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

ME (Electronics and Telecommunication Engineering)							**SEM:** III		
Course Name: High Performance Networks							**Course Code:** PEC- ETCME3011		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Communication									

Course Objective:

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

- Describe and analyze different networking protocol models.
- Design, VOIP and VPN based computer networks.
- Describe different traffic models used to evaluate network performance.
- Estimate different security issues in high performance network and apply suitable solutions.
- Design engineering applications with modern networking tools.

Course Outcomes:

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

Sr. No.	Course Outcome	Cognitive levels as per Bloom's Taxonomy
1.	Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.	Apply (A)
2.	Design, implement, and analyze VoIP and VPN based computer networks.	Analyze (AN)
3.	Analyze different traffic models and measure network performance.	Analyze (AN)

4.	Identify different security issues in high performance computer networks and formulate solutions.	Analyze (AN)
5.	Apply techniques, skills, and modern networking tools necessary for engineering applications.	Apply (A)

Sr. No.	Module	Hrs.	Cognitive Level as per Bloom's Taxonomy
Module 1	Types of Networks, Network design issues, Data in support of network design. Network design tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services	**08hrs**	**~~Apply (A)~~ Understand (U)**
Module 2	VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols for the transport of voice media over IP networks. Providing IP quality of service for voice, signaling protocols for VoIP, PSTN gateways, VoIP applications.	**08hrs**	**Understand (U)**
Module 3	VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS- operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections	**08hrs**	**Understand (U)**
Module 4	Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poisson models, Network performance evaluation	**08hrs**	**Analyze (AN)**
Module 5	Network Security and Management: Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.	**08hrs**	**Understand (U)**
Module 6	Infrastructure for network management, The internet standard management framework – SMI, MIB, SNMP, Security and administration, ASN.1.	**08 hrs**	**Understand (U)**

Reference Books:

- Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill, 1993.
- Larry Peterson & Bruce David, "Computer Networks: A System Approach", Morgan Kaufmann, 2003.
- Douskalis B., "IP Telephony: The Integration of Robust VoIP Services", Pearson Ed. Asia, 2000.
- Warland J., Varaiya P., "High-Performance Communication Networks", Morgan Kaufmann, 1996
- Stallings W., "High-Speed Networks: TCP/IP and ATM Design Principles", Prentice Hall, 1998.
- Leon Garcia, Widjaja, "Communication networks", TMH 7th reprint 2002.
- William Stalling, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011.

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Remote Sensing							**Course Code : PEC- ETCM3012**		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Communication									

Course Objective:

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

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

Sr. No.	**Course Outcome**	**Cognitive levels as per Bloom's Taxonomy**
1.	Explain basic concepts and principals of remote sensing	Understand (U)
2.	Explain different platforms used for data acquisition in remote sensing	Understand (U)
3.	Describe different photographic products used in remote sensing applications	Understand (U)
4.	Apply geometric and radiometric principals in different types of remote sensing platforms.	Apply (A)
5.	Apply remote sensing principles in Thermal and Hyper Spectral Remote Sensing	Apply (A)

6.	Summarize different applications of remote sensing related to data collection, radiation, resolution, and sampling.	Analyze (AN)

Sr. No.	Module	Hrs.	Cognitive Level as per Bloom's Taxonomy
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**	**Understand (U)**
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.	**08hrs**	**Understand (U)**
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.	**07hrs**	**Understand (U)**
Module 4	Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.	**09hrs**	**Understand (U)**
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.	**09hrs**	**Understand (U)**

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.	**08hrs**	**Analyze (AN)**

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 –III
Choice Based Credit Grading Scheme (CBCGS 2019)

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name: Pattern Recognition and Machine learning.							**Course Code :** PEC- ETCME3013		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Communication									

Course Objectives:

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

- Study the parametric and linear models for classification
- Design neural network and SVM for classification
- Develop machine independent and unsupervised learning techniques.

Course Outcomes:

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

Sr. No.	**Course Outcome**	**Cognitive levels as per Bloom's Taxonomy**
1.	Explain basic concepts and principals of Pattern Recognition	Understand (U)
2.	Apply parametric and linear models for classification in pattern recognition	Apply (A)
3.	Design Neural network and SVM for pattern recognition	Create (C)
4.	Investigate Linear discriminant functions for machine learning	Analyze (AN)
5.	Investigate Algorithm independent machine learning techniques.	Analyze (AN)
6.	Analyze unsupervised machine learning techniques.	Analyze (AN)

