Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for First Year M.Tech Program in Computer Engineering: Semester II (Autonomous)

(Academic Year 2019-2020)

Sr	Course Code	Course	Teaching Scheme				Semester End Examination						Continuous Assessment							Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork			CA Total (B)			
																Laboratory Work	Tutorial / Mini project /	Term Work				
1	DJ19CEPGC201	High Performance Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
2	DJ19CEPGC202	Secure Coding	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**4**
	DJ19CEPGL202	Secure Coding Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
3	DJ19CEPGC203	Predictive Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**4**
	DJ19CEPGL203	Predictive Analytics Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
4	DJ19CEPGC204	Data Storage Technology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
5@	DJ19CEPGE201	Business Intelligence	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
	DJ19CEPGE201	Blockchain Technologies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
6#	DJ19OPGC2021	Project Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
	DJ19OPGC2022	IPR and Patenting	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
	DJ19OPGC2023	Remote Sensing Concepts	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
	DJ19OPGC2024	Product Life Cycle Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
	DJ19OPGC2025	Research Methodology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	**3**
		Total	**18**	**4**	**0**	**20**	**--**	**450**	**50**	**0**	**0**	**500**	**150**	**150**	**150**	**30**	**20**	**50**	**200**	**700**	**20**	

@ Any 1 Department Level Elective
# Any 1 Institue Level elective

1. **Prepared by**

1. **Checked by**

Head of Dept

Vice Principal

Principal

Syllabus for First Year M.Tech Program in Computer Engineering: Semester II (Autonomous) (Academic Year 2019-2020)

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course: High Performance Computing</td><td colspan="3">Course Code:DJ19CEPGC201</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="4">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">--</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Distributed Systems

Objectives:

The objective of this course is to introduce students with the concepts of distributed and parallel computing architecture. The course also aims to design the parallel algorithms and programs using MPI and OpenMP. The course also includes the various computing technologies that falls under the category of high-performance computing.

Outcomes: On completion of the course, learner will be able to:

1. Comprehend the various parallel processing approaches that forms base for high performance computing.
2. Design and develop parallel algorithms and programs.
3. Explore various standard and advanced high-performance computing technologies.
4. Analyze the performance measures in high performance computing.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Parallel Processing** Introduction to Parallel Processing, Levels of Parallelism (instruction, transaction, task, thread, memory, and function), Models (SIMD, MIMD, SIMT, SPMD), Parallel Architecture (Interconnection network, processor array, multiprocessor, Difference between distributed and parallel architectures and examples of both.	05
2	**Parallel Programming using MPI** Designing Parallel Algorithms (Partitioning, Communication, Mapping, Matrix Input/output) Principles, building blocks, MPI, overlapping communication and computation, collective communication operations, composite synchronization constructs, OpenMP Threading Building blocks; An Overview of Memory Allocators, Parallel Programming Model, Combining MPI and OpenMP, Shared Memory Programming.	06
3	**Programming using GPGPU** An Overview of GPGPUs, An Overview of GPGPU Programming, An Overview of GPGPU Memory Hierarchy Features, An Overview of OpenCL API, CUDA Programming, OpenCL vs. CUDA.	06
4	**Grid and Cloud Computing** Data & Computational Grids, Grid Architectures and its relation to various Distributed Technologies, Examples of The Grid Computing, Cloud Computing, High Performance Cloud Computing (HPC2), Cloud Tensor Processing Units (TPUs).	08
5	**Performance Measures** Speedup, Efficiency and Scalability, abstract performance metrics (work, critical paths), Amdahl's Law, Gustafson's Law, Weak vs. Strong Scaling, Performance Bottlenecks, Data Races and Determinism, Data Race Avoidance. Cluster Setup & its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems, Process Scheduling, Load Sharing and Balancing; Distributed Shared Memory, Parallel I/O.	08
6	**Advanced Technologies** Application Specific Integrated Circuit (ASIC), FPGA Architecture and Design Process, Cluster System – Beowulf; Cluster Operating Systems: COMPaS and NanOS, Pervasive Computing Concepts & Scenarios; Nanotechnology and its impact on high performance computing.	06

