B. Tech SEM-1

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT401
Course Name	Data Mining
Desired Requisites:	Basic Statistics, Mathematics, Computer Algorithms and any programming language

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	Provide the student with an understanding of the concepts of data mining and knowledge discovery process
2	Describe the data mining tasks and study their well-known techniques
3	Develop an understanding of the role played by knowledge in a diverse range of applications.
4	Test real data sets using popular data mining tools such as WEKA, Knime

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To provide a brief introduction to general issues of data mining for understanding.	II	understanding
CO2	To apply different algorithms and mining techniques with clear understanding of the methods	III	Applying
CO3	To plan, design and evaluate different data mining techniques.	V	Evaluating
CO4	To design, develop and validate decision making process via output from data mining	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction : Basic Concepts in Data Mining** Data mining background, classification of Data Mining, Data Mining Techniques. Data Preprocessing: Cleaning, Integration , Transformation, Reduction, Discretization, Data categories, supervised unsupervised learning, Fielded Applications, Data mining and ethics	7
II	**Data Mining Primitives** Data Mining Primitives, Architecture of Data Mining, Knowledge representation **Concept Description:** Data generalization & summarization, analytical Characterization, mining class comparison, mining statistical measures in Databases.	7
III	**Association Rule mining,** mining 1-dimensional & Multilevel Association Rule from transactional Database and Data Warehouse Association mining to correlation analysis, constraint based Association mining, Algorithms for association rules	6
IV	**Classification & Prediction,** Issues, Regression, Decision Tree, Bayesian classifier, Classification methods, Prediction, ensemble classification	6

V	**Cluster analysis** Clustering, analysis, methods, (partitioning based, hierarchical based, density based, grid based, model based), cluster validation techniques, constraint based cluster analysis, outlier analysis, applications	7
VI	**Mining Complex Data sets** Multidimensional analysis & descriptive mining of complex data types, mining spatial DB, Multimedia DB, Mining time series and sequential data, mining text datasets, web mining, data stream mining	6

Textbooks	
1	"Data Mining – Concepts and Techniques" Jiawei Han and Micheline Kamber, 3rd Edition, The Morgan Kaufmann Series in Data Management Systems, 2011
2	"Data Mining: Introductory and Advanced topics", M.H. Dunham, 2nd Edition, Pearson, 2003
3	"Data Mining: Practical Machine Learning Tools and Techniques", Ian Witten, Eibe Frank and Mark Hall, 3rd Edition, 2011
References	
1	"Data Mining Methods : Concepts & Applications", Rajan Chattamvelli, Narosa Publishing House, International Publisher, 2010
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs22/preview
2	https://onlinecourses.nptel.ac.in/noc24_mg08/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2						2				3		2
CO2	1		3	2	3			2		2				2
CO3		3	3			3	2	3				2		3
CO4	3	2												

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2024-25						
Course Information						
Programme	B.Tech. (Information Technology)					
Class, Semester	Final Year B. Tech., Sem. VII					
Course Code	6IT402					
Course Name	Cryptography & Network Security					
Desired Requisites:	Computer Networks					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**	
Tutorial	-	20	30	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To describe the fundamental concepts of network security using confidentiality, integrity and availability (CIA) of the information
2	To explain various encryption techniques
3	To apprise security mechanisms and services against threats

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Extend number coding theory in view of information security aspects	II	Understanding
CO2	Practice various crypt-complex encryption algorithms providing confidentiality	III	Applying
CO3	Compare access control mechanisms and authentication services resolving the security issues	IV	Analyzing
CO4	Recommend mathematical functions that are able to check information integrity	V	Evaluating
CO5	Propose application of security framework at the desired network layer	VI	Creating

Module	Module Contents	Hours
I	**Security Overview:** Services, Mechanism and Attacks, The OSI Security Architecture, Classical Encryption Techniques, Substitution Techniques, Transposition Techniques, Steganography	7
II	**Block Cipher:** Block Cipher Design Principles, Modes of Data Transfer, Symmetric Cipher Model, Data Encryption Standard, Security of 2DES, 3DES & AES	7
III	**Public Key Encryption:** Principles of Public-Key Cryptosystem, RSA Algorithm, Distribution of Public Keys, Diffie-Hellman Key Exchange	6
IV	**Authentication Functions and Services:** Hash Functions, Message Authentication Codes, Digital Signatures Kerberos, X.509 Certificates	6
V	**IP & Web Security:** IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction	6

VI	**Perimeter Security:** Intruders, Intruder Detection, Password Management, MalwaresFirewall Configurations, Trusted Systems, Honeypots	7

Text Books

1	William Stallings, *"Cryptography and Network Security, Principles and Practices",* Pearson Publication, 8th Edition 2020
2	Atul Kahate, *"Cryptography and Network Security",* McGraw Hill Education India, 4th Edition, 2017

References

1	Menezes, A. J., P. C. Van Oarschot, and S. A. Vanstone, "*Handbook of Applied Cryptography*", CRC Press, 2nd Edition, 2018
2	Schneier, Bruce, "*Applied Cryptography: Protocols & Algorithms*", Wiley Publication,2nd Edition, 2015

Useful Links

1	https://www.researchgate.net/publication/26585503_Network_Security_Policies_and_Guidelines_for_Effective_Network_Management
2	https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
3	https://cis-india.org/internet-governance/publications/it-act/short-note-on-amendment-act-2008

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2										1		
CO2			1		3								2	
CO3		3				2	1							
CO4	2		3											1
CO5				2				1						3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessmentcan be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6IT403
Course Name	Machine Learning
Desired Requisites:	Linear Algebra

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To elaborate basic concepts of knowledge, reasoning and machine learning
2	To use different linear methods of regression and classification
3	To interpret the different supervised classification methods

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Recognize the characteristics of machine learning for the real-world problems	II	Understanding
CO2	Apply the different supervised learning methods for real-world problems	III	Applying
CO3	Use different linear methods for regression and classification	IV	Analyzing
CO4	Explain Bayesian Classification in machine learning	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to ML:** History of ML Examples of Machine Learning Applications, Learning Types, ML Life cycle, AI & ML, dataset for ML, Data Pre-processing, Training versus Testing, Positive and Negative Class, Cross-validation.	6
II	**Regression Analysis:** Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Supervised learning and Regression, Statistical Relationship between Two variables and scatter plots, Logistic Regression.	7
III	**Decision Tree:** Introduction to Classification and Decision Tree(DT), Problem solving using Decision Tree, Basic DT Learning algorithm, classification and DT, Issues in DT, Rule based classification	6
IV	**Artificial Neural Networks:** Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation	7
V	**Unsupervised Learning** Clustering, Types of clustering, K-means, K- Medoids, Hierarchical, Agglomerative	6

VI	**Bayesian Classification:** Introduction to Baysian classification, Naive Bayes classifiers, Baysin Belief Network, KNN , Measuring classifier Accuracy	7
Textbooks		
1	Tom M. Mitchell, “Machine Learning”, India Edition 2013, McGraw Hill Education.	
References		
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.	
2	J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016	
Useful Links		
1	https://onlinecourses.nptel.ac.in/noc23_cs18/unit?unit=22&lesson=23	
2	https://onlinecourses.nptel.ac.in/noc23_cs87/preview	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				1								1	
CO2		3											2	
CO3	2	1			2									2
CO4	3												3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT451
Course Name	Data Mining Laboratory
Desired Requisites:	Computer programming, Knowledge about Mathematics and Statistics

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	Students will be able to describe data processing methods for data cleaning and summarization.
2	Students will demonstrate competency in data modelling and presenting.
3	Students will learn steps involved in development of data mining algorithms and use at least one data mining tool.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To apply appropriate data preprocessing techniques	III	Applying
CO2	To study, evaluate and test various data mining algorithms	IV	Analyzing
CO3	integrate learning from domain for decision making process in an organization	VI	Creating
CO4	To design a data mining algorithm to solve real word problems	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Experiment 1: Understanding Data Set and its characteristics to plot various graphs to visualize data
2. Experiment 2: Perform data Cleaning, smoothing, transformation, normalization.
3. Experiment 3: Finding 5 number summary for dataset and study of Box plot.
4. Experiment 4: Perform data generalization & summarization.
5. Experiment 5: Finding frequent itemset on transaction data.
6. Experiment 6: Unsupervised Learning Methods : Finding association Rules
7. Experiment 7: Perform Prediction and Classification – Regression analysis
8. Experiment 8: Supervised Learning Methods Classification - Decision Tree
9. Experiment 9: Unsupervised Learning Methods : Cluster Analysis - partitioning based
10. Experiment 10: Unsupervised Learning Methods : Cluster Analysis - hierarchical based
11. Experiment 11: Unsupervised Learning Methods : Cluster Analysis - density based
12. Experiment 11: Perform various data mining tasks using WEKA and KNIME tools.
13. Experiment 13: Project - Using some sample data provide data mining based solution.