Sr. No.	Module	Hrs.	Cognitive Level as per Bloom's Taxonomy
Module 1	**Introduction to Pattern Recognition**: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis.	**08hrs**	**Understand (U)**
Module 2	**Linear models:** Linear Models for Regression, linear regression, logistic regression Linear Models for Classification	**07hrs**	**Apply (A)**
Module 3	**Neural Network**: perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces, practical techniques for improving backpropagation, additional networks and training methods, Adaboost, Deep Learning	**05hrs**	**Analyze (AN)**
Module 4	**Linear discriminant functions**: decision surfaces, two-category, multi-category, minimum- squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine	**08hrs**	**Apply (A)**
Module 5	**Algorithm independent machine learning**: lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers	**09hrs**	**Analyze (AN)**
Module 6	**Unsupervised learning and clustering**: k-means clustering, fuzzy k-means clustering, hierarchical clustering	**08hrs**	**Analyze (AN)**

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.
3. C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

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

ME (Electronics and Telecommunication Engineering)							**SEM:** I		
Course Name: Artificial Intelligence							**Course Code:** PEC- ETCME3014		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

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

- Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues
- Understanding reasoning and fuzzy logic for artificial intelligence
- Understanding game playing and natural language processing.

Course Outcomes:

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

Sr. No.	**Course Outcome**	**Cognitive levels as per Bloom's Taxonomy**
1.	Explain basic concepts and principles of Artificial Intelligence	Understand (U)
2.	Explain different search techniques and knowledge representation issues	Understand (U)
3.	Explain reasoning and fuzzy logic for artificial intelligence	Understand (U)
4.	Describe game playing and natural language processing	Understand (U)

Sr. No.	Module	Hrs	Cognitive Level as per Bloom's Taxonomy
Module 1	What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining the Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, and Issues in the Design of Search Programs, Additional Problems. Generate- and-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means- Ends Analysis.	08 hrs	**Understand (U)**
Module 2	Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning	08 hrs	**Apply(A)**
Module 3	Symbolic Reasoning Under Uncertainty: Introduction to No monotonic Reasoning, Logics for Non-monotonic Reasoning. Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory	07 hrs	**Analyze (AN)**
Module 4	Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC.	10 hrs	**Apply(A)**

Module 5	Game Playing: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction	08 hrs	**Analyze (AN)**
Module 6	Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning in Neural Network, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	07 hrs	**Apply (A)**

Reference Books:

- Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
- Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

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

ME (Electronics and Telecommunication Engineering)							**SEM:** I		
Course Name: Optimization Techniques							**Course Code:** PEC- ETCME3015		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Signal Processing.									

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

- Understand importance of optimization
- Apply basic concepts of mathematics to formulate an optimization problem
- Analyze and appreciate variety of performance measures for various optimization problems

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

Sr. No.	**Course Outcome**	**Cognitive levels as per Bloom's Taxonomy**
1.	Understand importance of optimization	Understand (U)
2.	Explain different Linear Programming Problem	Understand (U)
3.	Describe different Single Variable Optimization Problems	Understand (U)
4.	Analyze and appreciate variety of performance measures for various optimization	Analyze (AN)
5.	Apply basic concepts of mathematics to formulate an optimization problem	Apply (A)

Sr. No.	Module	Hrs	Cognitive Level as per Bloom's Taxonomy
Module 1	Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers.	**08hrs**	**Apply(A)**
Module 2	Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.	**07hrs**	**Apply(A)**
Module 3	Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.	**06hrs**	**Apply(A)**
Module 4	Multi Variable and Constrained Optimization Technique, Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve's pattern search method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent method, Newton's method , Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method	**09hrs**	**Apply(A)**
Module 5	Intelligent Optimization Techniques: Introduction to Intelligent Optimization, Soft Computing, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) - Graph Grammar Approach - Example Problems	**08hrs**	**Analyze (AN)**
Module 6	Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.	**10 hrs**	**Apply (A)**

Reference Books:

- S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley, 2008.

- K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.
- C.J. Ray, "Optimum Design of Mechanical Elements", Wiley, 2007.
- R. Saravanan, "Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006.
- D. E. Goldberg, "Genetic algorithms in Search, Optimization, and Machine learning", Addison-Wesley Longman Publishing, 1989.

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

ME (Electronics and Telecommunication Engineering)							**SEM:** I		
Course Name: Modelling and Simulation Techniques							**Course Code:** PEC- ETCME3016		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Undergraduate subjects related to Signal Processing.									