Text Books:

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Pearson Education, Second Edition, 2007.
2. Kai Hwang,Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill,Second Edition, 2010.
3. Edward Kandrot and Jason Sanders, "CUDA by Example – An Introduction to General Purpose GPU Programming", Addison-Wesley Professional, 2010.
4. Benedict R Gaster, Lee Howes, David R KaeliPerhaad Mistry Dana Schaa, "Heterogeneous Computing with OpenCL", Elsevier, Second Edition, 2013.

Reference Books:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
2. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill International Editions, Computer Science Series, 2008.
3. Kai Hwang, Zhiwei Xu, "Scalable Parallel Computing: Technology, Architecture, Programming", McGraw Hill, 1998.
4. Laurence T. Yang, MinyiGuo, "High- Performance Computing: Paradigm and Infrastructure" Wiley, 2006.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on liveproblems.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: First Year M.Tech Computer Engineering										Semester: II
Course: Secure Coding										Course Code:DJ19CEPGC202
Course: Secure Coding Laboratory										Course Code:DJ19CEPGL202
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	15	10	25	

Pre-requisite: Knowledge of

1. Cryptography and System Security

Objectives:

1. To learn principles of secured coding and design.
2. To learn various secure access control mechanism with access privileges.
3. To understand cryptographic foibles and data security.
4. To determine various threats to system.
5. To learn security issues in network programming.

Outcomes: On completion of the course, learner will be able to:

1. Write secure programs and identify various risk in the software.
2. Design secure system by threats modeling.
3. Determine appropriate secure access control mechanism and access privileges.
4. Learn common mistake made while using cryptography and data protection.
5. Design secure network program.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Contemporary Security** The Need for Secure Systems, The Proactive Security Development Process, Security Principles to Live By, Threat Modelling. **Threat Modeling.** Secure Design Through Threat Modeling, Security Techniques, Mitigating the Sample Payroll Application Threats, Cornucopia of Threats and Solutions	**06**
2	**Secure Coding Technique** Public Enemy #1: The Buffer Overrun**,** Unicode and ANSI Buffer Size Mismatches, Preventing Buffer Overruns.	**04**
3	**Determine Appropriate Access Control** Why ACLs Are Important, What Makes Up an ACL, A Method of Choosing Good ACLs, Creating ACLs, Getting the ACE Order Right, Be Wary of the Terminal Server and Remote Desktop SIDs,0 NULL DACLs and Other Dangerous ACE Types, Other Access Control Mechanisms.	**06**
4	**Running with Least Privilege** Least Privilege in the Real World , Brief Overview of Access Control, Brief Overview of Privileges, Brief Overview of Tokens, How Tokens, Privileges, SIDs, ACLs, and Processes Relate, Three Reasons Applications Require Elevated Privileges, Solving the Elevated Privileges Issue, A Process for Determining Appropriate Privilege, Low-Privilege Service Accounts in Windows XP and Windows .NET Server 2003,The Impersonate Privilege and Windows .NET Server 2003, Debugging Least-Privilege Issues	**06**
5	**Cryptographic Foibles** Using Poor Random Numbers, Using Passwords to Derive Cryptographic Keys, Key Management Issues, Creating Your Own Cryptographic Functions,Using the Same Stream-Cipher Encryption Key, Bit-Flipping Attacks Against Stream Ciphers, Reusing a Buffer for Plaintext and Ciphertext. **Protecting Secret Data** Attacking Secret Data, Sometimes You Don't Need to Store a Secret, Getting the Secret from the User, Protecting Secrets in Windows 2000 and Later, Protecting Secrets in Windows 95, Windows 98, Windows Me, and Windows CE, Not Opting for a Least Common Denominator Solution, Managing Secrets in Memory, Locking Memory to Prevent Paging Sensitive Data, Protecting Secret Data in Managed Code, Raising the Security Bar.	**09**
6	**Socket Security** Avoiding Server Hijacking, TCP Window Attacks, Choosing Server Interfaces, Accepting Connections, Writing Firewall-Friendly Applications, Spoofing and Host-Based and Port-Based Trust, IPv6 Is Coming! **Protecting Against Denial of Service Attacks** Application Failure Attacks, CPU Starvation Attacks, Memory Starvation Attacks, Resource Starvation Attacks, Network Bandwidth Attacks	**08**