Textbooks

1	Jiawei Han and Micheline Kamber, "*Data Mining – Concepts and Techniques*", 3rd Edition, The Morgan Kaufmann Series in Data Management Systems, 2011
2	Ian Witten, Eibe Frank and Mark Hall, "*Data Mining: Practical Machine Learning Tools and Techniques*", 3rd Edition, 2011

3	

References	
1	Chris Pal, Ian Witten, Eibe Frank, and Mark Hall, "*Data Mining: Practical Machine Learning Tools and Techniques",* Morgan Kaufmann Series in Data Management Systems, 4th Edition, 2013
2	Bostjan Kaluza, *"Instant Weka How-to*", Packt Publishing Limited, June 2013

Useful Links	
1	https://nptel.ac.in/courses/110/107/110107092/
2	https://nptel.ac.in/courses/110/107/110107095/
3	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2						2				3		2
CO2			3	2	3			2		2				2
CO3		3	3			3	2	3				2		3
CO4			2	3				2				2	2	3

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Marks Submission at the end of Week 4	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Marks Submission at the end of Week 8	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 9 to Week 13 Marks Submission at the end of Week 13	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2024-25					
Course Information					
Programme	B.Tech. (Information Technology)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code	6IT452				
Course Name	Open Source Software Lab				
Desired Requisites:	Unix Operating Systems, Software Engineering, Computer Network, Web Technology				
Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	2 Hr	30	30	40	100
		Credits: 3			

Course Objectives	
1	To configure the open source software
2	To contribute or develop software in open source environment
3	To use FOSS for software engineering

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Exercise the FOSS tools in software development	III	Applying
CO2	Analyze the economics of FOSS	IV	Analyzing
CO3	Compare the open source licenses for software start up	IV	Analyzing
CO4	Create new FOSS or Contribute to existing FOSS	VI	Creating

Module	Module Contents	Hours
I	**Introduction** Introduction to open sources- Need of Open Sources- Advantages of Open Sources-Applications of Open Sources- commercial aspects of Open source movement, Notion of Community, Guidelines for effectively working with FOSS community, Benefits of Community based Software Development Requirements for being open, free software, open source software, FOSS Licensing Models –GPL, AGPL, LGPL, FDL, Economy of FOSS, History of Linux, Kernel Versions.	6
II	**Open source development and FOSS languages** Proprietary software development model vs. Open Source software development model, models for FOSS- Cathedral model and Bazaar model. Software package management: RPM, DEB – building.	4
III	**Introduction to collaborative development** Developer communities, mailing lists, IRC, wiki, version control (git/github), bug tracking, handling non-technical issues, localization, accessibility, documentation FOSS code by doxygen.	5
IV	**Open source Virtualization and FOSS** Containerization technologies: docker, Container Images, alternative to virtualization: rocket, etc, Containerization of FOSS tools	4

V	**Configuration of Network services** DHCP, DNS, WINES, NFS, NIS, Web server, Ftp Server, Telnet Server, etc. GUI configuration tools: webmin or usermin.	4
VI	**Web Server Tools and FOSS CMS** Installation and Administration of Web Servers- LAMP, XAMPP, Apache, mysql, etc. Installation of Content Management Systems – WordPress, Joomla, Drupal, Moodle, MaheraXoops, Magento, social networking.	3

List of Experiments / Lab Activities

1. Compare the various Linux Distributions and their usage
2. Comparison of various Open Source tools : Project management
3. Comparison of various Open Source tools: bug tracking
4. Comparison of various Open Source tools: version control system
5. Comparison of various Open Source tools: CMS
6. Compilation and installation of Linux Kernel
7. Creation Of RPM/DEB packages
8. Excise the development of Open Source Software:-Develop simple software for basic needs such as calculator, editor or any small noticeable contribution in existing FOSS.
9. Configuration of Server based services and their uses
10. Docker container : An open source software development platform

Text Books

1	Andrew M. St. Laurent , "*Understanding Open Source and Free Software Licensing*", First edition, O'Reilly Media, Inc, ISBN:9780596005818
2	Paul Kavanagh, "*Open Source Software: Implementation and Management*", First edition, Digital Press, 2004, ISBN**:** 9780080492001.
3	Stefan Koch, "*Free/Open Source Software Development*", First edition, Idea Group Publishing, 2004.

References

1	Zhao Jiong, "*A Heavily Commented Linux Kernel Source Code*", Third edition, Old Linux Publications, 2019
2	Stefan Koch · "*Free/Open Source Software Development*", First edition, IGI Publishing, 2004, ISBN-13: 978-1591403692
3	

Useful Links

1	https://bitnami.com/
2	https://labs.play-with-docker.com/
3	https://github.com/mit-pdos/xv6-public
4	https://www.gnu.org/software/fsfe/projects/ms-vs-eu/halloween1.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1		3								2	1
CO2		3			2				2		3		2	3
CO3			2									2	1	2
CO4		1			2				2		1		3	2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as perthe nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT453
Course Name	IT Practices Lab 2
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To discuss applications of CNS and ML with its probable implementations
2	To introduce integration of Rasberry Pi, Arduino, Web services and AIML
3	To explain information security services and mechanisms

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe architectural models of CNS and ML technologies	II	Understanding
CO2	Apply tools and technologies to solve the problems in various domains of CNS and ML	III	Applying
CO3	Integrate framework addressing specific requirements during data communication on web services	IV	Analysing
CO4	Classify algorithms providing confidentiality, integrity and availability of information	V	Evaluating
CO5	Propose prototypes with economical solutions to the problems in the fields of CNS and ML	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

Various Experiments using Raspberry Pi / Arduino/ESP32 and sensors Such as: (1-5)

1. House price prediction on the Boston housing data set from Kaggle.
2. Application of logistic regression on Titanic dataset from Kaggle.
3. Application of Artificial Neural Network on the Boston housing data set from Kaggle for house price prediction.
4. Application of Artificial Neural Network on Titanic dataset from Kaggle for classification
5. Application of SVM on Titanic dataset from Kaggle for classification
6. Application of K-NN on the Titanic dataset from Kaggle for classification.
7. Application of Decision tree on Titanic dataset from Kaggle for classification.
8. Implementing classical cryptographic algorithms
9. Applying hash functions using salt values
10. Analysing OTP (One time password) security
11. Comparing multiple level encryption to crypt-complexity
12. Setting system security and parameters

Textbooks	
1	Pethuru Raj and Anupama C. Raman, *"The Internet of Things: Enabling Technologies, Platforms, and Use Cases"*, CRC Press, 1st edition, 2017
2	William Stallings, *"Cryptography and Network Security, Principles and Practices"*, Pearson Publication, 8th Edition 2020

References	
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, *"IoT Fundamentals:Networking Technologies, Protocols, and Use Cases for the Internet of Things"*, 1st Edition, Pearson Education (Cisco Press Indian Reprint).
2	Adrian McEwen, Hakim Cassimally, *"Designing the Internet of Things"*, Wiley, 1st Edition, 2013
3	Menezes, A. J., P. C. Van Oarschot, and S. A. Vanstone, "*Handbook of Applied Cryptography*",CRC Press, 2nd Edition, 2018

Useful Links	
1	https://www.coursera.org/learn/introduction-iot-boards?action=enroll
2	https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3											1	2	
CO2		2			3									1
CO3				3			2	1						
CO4	2	3		1										
CO5			2			1								3

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**

LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 7 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 14 Marks Submission at the end of Week 14	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 15 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2024-25					
Course Information					
Programme	B.Tech. (Information Technology)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code	6IT491				
Course Name	Project-2				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Practical	6 Hrs/Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 3			

Course Objectives	
1	To help students to identify real life needs and discuss project requirements.
2	To give technical solutions through latest design & development tools.
3	To direct students to compare and analyze the IT platforms for efficient solutions.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Integrate project at each stage of the software development life cycle	III	Applying
CO2	Evaluate project plans that address real-world challenges	V	Evaluating
CO3	Measure the results of project to justify the solutions to problem statement	V	Evaluating
CO4	Develop successful software projects that support program's strategic goals and satisfies the customer needs	VI	Creating

List of Experiments / Lab Activities

List of Experiments:

Project is to be carried out in a group of maximum 5 to 6 students.
Each group will carry out a project by developing any application software based on the following areas.

1. Application can be based on any trending new technology.
2. Application can be extension to previous projects.
3. Project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
5. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
6. Project will be evaluated continuously by the guide/panel as per assessment plan.
7. Presentation and report should use standard templates provided by department.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along
with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or
on an online repository.
Students should maintain a project log book containing weekly progress of the project.

