GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code:3730007
Semester III
Operation Research

Type of Course: Open Elective

Prerequisite: Nil

Rationale: Operation research techniques are useful for solving real life Industrial problem, Problems can be of Manufacturing, Service and supply related. Different techniques help for optimization of linear as well as non - linear type problem.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Sr. No.	Topics	Teaching Hours
1	**Linear Programming Problems:** Formulation of a LPP, - graphical solution, simplex method, duality in LPP, sensitivity analysis, Integer linear programming, revised simplex method, parametric linear programming, Dynamic programming under certainty, Dynamic programming approach for solving LPP.	12
2	**Project Management , Inventory Control and Decision Making:** CPM, PERT, Project time cost trade off, Resource allocation, Deterministic inventory control models, Probabilistic inventory control models, Decision making process, Decision making under uncertainty, Decision making under risk, Decision tree analysis, Theory of games, Pure strategies, Mix strategies, Solutions method games without saddle points.	10
3	**Classical Optimization Methods:** Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Kuhn-Tucker conditions	06
4	**Non-linear Programming:** **Constrained Optimization Techniques** Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method **Unconstrained Optimization Techniques** Direct Search Methods: Random search methods, Grid search method, Univariate method, **Constrained Optimization Techniques** Direct Methods: Random search method, Sequential linear programming.	10
5	**Evolutionary Algorithms** An overview of evolutionary algorithms, Simulated annealing algorithm, Genetic algorithm, Particle swarm optimization	04

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	Marks % weightage

Recall	10
Comprehension	10
Application	25
Analysis	25
Evaluate	20
Create	10

References:

1. J. K. Sharma, Operation Research, Theory and Application, Macmillan Publishers India Ltd,2013
2. H.A. Taha, Operations Research, An Introduction, PHI, 2008
3. S.S.Rao, Engineering Optimization Theory and Practice, New Age International (P) Ltd, Publishers.
4. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes:
After learning the course:

Sr. No.	CO statement	Marks % weightage
CO-1	Students should able to apply the Liner programming techniques to solve problems of real life applications and carry out post optimality analysis.	30
CO-2	Students should able to apply the concepts of non-linear programming and apply them for real life problems.	30
CO-3	Students should able to obtain quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.	20
CO-4	Students should able to implement various scientific tools and models that are available in the subject to take decisions in a complex environment.	20

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of EngineeringSubject Code: 3730507

Semester – III
Subject Name: Remote Sensing

Prerequisite: Basic knowledge of Satellite communication system, Fundamental knowledge of Radar and Antenna, Basic propagation mechanism, Physics of Remote sensing, Basics of Microwave engineering principles.

Rationale: PG Students of EC Engineering need to possess good understanding of modern satellite communication system and radar design. The course represents the recent trends and technologies regarding the design and analysis of radars and satellites along with their applications in the upcoming future generation remote sensing systems. The students are expected to be able to gain the theoretical and practical aspect of remote sensing system along with the MATLAB based realization.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
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.	
2	Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned spacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.	
3	Photographic products, B/W,color, color IR film and their characteristics –resolving power of lens and film - Optomechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.	
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.	

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.	
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.	

Course Outcomes

Sr. No.	CO statement	Marks % weightage
CO-1	Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles.	25
CO-2	Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.	20
CO-3	To focus on mathematical analysis of remote sensing techniques.	15
CO4	To understand the principles and applications of scatterometry,different RADARS ,different remote sensing platforms for remote sensing applications	20
CO-4	Apply the principles of thermal ,hyper spectral remote sensing of the terrain mapping for data analysis and interpretation	20

Reference Books:

1. Lillesand.T.M. and Kiefer.R.W,"Remote Sensing and Image interpretation", 6thEdition,
2. John Wiley & Sons, 2000.
3. John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective",
4. 2nd Edition, Prentice Hall,1995.
5. Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis",5th Edition,
6. Springer-Verlag Berlin Heidelberg, 2013.
7. Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group,
8. 1984.
9. Charles Elachi, Jakob J. van Zyl, "Introduction to The Physicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.
10. Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W.H.Freeman& Co, 1978