List of Laboratory Experiments:

1. Design and Implement static buffer overrun approach.
2. Design and Implement URL validation technique.
3. Design and Implement E-mail validation technique.
4. Design and Implement Input validation of User Interface (UI) and also check strength of password.
5. Implement prevention mechanism of SQL Injection attack.
6. Create Salted Hash mechanism to authenticate user credential.
7. Implement random sequence password and OTP generation technique.
8. Case study on ACL and least privileges on windows system.

Books Recommended:

Text books:

1. J. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft Press,(2e),2003.
2. Viega, M. Messier. Secure Programming Cookbook for C and C++, O'Reilly Media, Inc, 2003.

Reference Books:

1. J. Viega, G. McGraw. Building Secure Software, Addison-wesley Professional Computing Series,(1e),2010.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on liveproblems..
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7 experiments, and/or Power Point Presentation and/or assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Program: First Year M.Tech Computer Engineering	Semester: II
Course: Predictive Analytics	**Course Code:DJ19CEPGC203**
Course: Predictive Analytics Laboratory	**Course Code:DJ19CEPGL203**

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of

1.Basic Statistics

2.Data Lake Concepts

Objectives:

1. To analyze data collected from different sources and prepare them for analysis.
2. To learn different models for data prediction.
3. To compare different models of data prediction.

Outcomes: On completion of the course, learner will be able to:

1. Prepare raw data for predictive modeling.
2. Apply different models to perform predictive modeling.
3. Compare different models and asses the best model for prediction.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Introduction to Predictive Analytics, Steps involved in Predictive Analytics, Advantages of Predictive Analytics, Issues in Predictive Analytics. Data Exploration: Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and dissimilarity.	**04**
2	**Data Preprocessing and Describe key predictive modeling terms and concepts:** Data Cleaning: Replacing missing values, noise correction. Data Merging: Joining data from different sources. Data reduction: Attribute subset selection, correlation analysis. Data Transformation: Normalization, binning, Data Partitioning: Training, validation and testing sets, Data Visualization: Histogram, scatter plot, heat map, box plot, Line plot, bar graph.	**06**
3	**Build predictive models using decision trees:** Explain how decision trees identify split points: Build decision trees in interactive mode, Change splitting rules, explain how missing values can be handled by decision trees, assess probability using a decision tree, Overfitting and Underfitting corrections, Prune decision trees, adjust properties of the DECISION TREE node, including: subtree method, Number of Branches, Leaf Size, Significance Level, Surrogate Rules, Bonferroni Adjustment. Interpret results of the decision tree node, including: trees, leaf statistics, treemaps, score rankings overlay, fit statistics, output, variable importance, subtree assessment plots.	**07**
4	**Build predictive models using regression:** Relationship between target variable and regression technique: linear regression, logistic regression (Logit link function, maximum likelihood), impact of missing values on regression models, Select inputs for regression models using forward, backward, stepwise selection techniques, Adjust thresholds for including variables in a model, Interpret a logistic regression model using log odds, Interpret the results: Output, Fit Statistics, Score Ranking Overlay charts. Use fit statistics and iteration plots to select the optimum regression model for different decision types	**07**
5	**Build predictive models using neural networks:** Theory of neural networks (Hidden units, Tanh function, bias vs intercept, variable standardization). Build a neural network model, select inputs for a neural network, Delta learning for neural networks optimization. Recognize overfit neural network models. Interpret the results of a NEURAL NETWORK, including: Output, Fit Statistics, Iteration Plots, and Score Rankings Overlay charts	**07**