Text Books	
1	Rajendra Kumbhar , "*How to Write Project Reports, Ph. D. Thesis and Research Articles*", Universal Prakashan, 2015
2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017

References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
2	

Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1	2		2		2		1			3	3	3
CO2		3			3	2		2		2		3	2	1
CO3			2				3		2		3		2	2
CO4		3											3	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT411
Course Name	Professional Elective - 3: Big Data Analytics
Desired Requisites:	Data Mining

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
	-	**Credits: 3**			

Course Objectives

1	To elaborate the fundamental concepts of big data analytics
2	To discuss big data processing algorithms
3	To represent big data using visualization tools

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe big data types and characteristics	II	Understanding
CO2	Practice big data analytics techniques and algorithms	III	Applying
CO3	Studyvarious approach to implement distributed environment	IV	Analyzing
CO4	Check the performance of algorithms on advanced distributed system	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction to Big Data:** Big Data and its Importance, Four V's of Big Data, Drivers for Big Data – Introduction to Big Data Analytics, Big Data Analytics applications.	6
II	**Big Data Technologies:** Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics	7
III	**Processing Big Data:** Detecting Patterns in Complex Data with Clustering and Link Analysis, Identifying previously unknown groupings within a data set, Segmenting the customer market with the K–Means algorithm, Defining similarity with appropriate distance measures, Constructing tree–like clusters with hierarchical clustering, Clustering text documents and tweets to aid understanding	6
IV	**Hadoop Mapreduce:** Introduction to Map-Reduce, Hadoop Framework, Spark Framework	7
V	**Distributed Map Reduce:** TF-IDF Example, Page Rank Example, Demonstration: Page Rank Algorithm in Spark	7

VI	**Analytic Tools:** PIG overview, SQL vs. PIG, PIG Latin, User Defined Functions, DataProcessing Operators, Overview of Hive, Hive QL, Tables, Querying Data	6

Text Books	
1	Prajapati Vignesh, *"Big Data Analytics with R and Hadoop"*, Packt Publishing, 1st Edition, 2013
2	Minelli Michael, Chambers Michehe, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", Ambiga Dhiraj, Wiely CIO Series, 1st Edition, 2013

References	
1	Franks Bill, *"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics"*, Wiley and SAS Business Series,1st Edition , 2012

Useful Links	
1	Module I, II, III, IV, V, VI https://nptel.ac.in/courses/106/104/106104189/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3											2	1		3
CO2	1		3										2		1
CO3		3												2	
CO4	2			3	1									1	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.MSE
shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessmentcan be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage onmodules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT412
Course Name	Professional Elective – 3: Mobile Ad-hoc & Sensor Network
Desired Requisites:	Computer Networks, Wireless Network

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
	-	**Credits: 3**			

Course Objectives

1	To discuss different wireless technologies.
2	To introduce various protocols used in Adhoc and Sensor Networks.
3	To design sensor network scenario

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate different wireless network issues through ad-hoc concepts.	III	Applying
CO2	Integrate MAC and network layer protocols for mobile ad-hoc and sensor networks	IV	Analyzing
CO3	Discuss challenges in deploying wireless sensor network in real life applications	IV	Analyzing
CO4	Recommend different protocol of Mobile Adhoc and Sensor Networks(MANs)	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction Mobile Adhoc Networks(MANETs):** Introduction: Wireless Ad Hoc Networks, Self-organizing Behaviour of Wireless Ad Hoc Networks Cooperation in Mobile Ad Hoc Networks, MAC Protocols in MANETs	6
II	**Routing in MANETs:** Routing in MANETs,Multicasting in MANETs, Mobility Models for MANETs,Transport Protocols for MANETs	7
III	**Wireless Sensor Networks:** Opportunistic Mobile Networks, UAV Networks, Introduction: Wireless Sensor Networks	6
IV	**Wireless Sensor Network Management:** WSN Coverage & Placement, Topology Management in Wireless Sensor Network Mobile Wireless Sensor Networks, Medium Access Control in Wireless Networks	7
V	**Routing in WSN:** Routing in Wireless Sensor Networks, Congestion and Flow Control	7

VI	**Challenges in 5G:** Underwater Sensor Networks, Underwater Sensor Networks, Security of Wireless Sensor Networks, Hardware Design of Sensor Node, Real Life Deployment of WSN	6

Text Books	
1	C.K Toh, *"Ad hoc Mobile Wireless Networks Protocols and Systems",* Pearson Education, 1st Edition, 2002
2	KazemSoharby, Daniel Minoli,, TaiebZnati,"Wireless Sensor Networks, Technology, Protocols and applications",Wiley,1st edition, 2007
References	
1	Xiang-Yang Li, "Wireless Ad Hoc and Sensor Networks", Cambridge University press, 1st edition, 2008
Useful Links	
1	Module I, II, III, IV, V, VI https://nptel.ac.in/courses/106/105/106105160/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3		2										2		
CO2	1	2											2		
CO3		2	3											2	
CO4	2		1											1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT413
Course Name	Database Design and Performance Tuning
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To interpret database design, constructing and tuning according to the specifications.
2	To impart database security and administrative and performance monitoring tasks.
3	To apprise about the requirements, data structures, relative techniques of complex database systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the database design cycle, administration and performance management	II	Understanding
CO2	Demonstrate Parallel and distributed database architectures and concurrency control	III	Applying
CO3	Analyze database performance and tuning on the basis of guidelines	IV	Analysing
CO4	Devise optimized query plans and analyze complex database systems	IV, VI	Analysing, Creating

Module	**Module Contents**	**Hours**
I	**Concepts of Database Design and administration:** Introduction, software development cycle(SDLC), Database development cycle(DDLC), Automated Design tools, Normalization concepts, Database administration, DBA tasks, Defining the organizations DBMS strategy, Managing user access, Database performance management	7
II	**Query Processing and Optimization:** Introduction, Query processing, Syntax analyser, query decomposition, query optimization (cost estimation), pipelining and materialization, Heuristics in query optimization, Structure of query evaluation plans	6
III	**Parallel and distributed transaction processing:** Parallel and Distributed database architectures, Distributed transactions, Optimization of distributed queries, Multi-database Query Processing, Distributed concurrency control and recovery.	7
IV	**Database security:** Introduction, database security issues, Access control in database systems (DAC, MAC, RAC) Inference tolerant database systems, SQL injection	7

V	**Physical Database design and Tuning:** Physical Database Design, Index selection, Guidelines for Index selection, Clustering and Indexing, Overview of Database Tuning, Choices of Tuning the conceptual schema, Choices in Tuning queries, DBMS Benchmarks	6
VI	**Complex database systems:** Introduction to spatial databases: Spatial data structures, special storage and indexing, spatial queries, Multimedia databases, Temporal and spatial databases	6

Textbooks	
1	S. K. Singh, "Database systems: Concepts, Design and Application", 2nd Edition, Pearson Education, 2011
2	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Second Edition, Tata Mcgraw Hill Inc, 2008

References	
1	IBM DB2 Universal Database- Administration Guide: Performance, V.8, 2002.
2	Craig S. Mullins, Database Administration: The complete guide to practises and Procedures, Addison-Wesley professional, 2002.
3	Dennis Shasha and Philippe Bonnet, Database Tuning, Principles, Experiments and Troubleshooting Techniques, Elsevier Reprint 2005.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1												2
CO2	3	2											3	
CO3	2												1	2
CO4	3	1											2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT414
Course Name	Internet of Things
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To comprehend the foundational principles underlying IoT and AI technologies to develop a IoT applications
2	To examine the design methodology and diverse IoT hardware platforms
3	To explore the concepts surrounding IoT Data Analytics and AI
4	To discriminate between various IoT case studies and industrial applications, enabling the identification of unique features, challenges etc using AI techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate the fundamentals of IoT and the design methodology by analyzing various hardware platforms of IoT AI systems.	III	Applying
CO2	Apply analytical skills to examine and arrange data effectively within IoT contexts using AI.	III	Applying
CO3	Implement IoT AI System by incorporating current technological standards.	V,VI	Evaluating, Creating
CO4	Differentiate several AI-enabled IoT applications across industrial and real-world context..	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Fundamentals Of Iot:** Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages and Disadvantages of IoT , IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, , IoT Data Management and Compute Stack ,Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Challenges, IoT Network Architecture and Design,	7
II	**Iot Communication Protocols:** IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Business Case for IP, Optimizing IP for IoT, The Transport Layer, IoT Application Transport Methods -SCADA, Application Layer Protocols: CoAP and MQTT. Communication technologies Used in IoT: Bluetooth, Wi-Fi, Li-Fi, RFID, Cellular, Z-Wave	7