List of Experiments

To use MATLAB/SCILAB

1. for the realization of different remote sensing algorithms,
2. for the simulation of image processing techniques,
3. to compute RADAR parameters,
4. analyse different techniques ,
5. to understand matched filter and pulse compression technique,
6. to obtain Sensor characteristics ,
7. to obtain Spectral Resolution,
8. for the interpretation of data of the satellite images
9. other practicals in the scope of the syllabus

Case studies of remote sensing applications

List of Open Source Software/learning website: nptel lectures /IEEE Journals/ /ISRO/NASA publications and Journals

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730005
Semester III
Business Analytics

Type of Course:

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Sr. No.	Topics	Teaching Hours
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.	9
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	8
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	9
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	10
5	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making	8
6	Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism	4

References:

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

Course Outcomes:

After learning the course the students should be able to :

Sr. No.	CO statement	Marks % weightage
CO-1	Students will demonstrate knowledge of data analytics	
CO-2	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics	
CO-3	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making	
CO-4	Students will demonstrate the ability to translate data into clear, actionable insights	

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730506
Semester – III
Subject Name: Pattern Recognition and Machine learning

Type of course:

Prerequisite Higher Engineering Mathematics,Matrix Theory,Probability, Random variables, Statistics , Discrete Time Signals and systems

Rationale:

With the advent of computers and the information age, statistical problems have exploded both in size and complexity. Challenges in the areas of data storage, organization and searching have led to the new field of "data mining"; statistical and computational problems in biology and medicine have created "bioinformatics." Vast amounts of data are being generated in many fields, and the statistician's job is to make sense of it all: to extract important patterns and trends, and understand "what the data says." This is also called learning from data.

The learning problems that we consider can be roughly categorized as either supervised or unsupervised. In supervised learning, the goal is to predict the value of an outcome measure based on a number of input measures; in unsupervised learning, there is no outcome measure, and the goal is to describe the associations and patterns among a set of input measures.

PG Students of EC Engineering need to possess good understanding of statistical methods for pattern classification and recognition in various applications like image ,video , bioinformatics . They are expected to be able to apply machine learning algorithms.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Contents:

Sr. No.	Content	Total Hrs
1	INTRODUCTION Pattern Recognition Systems, Example,The Design Cycle, Learning and Adaptation	2
2	BAYESIAN DECISION THEORY Bayesian Decision Theory-Continuous Features, Minimum-Error-Rate Classification, Classifiers, Discriminant Functions, and Decision Surfaces, Discriminant Functions for the Normal Density, Error Probabilities and Integrals, Error Bounds for Normal Densities, Bayes Decision Theory-Discrete Features, Missing and Noisy Features, Bayesian Belief Networks, Compound Bayesian Decision Theory and Context	4
3	MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION Maximum-Likelihood Estimation, Bayesian Estimation, Sufficient Statistics, Problems of Dimensionality, Component Analysis and Discriminants, Expectation-Maximization (EM)	4

4	LINEAR DISCRIMINANT FUNCTIONS Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, Minimizing the Perceptron Criterion Function, Relaxation Procedures, Nonseparable Behavior, Minimum Squared-Error Procedures, The Ho-Kashyap Procedures, Linear Programming Algorithms, Support Vector Machines, Multicategory Generalizations	**8**
5	NEURAL NETWORKS Feedforward Operation and Classification, Backpropagation Algorithm, Error Surfaces, Backpropagation as Feature Mapping, Backpropagation, Bayes Theory and Probability, Practical Techniques for Improving Backpropagation, Second-Order Methods, Additional Networks and Training Methods, Regularization, Complexity Adjustment and Pruning	**10**
6	ALGORITHM-INDEPENDENT MACHINE LEARNING Lack of Inherent Superiority of Any Classifier, Bias and Variance, Resampling for Estimating Statistics, Resampling for Classifier Design, Estimating and Comparing Classifiers, Combining Classifiers	**8**
7	UNSUPERVISED LEARNING AND CLUSTERING Mixture Densities and Identifiability, Maximum-Likelihood Estimates, Application to Normal Mixtures, Unsupervised Bayesian Learning, Data Description and Clustering, Criterion Functions for Clustering, Iterative Optimization, Hierarchical Clustering, The Problem of Validity, On-line clustering, Graph-Theoretic Methods, Component Analysis, Low-Dimensional Representations and Multidimensional Scaling (MDS)	**10**
	Total	**46**