Course Objective:

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

- Identify and model discrete systems (deterministic and random)
- Identify and model discrete signals (deterministic and random)
- Understand modelling and simulation techniques to characterize systems/processes

Course Outcomes:

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

Sr. No.	**Course Outcome**	**Cognitive levels as per Bloom's Taxonomy**
1.	Identify various discrete systems (deterministic and random)	Understand (U)
2.	Model Various discrete systems (deterministic and random)	Apply(A)
3.	Identify discrete signals (deterministic and random)	Understand (U)
4.	Model discrete signals (deterministic and random).	Apply(A)
5.	Understand modelling and simulation techniques to characterize systems/processes	Understand (U)

Sr. No.	Module	Hrs	Cognitive Level as per Bloom's Taxonomy
Module 1	Introduction Circuits as dynamic systems, Transfer functions, poles and zeroes, State space, Deterministic Systems, Difference and Differential Equations, Solution of Linear Difference and Differential Equations, Numerical Simulation Methods for ODEs, System Identification, Stability and Sensitivity Analysis	**08hrs**	Understand (U)
Module 2	Statistical methods, Description of data, Data-fitting methods, Regression analysis, Least Squares Method, Analysis of Variance, Goodness of fit.	**07hrs**	Apply(A)
Module 3	Probability and Random Processes, Discrete and Continuous Distribution, Central Limit theorem, Measure of Randomness, MonteCarlo Methods.	**05hrs**	Understand (U)
Module 4	Stochastic Processes and Markov Chains, Time Series Models.	**08hrs**	Understand (U)
Module 5	Modeling and simulation concepts, Discrete-event simulation, Event scheduling/Time advance algorithms, Verification and validation of simulation models.	**09hrs**	Apply(A)
Module 6	Continuous simulation: Modeling with differential equations, Example models, Bond Graph Modeling, Population Dynamics Modeling, System dynamics.	**11 hrs**	Apply(A)

Reference Books:

- R. L. Woods and K. L. Lawrence, "Modeling and Simulation of Dynamic Systems", Prentice-Hall, 1997.
- Z. Navalih, "VHDL Analysis and Modelling of Digital Systems", McGraw-Hill, 1993.
- J. Banks, JS. Carson and B. Nelson, "Discrete-Event System Simulation", 2nd Edition, Prentice-Hall of India, 1996.

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Business Analytics							**Course Code :** OEC-ETCME301		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
• Prerequisite: General Knowledge about business organization									

Course Objective:

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

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.

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 the role of business analytics within an organization	Understand (U)
2	Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization	Analyze (An)
3	Understanding of how managers use business analytics to formulate and solve business problems	Understand (U)

	and to support managerial decision making.	
4	Manage business process using analytical and management tools. .	Apply (A)

Sr. No.	Module	Hrs
Module 1	Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview	**09hrs**
Module 2	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	**08hrs**
Module 3	Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	**09hrs**

Module 4	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	**10hrs**
Module 5	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	**08hrs**
Module 6	Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**04hrs**

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Industrial Safety							**Course Code :** OEC-ETCME302		
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 /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: General knowledge about Industrial safety									

Course Objective:

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

- Enable to various industrial safety organization and their function.
- Analyse industrial related accidents, their occurrence, their effect and causation of accident.
- Analyse strategies applied for accident prevention.
- Understand about various industrial hazards and hazard control measures and technology applied

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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 various industrial safety organization and their function.	Understand(U)
2	Analyze industrial related accidents their occurrence, their effect and causation of accident	Analyse(An)
3	Understand about various industrial hazards and hazard control measures and technology applied	Understand(U)
4	Analyse strategies applied for accident prevention.	Analyse(An)

Sr. No.	Module	Hrs
Module 1	Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	**09hrs**
Module 2	Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	**08hrs**
Module 3	Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	**09hrs**
Module 4	Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipments like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	**10hrs**
Module 5	Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair	**08hrs**

	cycle concept and importance	

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Operations Research							**Course Code :** OEC-ETCME303		
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 /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	
3	-	-	3	3	-	-	25	25	50
Prerequisite : undergraduate Statistics									

Course Objective:

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

- Understand and carry out sensitivity analysis.
- Apply the dynamic programming to solve problems of discrete and continuous variables.
- Apply the concept of non-linear programming.
- Model the real world problem and simulate it.

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 and carry out sensitivity analysis.	Understand(U)
2	Apply the dynamic programming to solve problems of discreet and continuous variables. .	Apply(A)
3	Apply the concept of non-linear programming.	Understand(U)
4	Model the real world problem and simulate it.	Apply(A)

Sr. No.	Module	Hrs
Module 1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	**10hrs**
Module 2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	**10hrs**
Module 3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	**10hrs**
Module 4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming	**10hrs**
Module 5	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	**08hrs**

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Cost Management of Engineering Projects							**Course Code :** OEC-ETCME304		
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 /Presentation(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	-	-	25	25	
Prerequisite: Operations Management and Basic knowledge of Accounting.									