III	**Fundamentals of AI**- Problems and search: What is AI, AI Problems; AI Techniques; Problem Space and Problem Search techniques; Defining the problem as a state space search, production systems; Problem characteristics, production system characteristics. Use of AI in IoT System to solve the issues.	5
IV	**Design And Development Of Ai Enabled Iot Applications** IoT Interfacing: Component selection criterion for Implementing IoT application, Hardware Components- Computing (NodeMCU, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino). Sensors interfacing: Interfacing of Temperature, humidity, light, accelerometer, ultrasonic, IR/PIR, Camera etc. Communication and I/O components Interfacing: Bluetooth, WiFi, GSM, Displays and touch sensor etc Introduction to cloud storage models and communication.Introduction to Amazon Web Services (AWS) IoT platform, Microsoft Azure IoT platform, Google Cloud Platform, IoT, IBM Watson IoT platform, Google IoT, ThingSpeak ,Thing Work IoT platform	7
V	**Data Analytics Used In Ai Enabled Iot Applications:** Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Structured Versus Unstructured Data, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics. Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M.	7
VI	**Case Studies/Industrial Ai Enabled Applications:** Solution framework for IoT applications, Implementation of Device integration, Data acquisition, Organization and integration and analytics. Device data storage-Unstructured data storage on cloud/local server, authorization of devices, role of Cloud in IoT, Security aspects in IoT. Case Study: Smart Cities, Smart Homes, Automobiles, Industrial IoT, Agriculture etc. Case studies: Activity Monitoring in Agriculture, Weather, Healthcare, Environment related applications.	6

Textbooks	
1	"Internet of Things – A hands-on approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2	"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", Pethuru Raj and Anupama C. Raman, CRC Press, 1st edition, 2017
3	"The Internet of Things – Key applications and Protocols", Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012
4	"Artificial Intelligence: A Modern Approach", Russell & Norvig, Third Edition, Prentice-Hall, 2010
References	
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals:Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint).
2	Andrew Minteer, "Analytics for the Internet of Things (IoT)" Packt Publications, Jul 2017
3	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education,2017.
4	Adrian McEwen, Hakim Cassimally," Designing the Internet Of Things", Wiley, 1st Edition, 2013
5	Giacomo Veneri , Antonio Capasso ," Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0", 29 Nov 2018
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2	https://www.coursera.org/learn/introduction-iot-boards?action=enroll

3	https://www.coursera.org/learn/iot-software-architecture

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2		2											3		
CO3	2		2											1	
CO4	1														
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.															

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2024-25					
Course Information					
Programme	B.Tech. (Information Technology)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code	6OE485				
Course Name	Open Elective - 3: Data Visualization and Interpretation				
Desired Requisites:	Programming Fundamentals				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
	-	**Credits: 3**			

Course Objectives	
1	To use R for analytical programming.
2	To visualize data in R.
3	To discuss problem solving approaches using appropriate machine learning techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Choose set of complex mathematical formulae using LATEX	III	Applying
CO2	Explain critical R programming concepts	IV	Analyzing
CO3	Analyze data and generate reports based on the data.	IV	Analyzing
CO4	Create bar charts, histograms, pie charts, scatter plots, line graphs, box plots, and maps using R and related packages	VI	Creating

Module	Module Contents	Hours
I	**Introduction:** Introduction to Data Science, Overview of the Data Science process, Introduction to Data Science technologies, Introduction to Machine Learning, Regressions, Classification, Clustering, Recommendation systems	7
II	**Working with Data:** Variables , Vectors, Matrices, lists & Data frames , Logical vectored operators Image data type, Image representation, categorical data using Factors in R.	6
III	**Data/Image Visualization:** Using graphs to visualize data, Basic plotting in R, Manipulating the plotting window, Advanced plotting using lattice library in R. Image visualization in using Image processing tools.	7
IV	**Models in Machine Learning:** Regression Models, Classification Models, Unsupervised Learning Models, Recommendation Models. Models considered: – Linear regression: lm() – Logistic regression: glm() – Poisson regression: glm() – Survival analysis: Surv(), coxph() – Linear mixed models: lme()	7

V	**Data Reporting using LaTex:** LATEX Software installation, LATEX typesetting basics, LATEX math typesetting, Tables and matrices, Mathematics in Latex.	6
VI	**Case Studies –** Titanic Survival analysis, face detection, Housing price prediction analysis, Customer segmentation analysis, Iris	6

Text Books	
1	Dr. Mark Gardner, Beginning R:statistical Programming Languages, Wrox (Amazon),Mar2013
2	Griffithas, Higham, Learning LATEX ,Amazon,2014

References	
1	Basic Data Analysis Tutorial, by Jacob Whitehill, Department of Computer Science, University of the Western Cape, 24/07/2009 [UWCDataAnalysisTutorial.pdf]
2	NPTEL,edx,COURSERA (MOOC courses)

Useful Links	
1	Module I https://www.coursera.org/learn/what-is-datascience?specialization=introduction-datascience#syllabus
2	Module II, III, IV and VI https://onlinecourses.nptel.ac.in/noc21_cs23/preview https://www.coursera.org/learn/r-programming/home/welcome
3	Module V https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		1										2		
CO2		2													
CO3	2		1											1	
CO4															

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE486
Course Name	Spatial Informatics
Desired Requisites:	Database engineering, Statistics and basic mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives	
1	To learn and understand concepts of Remote sensing and GIS
2	To develop the skill for handling spatial data and perform spatial data analysis
3	To acquire knowledge of spatial information systems

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the role of RS and GIS to handle large location-based spatial data	II	Understanding
CO2	Solve diverse societal issues using technical, engineering and GIS skills with spatial informatics	III	Applying
CO3	Measure accuracy in spatial dat analysis	V	Evaluating
CO4	Develop engineering practices relevant to theories and application of spatial data	Vi	Creating

Module	**Module Contents**	**Hours**
I	Remote Sensing, Coordinate Systems, Maps and Numbering, Map Projections, Positional Accuracy and Source of Errors, Classification Accuracy and Pixel Errors	7
II	Geographical Information System (GIS), components of GIS, Real World to Digital World through GIS, GIS data and structures, Data compression	6
III	Introduction to Spatial Informatics, Spatial Database, Spatial Data Models, Needs and Semantics, Attribute data,	6
IV	Spatial Query and analysis Spatial Query - Introduction, Spatial analysis, Raster and vector data analysis, Overlay operations, Basic spatial analysis, advanced spatial analysis	7
V	Spatial Computing, Spatial Analysis Interpolation and extrapolation Basic operations on lines and points, Some operations for polygons, Spatial data transformations, Transformations between regular cells and entities, Access to spatial data	7
VI	Intelligent spatial information systems, Spatial Web Services, Spatial Data Infrastructure, Geo-visualization, Spatial Cloud	6

Textbooks	
1	Kang-tsung Chang, "Introduction to Geographic Information Systems", Tata McGrawHill, 4thEdition, 2007
2	Ian HeyWood, Sarah Cornelius and Steve Carver , "An Introduction to Geographical Information Systems" , Pearson Education, 2nd Edition, 2006
3	Robert Laurini and Derek Thompson**, "Fundamentals of Spatial Information Systems",** Elsevier Ltd. 1992.
References	
1	Peter A. Burrough, Rachael A. McDonnell and Christopher D. Lloyd, "Principles of Geographical Information System", Oxford University Press, 2016
2	Keith C. Clarke, Bradley O. Parks, and Michael P. Crane, "Geographical Information Systems and Environmental Modeling", Prentice-Hall India, 2001
Useful Links	
1	https://nptel.ac.in/courses/106105219
2	https://www.sciencedirect.com/book/9780124383807/fundamentals-of-spatial-information-systems

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											1	
CO2		2	3						3					2
CO3				2				3			2		1	2
CO4					2	3						3		3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

B. Tech SEM-2

Walchand College of Engineering, Sangli
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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT492
Course Name	Project – 3
Desired Requisites:	Project – 2

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	12 Hrs/Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
	-	**Credits: 6**			

Course Objectives

1	To help students to identify real life needs and discuss project requirements.
2	To give technical solutions through latest design & development tools.
3	To direct students to compare and analyze the IT platforms for efficient solutions.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Integrate project at each stage of the software development life cycle	III	Applying
CO2	Recommend project plans that address real-world challenges	V	Evaluating
CO3	Develop successful software projects that support program's strategic goals and satisfies the customer needs	VI	Creating
CO4	Measure and compare the results with existing system to validate the precision of project outcomes	V	Evaluating

List of Experiments / Lab Activities

List of Experiments:

Project is to be carried out in a group of maximum 5 to 6 students. Project is to be carried based research paper from journals.
Each group will carry out a project by developing any application software based on the following areas.

1. Application can be based on any trending new technology.
2. Application can be extension to previous projects.
3. Results of the project is to be tested and validated against standard data set.
4. Project group should achieve all the proposed objectives of the problem statement.
5. The work should be completed in all aspects of design, implementation and testing and follow software engineering practices.
6. Project reports should be prepared and submitted in soft and hard form along with the code and other dependency documents. Preferable use online code repositories (github/bitbucket)
7. Project will be evaluated continuously by the guide/panel as per assessment plan.
8. Presentation and report should use standard templates provided by department.
9. Preferably student should present/publish article.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along
with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or
on an online repository.
Students should maintain a project log book containing weekly progress of the project.