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.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Study the parametric and linear models for classification	25
CO-2	Design neural network for classification	20
CO-3	Design Support Vector Machine for classification	15
CO4	Develop and Apply machine independent learning techniques	20
CO-4	Develop and Apply and unsupervised learning techniques	20

List of Experiments:

1.Implement maximum likelihood algorithm
2. Implement Bayes classifier
3. Implement linear regression
4. Design a classifier using perceptron rule
5. Design a classifier using feedforward back-propagation and delta rule algorithms
6. Implement deep learning algorithm
7. Implement linear discriminant algorithm
8. Design a two class classifier using SVM
9. Design a multiclass classifier using SVM
10. Perform unsupervised learning

Open Ended Problems:

1. Implement algorithm for the image/video classification

List of Softwares:

1. MATLAB
2. Scilab
3.Python

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730505
Semester – III
Subject Name: High Performance Networks

Type of course: Data Networking

Prerequisite:

- Higher Engineering Mathematics,
- Fundamental knowledge of Data communication networks
- Digital Communication theory
- Wireless Networks
- Probability and random processes
- Programming skills in Simulation Exercises(MATLAB, Network Emulator Tool,NS2 or equivalent)

Rationale:

The purpose of this course is to provide an understanding of modern high performance communication networks. Topics include: overview of types of networks; design issues and tools, VOIP, Traffic Engineering, and Traffic modelling, Network Security and management.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weight age
1	**Chapter 1**- Types of Networks, Network design issues, Data in support of network design. Network design tools, protocols and architecture. Streaming of 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.	9	20%
2	**Chapter 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.	9	20%
3	**Chapter 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, and MPLS based VPN, overlay networks-P2P connections.	8	20%
4	**Chapter 4**- Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-Poisson models, and Network performance evaluation.	6	15%
5	**Chapter 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.	5	15%
6	**Chapter 6**- Infrastructure for network management, the internet standard	5	10%

	management framework – SMI, MIB, SNMP, Security and administration, ASN.1.		
	Total	42	**100%**

Reference Books:

1. J.F. Kurose & K.W. Ross,"Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
4. Aunuragkumar, D. Manjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
5. HersentGurle& petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni," Computer Networking and the Internet" fifth edition, Pearson education
7 Nader F.Mir ,Computer and Communication Networks, first edition.
8. Larry l.Peterson& Bruce S.David, "Computer Networks: A System Approach"- 1996

Course Outcome:

By the end of this course, the student will be able :

Sr. No.	COURSE OUTCOMES	%age
1	To identify the present-day high-performance network technologies.	20
2	To explore the voice over IP, VoIP implementations aspects and signalling.	20
3	To use techniques, skills, and modern networking tools necessary for engineering practice.	20
4	To manage the high-performance networks, and to address and solve the network security issues.	15
5	To identify, formulate, and solve networking problems.	25

List of Experiments:

Sr. No.	Experiment Name
1	To study Network Emulator Tool.
2	To study router configuration using Network Emulator Tool.
3	To configure VPN Remote access in Network Emulator.
4	To Configure VoIP in Network Emulator.

5	To implement SNMP protocol in Network Emulator.
6	To implement basic MPLS VPN in Network Emulator.
7	To implement Poisson distribution based traffic model in Matlab.
8	To implement encryption and decryption.
9	To implement VPN tunnelling over PPP in Network Emulator.

List of Software:

- NS-2, NS-3
- MATLAB
- Network Emulator Tool

Learning website:

- www.nptel.ac.in,www.cisco.com, www.gns3.com