ideas, Applications: Speech, audio, image and video compression; signal denoising, feature extraction, inverse problem.	**11hrs**

Reference Books:

1. S. Mallat, "A Wavelet Tour of Signal Processing," 2nd Edition, Academic Press, 1999.
2. L. Cohen, “Time-frequency analysis”, 1st Edition, Prentice Hall, 1995.
3. G.Strang and T. Q. Nguyen, “Wavelets and Filter Banks",2nd Edition, Wellesley Cambridge Press, 1998.
4. I. Daubechies, "Ten Lectures on Wavelets", SIAM, 1992.

5. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1993.
6. M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall, 1995

M.E. Semester –I
Choice Based Credit Grading Scheme(CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Voice and Data Networks							**Course Code : PEC- ETCME1025**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	100
IA- In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE-** End Semester Examination - **3 Hours**									
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objectives:

At the end of this course, students will be able to understand:

- Protocol, algorithms, trade-offs rationale.
- Routing, transport, DNS resolutions
- Network extensions and next generation architectures.

Course Outcomes:

At the end of this course, students will be able to explain:

- Protocol, algorithms, trade-offs rationale.
- Routing, transport, DNS resolutions
- Network extensions and next generation architectures.

Module 1	Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.	**08hrs**
Module 2	Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.	**07hrs**

Module 3	Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.	**05hrs**
Module 4	Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks.	**08hrs**
Module 5	Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting, Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery.	**09hrs**
Module 6	Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.	**11hrs**

Reference Books:

1. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.
3. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
4. Walrand,"Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
5. Leonard Kleinrock, "Queueing Systems,Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
6. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.
7. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : English for Research Paper Writing							**Course Code : AC-ETCME001**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

Course Objective :

At the end of this course, students should be able to

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Course Outcomes:

At the end of this course, students will be able to

- How to enhance your writing skills and level of readability
- Know what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Module 1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	**04hrs**
Module 2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	**04hrs**

Module 3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	**04hrs**
Module 4	Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature	**04hrs**
Module 5	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	**04hrs**
Module 6	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	**04hrs**

Reference Books:

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
- Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Disaster Management							**Course Code :** AC- ETCME002		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	-	-	-	50	

Course Objective :

At the end of this course, students should be able to

- Analyse a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Analyse evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Know standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Analyse strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Course Outcomes:

At the end of this course, students will be able to

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Module 1	Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	**04 hrs**

Module 2	Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	**04 hrs**
Module 3	Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	**04 hrs**
Module 4	Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	**04 hrs**
Module 5	Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	**04 hrs**
Module 6	Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	**04 hrs**

Reference Books:

- R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies " , New Royal book Company.
- Sahni, Pardeep Et.Al. (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
- Goel S. L., "Disaster Administration And Management Text And Case Studies" , Deep &Deep Publication Pvt. Ltd., New Delhi

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Sanskrit for Technical Knowledge							**Course Code :** AC- ETCME003		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	-	-	-	50	

Course Objective:

At the end of this course, students should be able to

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes:

At the end of this course, students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

Module 1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	**08hrs**

Module 2	Order Introduction of roots Technical information about Sanskrit Literature	**08hrs**
Module 3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	**08hrs**

Reference Books:

- "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
- "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
- "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Value Education							**Course Code :** AC- ETCME004		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

Course Objective:

Students should be able to

- Understand value of education and self- development
- Imbibe good values in students
- Understand the importance of character

Course Outcomes:

Students will be able to

- Knowledge of self development
- Learn the importance of Human values
- Developing the overall personality

Module 1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments	**6hrs**
Module 2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline	**6hrs**

Module 3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	**6hrs**
Module 4	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	**6hrs**

Reference Books:

- Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Constitution of India							**Course Code :** AC- ETCME005		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

Course Objective :

Students will be able to:

- To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

Students will be able to

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Module 1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	**04hrs**
Module 2	**Philosophy of the Indian Constitution:** Preamble Salient Features	**04hrs**
Module 3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	**04hrs**
Module 4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	**04hrs**
Module 5	**Local Administration:** District's Administration head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	**04hrs**

Module 6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	**04hrs**

Reference Books

- The Constitution of India, 1950 (Bare Act), Government Publication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
- M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Pedagogy Studies							**Course Code :** AC- ETCME006		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

Course Objective:

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Module 1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	~~**06hrs**~~ **04 hrs**

Module 2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	**~~06~~hrs** **02 hrs**
Module 3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	**~~06~~hrs** **04 hrs**
Module 4	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	**~~06~~hrs** **04 hrs**
Module 5	Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact	**02 hrs**

Reference:

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
- Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational

Development, 33 (3): 272–282.

- Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Stress Management by Yoga							**Course Code :** AC- ETCME007		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	–	–	-	50	

Course Objective :

At the end of this course, students should be able to

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes:

At the end of this course, students will be able to

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

Module 1	Definitions of Eight parts of yog. (Ashtanga)	**08hrs**
Module 2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	**08hrs**
Module 3	• Asan and Pranayam i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects -Types of pranayam	**08hrs**

Reference Books:

- 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
- "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Personality Development through Life Enlightenment Skills.							**Course Code :** AC- ETCME008		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**MSE**	**SEE**	**PR/OR**	**TW**	50
2	-	-	2	-	-	-	-	50	

Course Objective :

At the end of this course, students should be able to

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes:

At the end of this course, students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

Module 1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)	**08hrs**
Module 2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	**08hrs**

Module 3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	**08hrs**

Reference Books:

- "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
- Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** I		
Course Name : Computational Lab1: Advanced Communication Networks Laboratory							**Course Code :** LC- ETCME101		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (50)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**50**
-	-	4	4	2	–	–	25	25	

Each Laboratory assignment will be done by an individual student. The Faculty teaching core subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study

Course Outcomes:

At the end of this course, students will be able to

- Identify the different types of network devices and their functions within a network.
- Understand and build the skills of sub-netting and routing mechanisms.
- Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Suggested list of Assignments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
    a. Configuring NIC's IP Address.
    b. Determining IP Address and MAC Address using if-config command.
    c. Changing IP Address using if-config.
    d. Static IP Address and Configuration by Editing.
    e. Determining IP Address using DHCP.
    f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.
4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
5. Design UDP Client Server to transfer a file.
6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

a. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.

7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
9. Signaling and QoS of labeled paths using RSVP in MPLS.
10. Find shortest paths through provider network for RSVP and BGP.

Understand configuration, forwarding tables, and debugging of MPLS.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS2019)

ME (Electronics and Telecommunication Engineering)							SEM : I		
Course Name : Computational Lab2: Wireless and Mobile Communication Laboratory							Course Code : LC- ETCME102		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (50)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	50
-	-	4	4	2	-	-	25	25	

Each Laboratory assignment will be done by an individual student. The Faculty teaching core subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study

Course Outcomes:

At the end of this course, students will be able to

- Understanding Cellular concepts, GSM and CDMA networks
- To study GSM handset by experimentation and fault insertion techniques
- Understating of 3G communication system by means of various AT commands usage in GSM
- Understanding CDMA concept using DSSS kit
- To learn, understand and develop concepts of Software Radio in real time environment

Suggested list of Assignments:

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.

2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release, Security and Power Control, Handoff Process and types, Rake Receiver etc.

3. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

4. To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.

5. To study various GSM AT Commands their use and developing new application using it. Understating of 3G Communication System with features like; transmission of voice and videocalls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.

6. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.

7. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De- Interleaver.

8. To study and analyze different modulation techniques in time and frequency domain using SDR kit.