Text Books	
1	Rajendra Kumbhar , "*How to Write Project Reports, Ph. D. Thesis and Research Articles*", Universal Prakashan, 2015
2	Marilyn Deegan, " *Academic Book of the Future Project Report*", A Report to the AHRC & the British Library, 2017
References	
1	https://www.youtube.com/watch?v=0oSDa2kf5I8 (report writing)
2	
Useful Links	
1	https://pats.cs.cf.ac.uk/wiki/lib/exe/fetch.php?media=project-report.pdf
2	http://users.iems.northwestern.edu/~hazen/Writing%20Project%20Reports%202004a.pdf
3	https://www.upgrad.com/blog/java-project-ideas-topics-for-beginners/
4	https://www.geeksforgeeks.org/computer-science-projects/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1	2		2		2			2		3	3	1
CO2		3			3	2		3	2	3	2		2	3
CO3			3		3		3		3		2		2	3
CO4		3						2					3	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli
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Course Information

Programme	B.Tech. (Information Techology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT471
Course Name	Techno-Socio Activity
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	1 Hrs/week	15	15	20	50
		Credits: 1			

Course Objectives

1	To propose a structured and rational solution to address the relevant skills
2	To motivate students towards the desirous need of industry, economy and society
3	To provide opportunity to integrate IT based solutions with various enterprises

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Engage the programme for welfare of society and environment	III	Applying
CO2	Appraise pragmatic skills for national and international competitions	IV	Analysing
CO3	Develop engineering solution for industry and community	V	Evaluating
CO4	Compose and communicate paper in international conference or journals	VI	Creating

List of Experiments / Lab Activities

Assessment is based on the rubric decided by department

Student can undertake any techno-socio activity as listed below but not limited to:

1. Each student or group of students may work for the welfare of the environment, society through programmes such as tree plantation, blood donation campaigns etc.
2. Each student or group of students participating in technical events/competition/exhibition.
3. Certification of the MOOC courses (beyond syllabus) / Programming competition/ interaction with industry
4. Developing any innovative gadget / solution / system and technology transfer in the interest of

Nation / Society / Institute (WCE)

5. Publishing papers /articles in national / international conferences / journals or similar contributions
6. Coordinating students' clubs / services like SAIT/WLUG/Lab administration or any other
7. Organizing techno-socio activity for the students / community in rural areas, unprivileged areas

Text Books

1	

References

1	

Useful Links

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1		3					2		2	2	
CO2		2							2		3		3	
CO3		2			3				1			2	1	3
CO4			2		2					1				3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	15
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	15
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	30
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT431
Course Name	Professional Elective-4: Deep Learning
Desired Requisites:	Machine Learning, Data Mining, Pattern Recognition

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To introduce students to major deep learning algorithms
2	To make students ready to solve real world problems using deep learning
3	To explain the students the advanced algorithms for Natural Language Processing, Computer Vision and Generative AI.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret the logic behind functioning of deep neural networks	II	Understanding
CO2	Examine the deep learning logic for auto encoders, natural language processing and computer vision	IV	Analyzing
CO3	Value deep learning technology to solve real world problems	V	Evaluating
CO4	Classify various deep learning techniques for Natural Language Processing	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Deep Learning Introduction:** History (Partial) of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm,Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks	7
II	**FeedForward Neural Networks:** FeedForward Neural Networks, BackpropagationGradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.	6
III	**Autoencoders:** Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	6
IV	**Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout	6

V	**Convolutional Neural Networks:** Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. **Deep Learning for Natural Language Processing:** Learning Vectorial Representations of Words	7
VI	**Advanced Topics:** Recurrent Neural Networks, Encoder Decoder Models, Attention Mechanism and Architecture of Generative Models	6

Textbooks	
1	Ian Goodfellow, Yoshua Bengio and Aoron Courville "Deep Learning", The MIT Press Cambridge, Massachusetts London, England, 2017,ISBN: 9780262035613
References	
1	Prof.Mitesh M. Khapra, "Deep Learning", course on NPTEL, July 2019
2	Andrew Ng, "Deep Learning Specialization", Coursera online course
Useful Links	
1	https://www.deeplearningbook.org/
2	http://www.cse.iitm.ac.in/~miteshk/CS7015_2018.html
3	https://onlinecourses.nptel.ac.in/noc19_cs85/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			2										1
CO2		2											3	2
CO3	3	3		3	3								2	3
CO4	1													

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2024-25					
Course Information					
Programme	B.Tech. (Information Technology)				
Class, Semester	Final Year B.Tech., Sem VIII				
Course Code	6IT432				
Course Name	Professional Elective - 4: Data Management, Protection and Governance				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To introduce high-level phases of data life cycle management
2	To compare various aspects of data storage, data availability, data protection.
3	To provide exposure to various solutions/reference architectures data protection

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Discuss the data life cycle management	Understanding
CO2	Apply different standards for compliance and governance of data	Applying
CO3	Distinguish various types of data threats to ensure data center security	Analyzing
CO4	Design data intensive enterprise applications and industry standards in data management	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to data life cycle management (DLM)** Goals of data life cycle management, Challenges involved- Volume of data source, Ubiquity of data locations, User demand for access, Stages of data life cycle – creation, storage, usage, archival, destruction, Risks involved without DLM, benefits, best practices	6
II	**Data storage and data availability** **Storage technology:** Storage virtualization technologies - RAID level, storage pooling, storage provisioning, Advance topics in storage virtualization – storage provisioning, thinprovisioning, Cloud storage – S3, glacier, storage tiering, High Availability-Introduction to high availability, clustering, failover, parallel access, Disaster Recovery -Need of disaster recovery	7
III	**Introduction to data protection** Introduction-Need for data protection, basic of back-up/restore, Snapshots for data protection, copy-data management (cloning, DevOps), De-duplication, Replication, Long Term Retention – LTR, Archival, Design considerations-System recovery, Solution architecture	6
IV	**Data Threats and Data center security** Type of Threats-Denial of Service (DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data, Understanding, Identification and Threat modelling tools, Introduction to Ransomware, Security- Authorization and authentication - access control	7
V	**Data regulation, compliance and governance** Regulations requirements and Privacy Regulations-General Data Protection Regulation (GDPR), The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personal Identity Information), Information Governance- Auditing, Legal Hold, Data classification and tagging (Natural Language Processing)	7

VI	**Applications uninterrupted** Understand data management aspects of traditional and new edge applications, Reference architecture/best practices (pick 2-3 case studies from below topics)- Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra)	6

Text Books	
1	Robert Spalding, "*Storage Networks: The complete Reference*" Tata McGraw-Hill, 2017
2	Vic (J.R.) Winkler, "*Securing The Cloud: Cloud Computing Security Techniques and Tactics*" (Syngress/Elsevier) - 978-1-59749-592-9, 2017
3	TBD – online reference for each topic.
References	
1	O'Reilly, Martin Kleppmann, *"Designing Data-Intensive Applications* " 2012
2	TBD: provide more online material details and books (This can include some publicly available white-paper, solution guides etc.)
Useful Links	
1	https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
	https://searchstorage.techtarget.com/definition/data-life-cycle-management
	https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
2	https://www.bmc.com/blogs/data-lifecycle-management/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											2		
CO2	3				2								3		
CO3	3	2									2			3	
CO4		3			1							1			

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT433
Course Name	Professional Elective 4: Data Server Management
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	Provide basics of data center and servers
2	Describe techniques to host data servers
3	Illustrate planning to host data center services

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Study Data Server Systems and Infrastructure Management	II	understanding
CO2	Identify Storage, Bandwidth and other resources for Data center	III	Applying
CO3	Analyze the flexible resource allocation for services in data center	IV	Analyzing
CO4	Examine the Networks and Resources	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Infrastructure for Data Servers** Required Physical Area, power, Cooling, Network Bandwidth and utilities for Data Servers	7
II	**Major equipment and Software** Linux (Kali/Fedora), Network Simulators, VMWare Workstation, ESXI Server Routers and Switches, Nagios, Ganglia, Untangle and ClearOS	7
III	**Data Center** Modern Data Center Architecture, Data Center Design, Modular Cabling Design, Points of Distribution, ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance	6
IV	**Data Server Management** Data center servers, Sever Capacity Planning, Best Practices for Server Cluster, Data Storage and Network Management	6
V	**Networking for Data Servers,** Device Naming, Naming Practices, NIS, DNS, LDAP, Load balancing Terminology and Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches	7
VI	**Data Server Security and Best practices** Security Guidelines Internet security, Source Security Issues, Best Practices for System Administration, System Administration Work Automation	6