6	**Ensemble Model:** Importance of Ensemble techniques, Random Forest: Theoretical concept, result analysis: including: Output, Fit Statistics, Iteration Plots, and Score Rankings Overlay charts **Predictive Modelling Assessment and Implementation:** Misclassification, Average Square Error, Profit/Loss, Other standard model fit statistics. Model assessment statistics. ROC Chart, Score Rankings Chart, including (cumulative) % response chart, (cumulative) Lift chart, gains chart. Total expected profit, Effect of oversampling	**08**

List of Laboratory Experiments:

1. Import data and perform statistical analysis on raw data.
2. Perform data preprocessing techniques on raw data.
3. Perform Decision Tree modeling on a categorical dataset.
4. Perform imputation on a regression dataset and apply linear regression.
5. Perform Logistic regression on a binary class label dataset.
6. Perform neural network model on a dataset.
7. Perform Random Forest on a dataset.
8. Perform Model Comparison on the models created above. Analyze the results.
9. Mini project

Books Recommended:

1. Data Mining: Concepts and Hierarchy by By Jiawei Han, Jian Pei, Micheline Kamber, Maurgan Kaufmann publisher, 2nd edition, 2006
2. Machine Learning by Tom Mitchell, McGraw Hills publisher, 1st edition, 2013
3. Data Mining and Predictive Analytics by Danial T Larose and Chantal D Larose, Wiley, 2nd edition, 2015
4. Applied Predictive Analytics by Kjell Johnson, Max Kuhn, Springer, 1st edition, 2013.
5. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst by Dean Abott, Willey, 1st edition, 2014
6. Predictive Analytics for Dummies by Anasse Bari, Mohamed Chaouchi, and Tommy Jung, Willey, 1st edition , 2014
7. Predictive Analytics, Data Mining and Big Data: Myths, Misconceptions and Methods, Springer, 1st edition, 2014

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems..
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7-8 experiments, and/or Power Point Presentation and/or assignments.

The distribution of marks for term work shall be as follows:

iii. Laboratory work (Performance of Experiments): 15 Marks

iv. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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<tr><td colspan="8">Course : Data Storage Technology</td><td colspan="3">Course Code:DJ19CEPGC204</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Computer Architecture
2. Operating System
3. Computer Network

Objectives:

1. To motivate business stakeholders and IT teams to recognize the critical role of 'information' infrastructure.
2. To differentiate, select, and deploy various storage networking solutions based on application requirements.
3. To discuss backup, recovery, and archival requirements and solutions for business-critical data.
4. To discover, monitor, and report information in real-time pertaining to storage infrastructure and implement third platform-centric processes to support on-going management operations.

Outcomes: On completion of the course, learner will be able to:

1. Acquire the basic knowledge of storage and Data center.
2. Analyze various network and infrastructure used for data storage.
3. Understand business continuity and various methods of data Back-ups.
4. Introduce about storage management and virtualization and storage security.
5. Differentiate cloud and network storage visualization.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Information Storage** Digital data and its types, Information Storage, Data Centre Infrastructure, Building blocks of a data center, Key Challenges, Information Life Cycle, Data Protection: RAID, RAID Implementation, RAID Levels.	**08**
2	**Storage Networking** SCSI, Parallel SCSI, Storage Area Networks: Fibre Channel, Software-defined networking FC SAN components and architecture, iSCSI protocol, network components, and connectivity Network Attached Storage, IP SAN,	**06**
3	**Business Continuity and Storage Security** Impact of information unavailability, Introduction to business continuity, data replication, data backup architecture and methods, and an overview of storage infrastructure security.	**06**
4	**Storage Infrastructure Management** Introduction to storage infrastructure, Storage management activities, Challenges, Developing an ideal solution: Storage management initiative, enterprise management platform.	**08**
5	**Storage Virtualization** Definition, benefits, Storage Virtualization: Forms, Challenges, Taxonomy, challenges, Types of Storage virtualization, Advantage and Disadvantages, FABRIC, Switched FABRIC.	**05**
6	**Cloud Virtualization and Storage Networking** Sever and Storage I/O fundamentals, Virtualization: Server, Storage and Networking, Networked Storage: Public and Private Cloud, Infrastructure Resource Management, Cloud and Solution Packages, Management and Tools.	**06**