Course Objective: Students should be able to

- Understand the Strategic Cost Management Process
- Apply Cost concepts in decision-making
- Apply Quantitative techniques for cost management

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	Use Cost concepts in decision-making	Understand(U)
2	Apply Quantitative techniques for cost management.	Apply(A)

Detailed Syllabus:

Sr. No.	**Module**	**Hrs**

Module 1	Introduction and Overview of the Strategic Cost Management Process	10hrs
Module 2	Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	10hrs
Module 3	Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process	10hrs
Module 4	Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of	10hrs
Module 5	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	**8hrs**

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Composite Materials							**Course Code :** OEC-ETCME305		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	**3**	**3**	_	_	25	25	

Course Objective : Students should be able to

- Understand the Strategic Cost Management Process
- Apply Cost concepts in decision-making
- Apply Quantitative techniques for cost management

Course Outcomes:

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Use Cost concepts in decision-making	Understand(U)
2	Apply Quantitative techniques for cost management.	Apply(A)

Detailed Syllabus:

Sr. No.	Module	Hrs
Module 1	INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.	**10hrs**
Module 2	REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions	**10hrs**
Module 3	Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	**10hrs**
Module 4	Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	**10hrs**
Module 5	Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations	**08hrs**

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Waste to Energy							**Course Code :** OEC-ETCME306		
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 /P(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	50
3	-	-	3	3	_	_	25	25	
Prerequisite: Renewable Energy Sources, Physics, Environmental Studies.									

Course Objective :

Sr. No.	**Module**	**Hrs**
Module 1	Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	**10hrs**
Module 2	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	**10hrs**
Module 3	Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.	**10hrs**
Module 4	Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	**10hrs**

Module 5	Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	**10hrs**

Reference:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

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

ME (Electronics and Telecommunication Engineering)							**SEM :** III		
Course Name : Dissertation –I/ Industry Project							**Course Code :** D1-ETCME301		
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/ Presentation (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR/PS**	**TW**	100
-	-	-	20	10	-	-	50	50	
Prerequisite: Domain knowledge Undergraduate subjects and Subjects studied in PG Sem 1 & 2.									

Major Project objective:

It is expected from the learner to undertake industrially relevant problem to develop an optimal solution through extensive research work.

Major Project Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Discover potential research areas in the field of study	Analyze (AN)
2	Conduct a survey of several available literature in the preferred field of study	Apply(A)
3	Compare and contrast the several existing solutions for research challenge	Evaluate(E)
4	Formulate and propose a plan for creating a solution for the research plan identified	Analyze(AN)

5	To report and present the findings of the study conducted in the preferred domain	Analyze(AN)
6	Patenting of outcomes if it is significant and of commercial value	Evaluate(E)

Guidelines: The students and faculty can design the research project in consultation with industry preferably in the region. The planning of laboratory work/ modelling/ computationalwork with execution schedule is to be suggested at the being of the programme to ensure expected outcome, The learner has to carry out research in the area of his interest under the guidance of a recognized PG teacher. The pedagogic approach for completion of the dissertation has to be followed, Detailed guidelines are given below based on these guidelines the PG student should complete 3 chapters of the dissertation and submit a detailed research proposal at the end of the semester.

Sr no.	**Detailed Guidelines**	**Hours**	**BRBT Levels**
1	Introduction: Problem statement, Research Question, Motivation of the study, Context causing the study, summarizing findings, importance of findings ,road map	**5hrs**	Analyze (AN)
2	Literature Review: Rigorous literature review of the area of research by reading and understanding at least 15 research papers from quality national/international journals/conferences. Seminal papers in the area of research should be included. Comprehensive and up to date, problem contextualization has to be done, Discussion on gaps found in extant literature .	**5hrs**	Analyze (AN)
3	Theory Theory has to be appropriate should be logical and should align with the research question	**5hrs**	Evaluate (E)

4	Research Proposal Writing A research proposal has to be prepared by each student which includes Introduction, Comprehensive Literature Survey pertinent to the topic of research along with research gaps that have been identified, rationale for the research, detailed methodology along with a rationale for its appropriateness, demonstration of the advantages and its disadvantages of the method and anticipated outcomes. Proposals should include the following sections 1. Introduction 2. Background and Significance 3. Literature Review 4. Research Design and Methods 5. Implications and anticipated outcomes 6. Conclusion Proper citations should be used for the sources while writing the proposal	**5hrs**	Create(C)
	Total Hours	**20**	

References:

1. Handbook of Scientific Proposal Writing ByA.YavuzOruc, CRC press

2.Guide to Research Projects for Engineering Students: Planning, Writing and PresentingBy EngChoon Leong, Taylor and Francis

3. Research Methods for EngineersBy David V. Thiel, Cambridge University Press

Web Reference:https://libguides.usc.edu/writingguide/researchproposal