Textbooks

1	Kailash Jayaswal ,"Administering Data Centers: Servers, Storage and Voice over IP" Edition 1st, Wiley, 2005

2	Mauricio Arregoces, Maurizio Portol , “Data center fundamental “, 1st Edition Cisco Press, 2003
References	
1	Gilbert Held,” Server Management (Best Practices)”, 1st Edition, Auerbach Publications, 2000
Useful Links	
1	https://www.vmware.com/topics/glossary/content/virtual-machine.html
2	https://docs.vmware.com/en/VMware-vSphere/7.0/com.vmware.vsphere.vm_admin.doc/GUID-588861BB-3A62-4A01-82FD-F9FB42763242.html

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											1	2
CO2	1				3									2
CO3		3											2	3
CO4	3	2			2									
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT434
Course Name	Professional Elective - 4: Management Information System
Desired Requisites:	Database management systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	Provide a perspective of information systems and what role they play in an organization.
2	Learn modern technologies and how organizations can use these technologies for their growth.
3	Use of MIS to make decisions more effectively

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	describe the principles, use and function of a management information system	II	Understanding
CO2	develop an understanding of global information system issues	III	Applying
CO3	analyze the relationship among issues raised by information systems	IV	Analyzing
CO4	evaluate the role of information systems in helping people working individually and in groups make decisions more effectively	V	Evaluating

Module	**Module Contents**	**Hours**
I	Information Systems in Global Business, Information Systems, Organizations, and Strategy, Ethical and Social Issues in Information Systems, Data vs. Information vs. Knowledge	6
II	IT Infrastructure and Emerging Technologies, Securing Information Systems, DBMS and Information systems, Information Technologies (SW, HW)	6
III	Planning Information Systems, Systems Development Life Cycle, Rapid Application Development, Object Oriented Systems Development, Security and Systems Development. Building Information Systems, Value of systems and managing change, Modeling and Designing Systems, Structured and object-oriented methodologies	7

IV	Information Systems within Organizations, Categories of Information Systems, Survey of Functional Systems, Competitive Strategy and Value Chains, Business Process Design E-Commerce and Supply Chain Systems, Doing Business on the WWW, Web Technologies, Supply Chain Management, Inter-Organizational Information Systems, Ethics of Supply Chain Information Sharing	7
V	Business Intelligence and Knowledge Management, Developing Business/IT Solutions, Data Warehouses and Data Marts, Data Mining, Knowledge Management, Information Systems Management, Planning the Use of IT, Managing the Computing Infrastructure, Enterprise Applications, Outsourcing, User Rights and Responsibilities Information Security, Security Threats, The Security Program, Senior Managements Role, Risk Management, Data Safeguards, Human Safeguards, Disaster Preparedness	7
VI	Building Information Systems, Making the Business Case for Information Systems and Managing Projects, Managing Global Systems	6

Textbooks	
1	Management Information Systems, Global Edition (15th), Kenneth C. Laudon, Jane P. Laudon, Pearson Education Limited.
2	

References	
1	Ken J. Sousa and Effy Oz, Management Information Systems, **7th** Edition, **Cengage Learning** Publication, **2014**
2	Ralph Stair, George Reynolds, **Fundamentals of Information Systems, 9th** Edition, **Cengage Learning, 2017**

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_mg60/preview
2	https://elearn.daffodilvarsity.edu.bd/pluginfile.php/943703/mod_resource/content/1/MIS%20reference%20book.pdf
3	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2			2		2			2					2	
CO3		2				2				3			1	2
CO4					3			2			2	3		3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT435
Course Name	Professional Elective - 4: Business Intelligence
Desired Requisites:	Database management systems concepts

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives	
1	To familiarize students with the ETL and data processing techniques.
2	To make students aware to the basic issues in business & data modelling techniques for business.
3	To compare various BI architectures and systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Perceive the knowledge and skills for working as a business intelligence developer.	II	Understanding
CO2	Distinguish business tools and techniques to create visualizations and dashboards.	IV	Analyzing
CO3	Design a BI application	VI	Creating
CO4	Plan and modify reporting, scorecard and enterprise dashboard	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Business Intelligence** Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP)	6
II	BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices	7
III	**Data Integration** Concepts of data integration needs and advantages of using data integration, introduction to common data integration approaches, Meta data –types and sources.	6
IV	**Data Processing** Introduction to data quality, data profiling concepts and applications, introduction to ETL (Extract-Transform-Loading) using Open Source Software.	6
V	**Data and Dimension Modelling** Introduction, ER Modelling, multidimensional data modelling, concepts of dimensional, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPLs, creating OLAP using Application Software.	7

VI	**Basic of Enterprise Reporting** A typical enterprise, Malcolm Baldrige – quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using software tools, best practices in the design of enterprise dashboards.	7
Textbooks		
1	R.N. Prasad and Seema Acharya, "Fundamentals of Business Analytics" Wiley Publication, 2011	
References		
1	Raiph Kimball and Ross, "The Data Warehouse Lifecycle Toolkit" Wiley Publication, 2nd edition, 2011	
2	Anahory and Murray, "Data Warehousing in the Real World" Pearson Education, 1997	
Useful Links		
1	https://onlinecourses.nptel.ac.in/noc24_cs65/preview	
2	https://www.gartner.com/en/digital-markets/insights/what-is-customer-lifetime-value	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												2
CO2		2			2								2	2
CO3	3		3											3
CO4	2	2	1		3								2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2024-25					
Course Information					
Programme	B.Tech. (Information Techology)				
Class, Semester	Final Year B. Tech., Sem VIII				
Course Code	6IT436				
Course Name	Professional Elective - 4: Agile Software Tools and Practices				
Desired Requisites:	Software Engineering				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To define basics of Software Testing and techniques.
2	To discuss project management cycle for software development.
3	To illustrate Agile development techniques for software development.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Demonstrate use of automation testing tools	Applying
CO2	Implement project management techniques like planning, risk analysis, scheduling.	Applying
CO3	Evaluate software development life cycle using Agile tools and DevOps.	Evaluating
CO4	Design an agile software development model to implement real time project management system	Creating

Module	**Module Contents**	**Hours**
I	**Software Testing Introduction:** Introduction, Importance of Software testing, How to conduct Software testing, Basic terminology of Software testing, Manual Testing Process, Difference between Manual and Automated Testing, Software testing Roles and Responsibilities, V Model of Software Development	7
II	**Test Case Design Techniques:** Static Techniques, Dynamic Techniques, Black-box Test Techniques, White-box Test Techniques, Experience-based Test Techniques, Levels of Software Testing, Test Driven Development	6
III	**Types of Software Testing:** **i) Functional Testing:** Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Testing. **ii) Non Functional Testing:** Performance Testing. (Load, Stress, Spike and Endurance Testing), Usability Testing, Compatibility Testing, Reliability Testing, Security Testing	7
IV	**Project Management:** Software Product Management, Requirements Analysis/Design, Planning and Scheduling, Monitoring, Risk Analysis, Project Leadership, Teamwork, Project Organization and Team Structures, Resource Allocation, Software Quality Management Software Testing Standards	6

V	**Agile testing:** The Fundamentals of Agile Software Development, Extreme Programming, Aspects of Agile Approaches, The Differences between Testing in Traditional and Agile Approaches, Status of Testing in Agile Projects, Role and Skills of a Tester in an Agile Team, Agile Testing Methods, Assessing Quality Risks and Estimating Test Effort, Techniques in Agile Projects, Tools in Agile Projects, JIRA Tool, Scum	6
VI	**DevOps Testing:** DevOps**,** Version control with Git, Git, Jenkins, Maven, Integration with Jenkins, Continuous Integration and Continuous Delivery CI/CD: Jenkins Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) or application development and deployment.	7

Text Books	
1	Glenford J. Myers, Corey Sandler, Tom Badgett, "*The Art of Software Testing*", Third edition, Wiley, 2011, ISBN: 978-1-118-13315-6
2	Ron Patton, Corey Sandler, Tom Badgett, "*Software Testing*", Second edition, Sams, 2005
3	Lisa Crispin and Janet Gregory, "*Agile Testing: A Practical Guide for Testers and Agile Teams*", First edition, Addison-Wesley Signature Series, 2009.
4	Teresa Luckey, Joseph Phillips, "*Software Project Management For Dummies*", First edition, Wiley, 2006, ISBN: 9780471749349.

References	
1	Lee Copeland, "*A Practitioner's Guide to Software Test Design*", First edition, Artech House, 2003, ISBN-13: 978-1580537919.
2	Joakim Verona · "*Practical DevOps*", First edition, Artech House, 2016, ISBN-13: 9781785886522, 1785886525.
3	Henry· "*Software Project Management: A Real-World Guide To Success*", First edition, Pearson Education, 2004, ISBN- 9788131717929, 8131717925.