Books Recommended:

Text books:

1. G. Somasundaram and Alok Shrivastava - Information Storage and Management by, EMC Education Services, Wiley Publishing, 2009.
2. IT Infrastructure Landscape Overview, Student Guide by IBM
3. Greg Schul-Cloud and Virtual Data Storage Networking by, CRC Press, 2012.

Reference Books:

1. Nigel Poulton - Data Storage Networking by, SYBEX, Wiley Publication.
2. Richard Barker and Paul Massiglia - Storage Area Network Essential, Wiley Publication.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : II</td></tr>
<tr><td colspan="8">Course : Business Intelligence</td><td colspan="2">Course Code:DJ19CEPGE201</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Data mining.
2. Analysis of Algorithms.

Objectives:

1. To introduce the idea of decision making in complex business environment.
2. To understand the science behind better predictions and decisions.
3. To generate an ability to design, analyze and perform experiments on real life problems using various decision making methodologies.

Outcomes: At the end of the course, learner will able to

1. Understand the characteristics of real world complex business problems.
2. Know the structure of Adaptive Business Intelligence System.
3. Analyze different prediction methods and models.
4. Analyze different modern optimization techniques.
5. Analyze different hybrid systems and adaptability.
6. Apply adaptive business intelligence in real time environment.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Complex Business Problems:** Introduction to decision making methods AHP, SAW, VIKOR, WPM, MCDM, MADM methods and examples. **Characteristics:** Number of Possible Solutions, Time-Changing Environment , Problem-Specific Constraints, Multi-objective Problems ,Modeling the Problem, A Real-World Example	04
2	**Business Intelligence:** Data Mining, Prediction, Optimization, Adaptability Structure of an Adaptive Business Intelligence System	06
3	**Prediction Methods and Models:** Data Preparation, Different Prediction Methods, Mathematical Methods Distance Methods: Logic Methods ,Modern Heuristic Methods ,Additional Considerations, Evaluation of Models	09
4	**Modern Optimization Techniques:** Local Optimization Techniques, Stochastic Hill Climber, Simulated Annealing, Tabu Search , Evolutionary Algorithms, Constraint Handling Classifiers Evolutionary Computation : Ant colony optimization	09
5	**Hybrid Systems and Adaptability:** Hybrid Systems for Prediction, Hybrid Systems for Optimization, Adaptability	06
6	**Applying Adaptive Business Intelligence:** Marketing Campaigns , Manufacturing, Investment Strategies, Emergency Response Services, Credit Card Fraud	05

Text Books:

1. Zbigniew Michalewicz, Martin Schmidt, Matthew Michalewicz, ConstantinChiriac,-Adaptive Business Intelligence, Springer publication,2006
2. Venkata Rao, - Decision Making in the Manufacturing Environment: Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods, Springer publications,2013
3. Da Ruan, - Computational Intelligence in Complex Decision Systems, Atlantis Press, Amsterdam Press, World Scientific,2010
4. Carlo Vercellis, - Business Intelligence: Data Mining and Optimization for Decision Making, Wiley Publications,2009

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : II</td></tr>
<tr><td colspan="8">Course : Blockchain Technologies</td><td colspan="3">Course Code:DJ19CEPGE201</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Cryptography and System Security

Objectives:

1. To understand the concept of Blockchain and its relevance with cryptography.
2. To acquire knowledge of various techniques used in Blockchain.
3. To apply the Blockchain concept in real life applications.

