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: 3730006
Semester III
Industrial Safety

Type of Course:

Prerequisite: Nil

Rationale: Safety is major issue in any industry; awareness about safety helps students from any major accidents, Different rules regulation of safety helps students apply it in industry for performance and productivity improvements. Knowledge of Maintenance, its type and application gives better work environments and helps industry from major shutdown. Different maintenance tools and techniques for different situation and industry equipment's helps students to apply it in real life industry problems.

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	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.	08
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	08
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	10
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 equipment's 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	09
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 cycle concept and importance	10

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	Marks % weightage
Recall	10
Comprehension	20
Application	25
Analysis	25
Evaluate	10
Create	10

References:

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

Course Outcomes:
After learning the course the students should be able to :

Sr. No.	CO statement	Marks % weightage
CO-1	Understand Importance of Safety and Important related Acts.	20
CO-2	Apply Maintenance techniques as per requirements and able to compare for with different technique for better performance.	30
CO-3	Understand wear and corrosion, its causes and remedial actions for preventions.	30
CO-4	Demonstrate fault tracing, its methods and application.	20

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 Engineering
Subject Code: 3730208
Semester – III
Subject Name: Cloud Computing

Type of course:

Prerequisite: opertating system,networking

Rationale: Organizations look for cloud solutions rather than investing and maintaining infrastructure on their part. Since the Cloud structure is complex, investigations are necessary from security perspective. Organizations are looking for Cloud service providers which are stable, secure and offer more than one layer of security for their client's data. This course will help in implementing cloud architecture, analyzing the security issues, writing incidence report and deploying the security architecture for cloud platform.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Cloud Computing** Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing	4
2	**Unit 2:** **Cloud Computing Architecture** Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model **Cloud Deployment Models** Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	11
3	**Unit 3:** **Security Issues in Cloud Computing** Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security	10

	Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management	
4	**Unit 4:** **Security Management in the Cloud** Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS **Privacy Issues** Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations	**11**
5	**Unit 5:** **Audit and Compliance** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud	**8**
6	**Unit 6:** Introduction to hybrid cloud Hybrid cloud management, Managing the Hybrid workloads, Development and Deployment in Hybrid cloud.	**4**

Reference Books:

1) Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009

2) Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

3) Hybrid Cloud For Dummies 2nd Edition

by Judith S. Hurwitz , Marcia Kaufman , Fern Halper , Daniel Kirsch

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Implement a public cloud instance using a public cloud service provider	50

CO-2	Develop a risk-management strategy for moving to the Cloud	20
CO-3	Identify security aspects of each cloud model	20
CO-4	Apply trust-based security model to different layer	10

List of Experiments:

1. Install public cloud. Analyze how handling in public cloud differs from private cloud?
2. Implement phishing attack on cloud.
3. Write a case study of incidence reporting in case of breach of cloud security.
4. Use the services offered by Azure, AWS and GOOGLE. Compare them.
5. Use open source tool to evaluate performance of cloud platform.
6. Prepare a case study of security policy or service level agreement is signed by cloud service provider.
7. Prepare a case study of facebook, twitter data which is stored on cloud. Write a program to inject malware in this data.
8. Implement attribute based encryption algorithm for cloud.
9. Implement compartmentalization techniques, the provider can use to prevent access into virtual container of one customer by other customers.
10. Implement identity management mechanism in cloud.

Major Equipment:

Computer systems having following minimum technical configurations

Processor:i3 or i5 or higher

RAM : minimum 4 GB

HDD : 1 TB

Internet and wifi connectivity

Licence Window/Linux operating system

List of Open Source Software/learning website:

https://npte;.ac.in

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730209
Semester III
SUBJECT NAME: High Performance Scientific Computing

Type of course: Elective

Prerequisite: Linear Algebra and Numerical Methods, Parallel Algorithms

Rationale: Computation and simulation are increasingly important in all aspects of science and engineering. At the same time writing efficient computer programs to take full advantage of current computers is becoming increasingly difficult. Even laptops now have 4 or more processors, but using them all to solve a single problem faster often requires rethinking the algorithm to introduce parallelism, and then programming in a language that can express this parallelism. Writing efficient programs also requires some knowledge of machine arithmetic, computer architecture, and memory hierarchies. High performance *programming* is an important aspect of high performance scientific computing, and so the main theme of the course is the use of basic tools and techniques to improve your efficiency as a computational scientist.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Single Processor Computing, Parallel Computing, Parallel System Organization	3	6
2	Numerical Linear Algebra, High Performance Linear Algebra, Numerical Treatment of Differential Equations	5	10
3	Applications: Molecular Dynamics, Sorting, Graph Analytics, N-body Problems, Monte Carlo Methods, Computation Biology	7	15
4	Interactive Python using IPython, and the IPython Notebook, Python scripting and its uses in scientific computing, Subtleties of computer arithmetic that can affect program correctness	10	21
5	Fortran 90, a compiled language that is widely used in scientific computing, Makefiles for building software and checking dependencies, Analyse the cost of data communication. Registers, cache, main memory, and how this memory hierarchy affects code performance.	10	21
6	OpenMP on top of Fortran for parallel programming of shared memory computers, such as a multicore laptop., MPI on top of Fortran for distributed memory parallel programming, such as on a cluster, Parallel computing in IPython, Debuggers, unit tests, regression tests, verification and validation of computer codes, Graphics and visualization of computational results using Python	13	27
	Total	48	**100%**