Useful Links	
1	https://www.javatpoint.com/software-testing-tutorial
2	https://www.guru99.com/software-testing.html
3	https://www.getzephyr.com/insights/developing-devops-testing-strategy-benefits-best-practices-tools
4	https://www.softwaretestinghelp.com/agile-scrum-methodology-for-development-and-testing/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2		2	2		2			2					2	2
CO3					3			2			2	3	3	3
CO4	3				3								2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT437
Course Name	Professional Elective 5: Transacting Blockchain
Desired Requisites:	Cryptography and Network Security

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
	-	**Credits: 3**			

Course Objectives

1	To discuss essentials of information security in distributed networks
2	To explain blockchain transactions in various applications
3	To provide insights in algorithms of mining and hashing in blockchain technologies

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss chains of data blocks and its types	II	Understanding
CO2	Implement appropriate hashing and mining algorithms	III	Applying
CO3	Compare permissions for observing behavior of blockchains in distribution systems	IV	Analyzing
CO4	Recommend blockchain environment suitable for the use case	V	Evaluating
CO5	Propose IT enabled tool to mange the execution of blockchain	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction Blockchain Technology** Introduction to Blockchain Architecture, Conceptualization, Basic Crypto Primitives	6
II	**Crypto Systems:** Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles	7
III	**Bitcoin:** Bitcoin Blockchain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc, Downside of Bitcoin – mining	6
IV	**Coins in Blockchain:** Alternative coins – Bitcoin Blockchain Ethereum and Smart contracts, The real need for mining – consensus – Byzantine Generals Problem	7
V	**Blockchain and Distributed Network:** Distributed coordination problem, permissioned blockchain, Introduction to Hyperledger	7
VI	**Blockchain use case:** Permissioned Blockchain use cases – Hyperledger, Corda, Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others	6

Text Books

1	Daniel Drescher*, "Blockchain Basics",* Apress Publications", 1st Edition,2017

2	Melanie Swa, *"Blockchain"*,O'ReillyPublications, 1st Edition, 2015
References	
1	Don Tapscott, Alex Tapscott, *"Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World",* Portfolio 2014
2	Alex Tapscott, *"Blockchain Revolution",* Microsoft Publication, 1st Edition, 2016
Useful Links	
1	Module I, II, III, IV, V, VI https://onlinecourses.nptel.ac.in/noc20_cs01/preview
2	https://www.coursera.org/learn/transacting-blockchain

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	3
CO1	3	2											1		
CO2	2	3	1												
CO3		2	2										2	2	
CO4	1			1									1		
CO5	3	2	1		2									3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT438
Course Name	High Performance Computing
Desired Requisites:	Parallel Computing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives	
1	To design best known sequential logic approach for the solution
2	To profile the sequential code and apply the parallel logic
3	To analyse the parallel approach

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Articulate the sequential logic to find solution of the problem	II	Understanding
CO2	Apply parallel computing algorithm to solve the problem.	III	Applying
CO3	Analyse the parallel implemented algorithms for performance parameters.	IV	Analysing
CO4	Design the appropriate parallel algorithm for the given problem	VI	Creating

Module	**Module Contents**	**Hours**
I	Basic communication Operations: One-to-All Broadcast and All-to-One Reduction Section, All-to-All Broadcast and Reduction Section, All-Reduce and Prefix-Sum Operations Section, Scatter and Gather Section, All-to-All Personalized Communication Section, Circular Shift	7
II	Analytical Model of Parallel Program: Sources of Overhead in Parallel Programs Section, Performance Metrics for Parallel Systems Section, The Effect of Granularity on Performance Section, Scalability of Parallel Systems Section, Minimum Execution Time and Minimum Cost-Optimal Execution Time Section, Asymptotic Analysis of Parallel Programs	7
III	Dense matrix algorithms: Matrix-Vector Multiplication Section,. Matrix-Matrix Multiplication Section, Solving a System of Linear Equations	6
IV	Sorting: Sorting Networks Section, Bubble Sort and its Variants Section, Quicksort Section, Bucket and Sample Sort	6
V	Graph Algorithms: Definitions and Representation Section, Minimum Spanning Tree: Prim's Algorithm Section, Single-Source Shortest Paths: Dijkstra's Algorithm Section, All-Pairs Shortest Paths Section, Transitive Closure Section, Connected Components	7

VI	Search Algorithms for Discrete Optimization Problem: Sequential Search Algorithms Section, Search Overhead Factor Section, Parallel Depth-First Search Section, Parallel Best-First Search Section, Speedup Anomalies in Parallel Search Algorithms	6
Textbooks		
1	Anath Grama, Ansul Gupta, George Karypis, Vipin Kumar, "Introduction to parallel computing, Second Edition", Pearson Education, 2003	
References		
1	Horowitz, Sahni, Rajasekaran, "Computer Algorithms", Computer Science, W. H. Freeman and Company Press, New York, 1997	
2		
Useful Links		
1	Internet YouTube and other Links announced in the class	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2												2
CO2	3		2	2	2									
CO3	2	3		1									1	3
CO4	1	2	3		3									2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year, Sem-VIII
Course Code	6IT439
Course Name	Professional Elective – 5: Information Storage Management
Desired Requisites:	Computer networks, Operating System

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
	-	**Credits: 3**			

Course Objectives

1	To introduce storage technologies for data center
2	To acquaint with architectures of information storage systems
3	To categorize backup and recovery technologies in data center

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Comprehend the logical and physical components of a storage infrastructure	II	Understanding
CO2	Classify the various data protection techniques	III	Applying
CO3	Choose various storage networking technologies for data center	III	Applying
CO4	Distinguish between backup and recovery technologies	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to information storage and Data center** Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle, Storage System Environment: Components of a Storage System Environment.	6
II	**Data Protection: RAID, Intelligent Storage System** Storage components ,Data organization: File vs. Block, Object; Data store; Searchable models ,Storage Devices (including fixed content storage devices) File Systems Volume Managers RAID systems Caches, Prefetching	7
III	**Direct-Attached Storage, SCSI, SAN, NAS** Fibre Channel , IP-based Storage (iSCSI, FCIP, etc.),Examples NAS,NFS,CIFS, DAFS	6
IV	**Network components** Connectivity: switches, directors, highly available systems Fibre Channel,1GE/10GE, Metro-Ethernet, Aggregation , Infiniband	6
V	**Business Continuity Backup and Recovery** Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets	7
VI	**Large Storage Systems** Google FS/BigTable, Cloud/Web-based systems (Amazon S3) FS+DB convergence ,Programming models: Hadoop	7

Text Books	
1	Somasundaram Gnanasundaram, Alok Shrivastava, *"Information Storage and Management"*, EMC Education Services (Wiley India), 2nd Edition, 2012.
2	Ulf Troppen, Rainer Erkens, Wolfgang Müller,, *"Storage Networks Explained"*, (Wiley India). 2nd Edition, 2016.
References	
1	Robert Spalding, "*Storage Networks: The complete Reference*", McGraw Hill Education Indian edition 2017.
2	Tom Clark, *"Designing Storage Area Networks, A Practical Reference for Implementing Fibre Chanel and IP SANs",* AddisonWesley Professional; 2nd edition 2010.
Useful Links	
1	Modules II,III,IV and VI https://nptel.ac.in/courses/106/108/106108058/

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3		2										3		
CO2	2	3			1								2	1	
CO3		3	2		3								1	2	
CO4	3	2	2		2									2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT440
Course Name	Professional Elective-5: Data Warehouse
Desired Requisites:	Database management systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To Introduce data warehousing concepts
2	To introduce designing dimensional model, fact table and dimension tables
3	To introduce various analytical and reporting Tools

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate concepts and terminology related to data warehousing	II	Understanding
CO2	Construct Dimensional model, Fact table and dimension tables and correlate them using various models	III	Applying
CO3	Choose data and dimensional modeling.	V	Evaluating
CO4	Design a warehouse considering appropriate theories, techniques, planning and requirements	VI	Creating

Module	**Module Contents**	**Hours**
I	**Basic Concepts of Data Warehousing** Introduction, Meaning and characteristics of Data Warehousing, Online Transaction Processing (OLTP)	6
II	**Data Warehousing Models** Data warehouse architecture & Principles of Data Warehousing, Benefits of Data warehousing	6
III	**Dimensional Modelling** Dimensional Modelling primer, Dimensions & Facts, Modelling Process overview, Four Step Modelling Process, Design the Dimensional Model.	7
IV	**Building a Data Warehouse** Structure of the Data warehouse, Data warehousing and Operational Systems, Organizing for building data warehousing, Important considerations – Tighter integration, Empowerment, Willingness Business Considerations: Return on Investment Design Considerations, Technical Consideration, Implementation Consideration	7
V	**Managing and Implementing a Data Warehouse** Project Management Process, Scope Statement, Work Breakdown Structure and Integration, Initiating a data warehousing project, Project Estimation, Analysing Probability and Risk, Managing Risk: Internal and External,	7