Outcomes: On completion of the course, learner will be able to:

1. Acquire the basic knowledge of Blockchain technology.
2. Analyze various algorithms used in Blockchain.
3. Introduce about cryptocurrency and various regulations.
4. Aware about privacy and security issues in Blockchain.
5. Design and understand various applications using Blockchain.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Blockchain Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	**07**
2	**Basic Crypto primitives and Distributed Computing:** Introduction, advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public Blockchain.	**07**
3	**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	**06**
4	**Cryptocurrency Regulations:** Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	**06**
5	**Privacy, Security Issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent theseattcks.	**07**
6	**BlockchainApplications and Technology Contributions by Industries:** Applications of Blockchain in Healthcare, Automotive, Government, Insurance, Media and Entertainment.The Linux Foundation's Hyperledger Fabric and Microsoft Azure's Blockchain as a Service.	**06**

Books Recommended:

Text books:

1. Josh Thompson, - Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
2. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, -Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019.

Reference Books:

1. Dr. Gavin Wood, -ETHEREUM: A Secure Decentralized Transaction Ledger,Yellow paper.2014

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : II</td></tr>
<tr><td colspan="8">Course : Project Management</td><td colspan="3">Course Code:DJ19OPGC2021</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Objectives:

1. Identify key areas of concern over Project Life Cycle (PLC) and use of project management principles across all the phases of PLC.
2. Make themunderstand the importance and necessity of project plan.
3. Make them understand the importance of team and how to work as a team member, share best project management practices.

Outcomes: On completion of the course, learner will be able to:

1. Assess a project by establishing a business case and accordingly prepare a project proposal.
2. Develop a project plan.
3. Identify task inter-dependencies, construct and analyze a network diagram
4. Monitorand control the performance of the project.
5. Demonstrate Team work and team spirit and resolveconflicts.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**An overview of Project Management:** What is project? Characteristics of project, Project Vs Operations, Project Goals, Project Life Cycle (typical & atypical), Evolution of Project Management, Need of Project Management, Different forms of Project Management, Project Environment, PMBOK. Remote (Virtual) Project Management: Introduction, benefits, challenges, tools for remote project management.	**05**
2	**Project Initiation and Planning:** Project Feasibility, Request for Proposal (RFP), Business Case, Project selection and approval process, Project Proposal, Project Contracting.Planning steps, Project Management Process, Project Charter, Project Planning Framework, Work Breakdown Structure (WBS), Linear Responsibility Chart, Gantt Chart.	**05**
3	**Project Time Management**: NetworkDiagrams (AOA&AON), Critical Path, PDM network, PERT, CPM, Resource Loading, Resource Leveling, Goldratt's Critical Chain.	**08**
4	**Project Cost Management:** Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Top down and bottom up budgeting, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts.	**04**
5	**Project Human Resource Management:** Formal & Informal organization, project team, multidisciplinary teams, project leadership, ethics in projects, multicultural projects, Role of project manager. The nature of change, the change management plan, dealing with resistance and conflicts. Remote collaboration and its current state, future prospect of remote collaboration, managing remote teams effectively.	**06**
6	**Project Communication Management:** Monitoring and controlling the project, the project communications plan, project metric – Earned Value Management, data collection and reporting, reporting performance and progress, information distribution.	**04**
7	**Project Risk Management:** Basic concepts, Identification, Assessment, and Response plan.	**04**
8	**Project Procurement Management and Project Closure:** Introduction, project procurement management, outsourcing. Project implementation, administrative closure, project evaluation.	**04**

Books Recommended:

Text books:

1. John M. Nicholas, Project Management for Business and Technology, 4th edition, Pearson Education.
2. Jack T. Marchewka, Information Technology Project Management, 4th edition, Wiley India, 2009.