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage

CO-1	demonstrate the knowledge of numerical computing using an appropriate programming language.	10%
CO-2	be competent in experimental computing in a numerical context and of the optimization of algorithms on high performance architectures.	20%
CO-3	be able to reason about the accuracy of mathematical and numerical models of real physical phenomena.	25%
CO-4	have an awareness of the modern field of computational science and engineering and of the impact of high performance computing on science and industry.	25%
CO-5	have an understanding of the various paradigms of high performance computing and their potential for performance and programmability.	20%

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	**Marks % weightage**
Recall	5
Comprehension	10
Application	20
Analysis	25
Evaluate	25
Create	15

Reference Books:

1. Scott, Clark, and Bagheri, *Scientific Parallel Computing*.
2. Parallel Programming for Multicore and Cluster Systems by Thomas Rauber and Gudula Runger.
3. Using OpenMP: Portable Shared Memory Parallel Programming by Chapman, Jost, and vander Pas.
4. An Introduction to High Performance Scientific Computing, Lloyds D. Fosdick, Elizabeth R. Jessup, Carolyn J. C. Schauble, Gitta Domik
5. Heath, M.T. Scientific Computation - An Introductory Survey, McGraw-Hill, 1997.
6. Buyya, R. High Performance Cluster Computing: Programming and Applications, Prentice Hall, Upper Saddle River, New Jersey 1999.s

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730210
Semester – III
Subject Name: Complier for HPC

Type of course: Elective

Prerequisite: Computer Organization and Architecture, Basics of Compiler Design

Rationale: Optimizing compilers play a critical role in modern computer systems ranging from mobile devices to supercomputers. Compilers can optimize for performance, power consumption and/or code size. Practically all computer scientists and engineers may benefit for a deep knowledge of compiler optimizations: programmers and application optimizers write programs that are better optimized by the compiler, computer designers design hardware features that are easy to use by compilers, and finally compiler writers develop new compiler optimizations. This course covers optimizations and aspects of the compiler back-end and middle-end such as: data-flow analysis, control Flow analysis, instruction level parallelism, memory hierarchy optimizations, data level parallelism and thread level parallelism.

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	% Weightage
1	**High Performance Systems,** Structure of a Compiler, Programming Language Features, Languages for High Performance.	6	12
2	**Data Dependence:** Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. **Scalar Analysis with Factored Use-Def Chains:** Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays, Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.	10	21
3	**Loop Restructuring:** Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. **Optimizing for Locality:** Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.	10	21
4	**Concurrency Analysis:** Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. **Vector Analysis:** Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.	10	21
5	**Message-Passing Machines:** SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments. **Scalable Shared-Memory Machines:** Global Cache Coherence, Local Cache	10	21

	Coherence, Latency Tolerant Machines.		
6	Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.	2	4
	Total	48	**100%**

After learning the course the students should be able to:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Be familiar with the structure of compiler	20%
CO-2	Understand the performance characteristics of modern processors	40%
CO-3	Have experience with algorithms for automatically taking advantage of SIMD, SIMT, and MIMD parallelism	40%

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	**Marks % weightage**
Recall	15
Comprehension	20
Application	15
Analysis	20
Evaluate	20
Create	10

Reference Books:

1. Muchnick, Steven S, *Advanced compiler design implementation*, Morgan Kaufmann, cop. 1997. ISBN: 978-1558603202
2. Michael Wolfe, *High-Performance Compilers for Parallel Computing*, Pearson
3. Aho, Alfred V, *Compilers : Principles, Techniques, and Tools*, Addison-Wesley, cop. 2007. ISBN: 9780321486813
4. Allen, Randy; Kennedy, Ken, *Optimizing Compilers for Modern Architectures : A Dependence-Based Approach*, Morgan Kaufmann Publishers, cop. 2002. ISBN: 1-55860-286-0

Practical List:

1) Setup LLVM on your machine. You should now have three directories (SimplePass, CellularAutomata, MysoreScript), one for each example.In each of these, you will find two build directories.
2) The SimplePass example must be modified to count instructions per basic block.
3) MysoreScript is a very simple language that provides a JavaScript-like model. You should improve the system using **improved dispatch tables**, replacing the linked list. Try adding either a sparse tree or inverted dispatch tables (where each selector has a class-to-method mapping, rather than each class having a selector-to-method mapping) and modify the compiler to do lookups inline, rather than calling out to C code. Whichever option you pick, show some example code where it gives a performance increase and be prepared to justify whether this is representative.
4) This is a simple compiler for a domain-specific language for generating cellular automata. The language itself is intrinsically parallel—you define a rule for updating each cell based on its existing value and

neighbours—but the compiler executes each iteration entirely sequentially, one cell at a time. Introduce the following parallelism into this system.

Vectorised implementation: The current version is not amenable to automatic vectorisation because the edge and corner implementations are not the same as the values in the middle. Modify the compiler to generate three versions of the program: one for edges, one for corners, and one for the middle. Make the edge and middle implementations simultaneously operate on 4 (or more) cells by using vector types in the IR. Be careful with the global registers!

List of Open Source Software/learning website:

- http://llvm.org/docs/LangRef.html