Reference Books:

1. E-Book –A Guide to Project Management Body of Knowledge (PMBOK ® Guide), 5th edition, Project Management Institute PA, USA.
2. Claudia M. Baca, Patti M. Jansen, PMP: Project Management Professional Workbook, Sybex Publication.
3. S. J. Mantel, J. R. Meredith and etal., Project Management 7thedition, Wiley India, 2009.
4. Joel Henry, Software Project Management, A real-world guide to success, Pearson Education, 2008.
5. Gido and Clements, Successful Project Management, 2ndedition, Thomson Learning
6. Hughes and Cornell, Software Project Management, 3rdedition, Tata McGraw Hill
7. Joseph Phillips, IT Project Management, end edition, Tata McGraw Hill
8. Robert K. Wyzocki, Effective Project Management, 5th edition, Wiley
9. Brown, K. A. Project Management, McGraw Hill, 2002.
10. Dinsmore, P. C. (Ed.), The AMA Handbook of Project Management. AMACOM, 1993.
11. https://www.pmi.org
12. https://www.projectmanager.com

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="8">Course:IPR and Patenting</td><td colspan="3">Course Code:DJ19OPGC2022</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
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<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty Procedures.
3. To get acquaintance with Patent search and patent filing procedure and applications

Outcomes: On completion of the course, learner will be able to:

1. Understand Intellectual Property assets
2. Assist individuals and organizations in capacity building
3. Work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	**05**
2	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement **Indian Scenario of IPR:**Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	**07**
3	**Emerging Issues in IPR:**Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	**05**
4	**Basics of Patents:** Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	**07**
5	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	**08**
6	**Procedure for Filing a Patent(NationalandInternational):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	**07**

Books Recommended:

Text books:

1 Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India.
2. Keayla B K, Patent system and related issues at a glance, published by National Working Group on Patent Laws.
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International.
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press.
5. Cornish, William Rodolph&Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell.
6. LousHarns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
7. PrabhuddhaGanguli, 2012, Intellectual Property Rights, 1st Edition, TMH.
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books.
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications.
10. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications.

Reference Books:

1. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual PropertyRights,
2. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, WorldScientific Publishing Company
3. N S Rathore, S M Mathur, PritiMathur, AnshulRathi**,** IPR: Drafting, Interpretation of PatentSpecifications and Claims**,** New India Publishing Agency
4. Vivien Irish, 2005, Intellectual Property Rights for Engineers,IET
5. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
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3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Course : Remote Sensing Concepts</td><td colspan="3">Course Code:DJ19OPGC2023</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Applied Physics
2. Digital Image Processing
3. Satellite Communication

Objectives:

1. To provide basic concepts and principle of Remote Sensing
2. To give an understanding of various sensors used in Remote Sensing
3. To explain various applications of Remote Sensing.

Outcomes: On completion of the course, learner will be able to:

1. Comprehend the basics of Remote Sensing
2. Describe various Remote Sensing methods and sensors
3. Explain various tools used for data extraction in Remote Sensing
4. Apply the concepts of Remote Sensing for various applications

Module No.	Unit No.	Topics	Hrs.
1		**Introduction and Basic Concepts**	6
	1.1	Introduction, Basic concepts and principle of remote sensing	
	1.2	Electromagnetic Radiation, Terms and Definitions, Laws of Radiation, Energy sources and radiation principles, Energy interactions in the atmosphere, Energy interactions with earth surface features	
2		**Remote Sensing Systems**	8
	2.1	Airborne and space born sensors, Passive and active remote sensing, Imaging and non-imaging systems, Orbits and platforms for Earth observation	
	2.2	Spectral, radiometric and spatial resolutions, Temporal resolution of satellites, Geometric, Atmospheric and Radiometric corrections	
	2.3	Some remote sensing satellites (LANDSAT, SPOT, IRS, IKONOS) their features and specification.	
3		**Thermal & Microwave Remote Sensing**	8
	3.1	Thermal radiation principles, processes and thermal properties of materials, thermal sensors and scanners, applications of thermal remote sensing	
	3.2	Active and passive microwave systems, basic principle of Radar/SAR (Geometric and statistical properties and imaging geometry) –Radar Relief displacement (Foreshortening, Layover, Shadow & Speckle), Applications of microwave remote sensing.	
4		**Multispectral and Hyper spectral Remote Sensing**	8
	4.1	Multispectral concept and sensors, Colour theory, Nature and construction of multispectral image, natural colour composite, false colour composite, interpretation of multispectral image	
	4.2	Hyper spectral concept and sensors, data collection systems, calibration techniques, data processing techniques; preprocessing, N-dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Mixture tuned matched filtering	
5		**Information Extraction**	6
	5.1	Ground truth data collection, use of radiometers, spectroradiometers and spectrophotometers	
	5.2	Spectral reflectance curves, Physical basis of spectral signatures of the objects and Spectral Signature for Vegetation, Soil, Water and Snow.	
6		**Remote Sensing Applications**	6
	6.1	Watershed management, Forest mapping & monitoring, Rainfall-runoff modeling, Irrigation management, Flood mapping, Drought assessment, Environmental monitoring.	

Text Books:

1. Introduction to Remote Sensing - Principles and Concepts by Paul J Gibson, Routledge - Taylor & Francis, 2000.
2. Introduction to Remote Sensing - Digital Image Processing and Applications by Paul J Gibson and Clare H Power, Routledge - Taylor & Francis, 2000.
3. Remote Sensing - Principles and Interpretation, F.F. SabinsJr, W.H. Freeman & Co., New York, 1986.
4. Remote Sensing - Models and Methods for Image Processing, R.A. Schowengerdt, Elsevier India Pvt. Ltd., New Delhi, 2006

Reference Books:

1. Lillesand Thomas M. & Kiefer Ralph: Remote Sensing and Image Interpretation Third Edition
2. John Wiley. Campbell John B.: Introduction to Remote Sensing Taylor & Francis

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : II</td></tr>
<tr><td colspan="8">Course : Product Life Cycle Management</td><td colspan="2">Course Code:DJ19OPGC2024</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
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Pre-requisite: Knowledge of

1. Product development process
2. Environmental science

Objectives:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes: On completion of the course, learner will be able to:

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Product Lifecycle Management (PLM):** Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	**06**
2	**Product Design:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and their use in the Design Process	**07**
3	**Product Data Management (PDM):** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	**06**
4	**Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	**07**
5	**Integration of Environmental Aspects in Product Design:** Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	**06**
6	**Life Cycle Assessment and Life Cycle Cost Analysis:** Properties, and Framework of LCA, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	**07**

Books Recommended:

Reference Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, AntoninoRisitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. SaaksvuoriAntti, ImmonenAnselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : II</td></tr>
<tr><td colspan="8">Course : Research Methodology</td><td colspan="3">Course Code:DJ19OPGC2025</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="5">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="5">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">--</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">--</td><td rowspan="2">--</td><td rowspan="2">3</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Pre-requisite: Knowledge of

1. Research concepts

Objectives:

1. To understand Research and Research Process.
2. To acquaint students with identifying problems for research and develop research strategies.
3. To familiarize students with the techniques of data collection, analysis of data and interpretation.

Outcomes: On completion of the course, learner will be able to:

1. Prepare a preliminary research design for projects in their subject matter areas.
2. Accurately collect, analyze and report data.
3. Present complex data or situations clearly.
4. Review and analyze research findings.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction and Basic Research Concepts:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, Issues and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	**06**
2	**Types of Research:** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	**07**
3	**Research Design and Sample Design:** Research Design – Meaning, Types and Significance Sample Design – Meaning and Significance, Essentials of a good sampling Stages in Sample Design Sampling methods/techniques, Sampling Errors	**06**
4	**Research Methodology:** Meaning of Research Methodology, Stages in Scientific Research Process: • Identification and Selection of Research Problem • Formulation of Research Problem • Review of Literature • Formulation of Hypothesis • Formulation of research Design • Sample Design • Data Collection • Data Analysis • Hypothesis testing and Interpretation of Data Preparation of Research Report	**07**
5	**Formulating Research Problem:** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**06**
6	**Outcome of Research:** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	**07**

Books Recommended:

Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C. R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley EasternLimited.

3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems..
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Prepared by Checked by Head of the Department Principal