VI	**OLAP** Need for OLAP, OLAP vs. OLTP Multidimensional Data Model Multidimensional verses Multi-relational OLAP, Characteristics of OLAP: FASMI Test (Fast, Analysis Share, Multidimensional and Information), Features of OLAP, OLAP Operations Categorization of OLAP Tools: MOLAP, ROLAP	6

Textbooks	
1	Ralph Kimball, "The Data Warehouse Lifecycle toolkit', 2nd edition, Wiley India
2	Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining, and OLAP”, McGraw-Hill
References	
1	Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals, 2nd Edn. Wiley, John & Sons
2	Anahory & Murray, “Data Warehousing in the Real World”, Pearson Publishers
3	Ralph Kimball , “The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling”, Corporate Information Factory
	George M. Marakas, “Modern Data Warehousing, Mining, and Visualization: Core Concepts”, Prentice Hall, 1st edition
Useful Links	
1	https://www.udemy.com/topic/data-warehouse/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2		3	2											3
CO3	1			2										3
CO4	2	1	1	1	3								2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT441
Course Name	Augmented Reality and Virtual Reality
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To illustrate historical, modern overviews and perspectives on Virtual Reality (VR)
2	To explain fundamentals of sensation, perception, and perceptual training.
3	To comprehend scientific, technical, and engineering aspects of augmented and virtual reality systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain historical, modern overviews and perspectives on Virtual Reality (VR)	IV	Analyzing
CO2	Study fundamentals of sensation, perception, and perceptual training.	IV	Analyzing
CO3	Identify various industry use cases on AR/VR systems	IV	Analyzing
CO4	Discuss scientific, technical, and engineering aspects of augmented and virtual reality systems.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction:** Overview of Augmented Reality (AR), Overview of Virtual Reality (VR), Comparison between AR and VR, Applications of AR and VR, Impact on user experiences, Future trends and advancements.	6
II	**AR/VR Development Tools:** Overview of popular development platforms like Unity and Unreal Engine, Introduction to ARKit, ARCore, and other AR/VR development kits, Understanding the hardware requirements for AR/VR development, including devices such as HoloLens, Oculus Rift, HTC Vive, and Vive Tracker	7
III	**Getting Started with UNITY 3D:** Hands on with Unity3D, make prototype with assets and scripts from store/lib.	6
IV	**Introduction to Marker Based AR (VUFORIA) and Markerless AR (ARCORE/ARKIT):** AR evolution and types of AR (marker, marker less, AR spark, Gesture based), make AR prototype with readily available assets.	7
V	**Introduction 360 VR (3DOF) and OCCULUS QUEST VR (6DOF):** VR evolution Google CARDBOARDVR, 360 VR, 3DOF vs 6DOF (Degree of Freedom), make 360 VR assets and scripts.	6
VI	**Advanced AR/VR and Industry Use cases:** AR /VR systems with IOT, AI and Haptics, XR technologies.	5

Textbooks	
1	Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013
2	Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-IEEE Press, 2003/2006.
References	
1	Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
2	
Useful Links	
1	https://lavalle.pl/vr/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2										1	
CO2		3			1									2
CO3	2	2	1										2	
CO4	1	2	3		2								1	2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT442
Course Name	Professional Elective – 6:Reinforcement Learning
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	Understand logic beind reinforcement learning
2	To make students ready to solve real world simple problems using reinforcement learning

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret the logic behind functioning of reinforcement learning	II	Understanding
CO2	Examine the reinforcement learning logic for problem solving	IV	Analyzing
CO3	Value reinforcement learning to solve real world problems	V	Evaluating
CO4	Classify various Reinforcement learning framework for real time applications	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction:** Reinforcement learning framework and applications, Introduction to Immididtae Reinforcement Learning, Bandit Optimalities, Value Function Based Methods	7
II	**Bandit algorithms I:** UCB 1, Concentration Bounds, UCB 1 Theorem, PAC Bounds, Median Elimination, Thompson Sampling.	6
III	**Bandit algorithms II:** Policy Search, REINFORCE, Contextual Bandits, Full RL Introduction.	6
IV	**Full RL & MDPs:** Returns, Value Functions and MDPs, MDP Modelling, Bellman Equation.	6
V	**Bellman Optimality:** Bellman Optimality Equation, Cauchy Sequence and Green's Equation, Banach Fixed Point Theorem, Convergence Proof.	7
VI	**Dynamic Programming & TD Methods:** Dynamic Programming, Monte Carlo, Control in Monte Carlo, Off Policy MC, UCT, TD(0), TD(0) Control, Q-Learning.	6

Textbooks

1	R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

References	
1	https://onlinecourses.nptel.ac.in/noc24_cs52/course
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_cs52/course
2	https://www.coursera.org/specializations/reinforcement-learning

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		2	3		3									2
CO3	3	1		2									2	3
CO4	2	3	2		2								1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT443
Course Name	Professional Elective 4: Data Server Management
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	Provide basics of data center and servers
2	Describe techniques to host data servers
3	Illustrate planning to host data center services

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Study Data Server Systems and Infrastructure Management	II	understanding
CO2	Identify Storage, Bandwidth and other resources for Data center	III	Applying
CO3	Analyze the flexible resource allocation for services in data center	IV	Analyzing
CO4	Examine the Networks and Resources	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Infrastructure for Data Servers** Required Physical Area, power, Cooling, Network Bandwidth and utilities for Data Servers	7
II	**Major equipment and Software** Linux (Kali/Fedora), Network Simulators, VMWare Workstation, ESXI Server Routers and Switches, Nagios, Ganglia, Untangle and ClearOS	7
III	**Data Center** Modern Data Center Architecture, Data Center Design, Modular Cabling Design, Points of Distribution, ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance	6
IV	**Data Server Management** Data center servers, Sever Capacity Planning, Best Practices for Server Cluster, Data Storage and Network Management	6
V	**Networking for Data Servers,** Device Naming, Naming Practices, NIS, DNS, LDAP, Load balancing Terminology and Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches	7
VI	**Data Server Security and Best practices** Security Guidelines Internet security, Source Security Issues, Best Practices for System Administration, System Administration Work Automation	6

Textbooks

1	Kailash Jayaswal ,"Administering Data Centers: Servers, Storage and Voice over IP" Edition 1st, Wiley, 2005

2	Mauricio Arregoces, Maurizio Portol , “Data center fundamental “, 1st Edition Cisco Press, 2003
References	
1	Gilbert Held,” Server Management (Best Practices)”, 1st Edition, Auerbach Publications, 2000
Useful Links	
1	https://www.vmware.com/topics/glossary/content/virtual-machine.html
2	https://docs.vmware.com/en/VMware-vSphere/7.0/com.vmware.vsphere.vm_admin.doc/GUID-588861BB-3A62-4A01-82FD-F9FB42763242.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2										1	2
CO2	1				3									2
CO3		3	2										2	3
CO4	3	2		1	2									

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B.Tech., Sem VIII
Course Code	6IT444
Course Name	Professional Elective - 6: 5G Technology
Desired Requisites:	Computer Network

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To introduce the evolution of mobile communication
2	To elaborate the key innovations in 5G networks
3	To optimize design of 5G network using modern tools

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe the concepts of 5G technology	Understanding
CO2	Illustrate the 5G physical and functional architecture	Applying
CO3	Distinguish the evolution of 5G network and spectrum challenges	Analyzing
CO4	Compare various radio access technologies for 5G networks	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction Wireless Communication:** Evolution of wireless Communication Standards From 2G to 5G, Merits and Demerits of 2G, 3G, 4G	6
II	**Introduction to 5G:** Requirements and operating scenarios of 5G, 5G scenarios, Ultra reliable low latency communication, Designing 5G new radio	7
III	**Waveform Design Aspects:** Waveform Design Aspects of 2G, Waveforms in 3G, 4G, 5G, Waveforms beyond 5G, Comparison of waveforms	6
IV	**5G Carriers and Channels:** LecFrame Structure in 5G NR, Numerology in 5G and adaptive subcarrier bandwidth, Channel models for performance evaluation	7
V	**Signal Processing:** MIMO Signal Processing (Receive Diversity) and Capacity, Hybrid beam forming (mmWave)	7
VI	**Challenges in 5G:** Spectrum availability and implementation,Deploying hybrid LTE-NR is critical, Complex network architecture, Demand for extensive 5G networks testing, Scarcity in 5G devices, Investment requirements, Regulations on radiation	6

Text Books

1	Asif Oseiran, Jose F.Monserrat and Patrick Marsch, *"5G Mobile and Wireless Communications Technology"*, Cambridge University Press, 2016
2	Jonathan Rodriquez, *"Fundamentals of 5G Mobile Networks"*, Wiley, 2015

References

1	Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, *"5G System Design – Architectural and Functional Considerations and Long Term Research",* Wiley, 2018

Useful Links	
1	Module I, II, III, IV, V https://nptel.ac.in/courses/108/105/108105134/

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3		1										3		
CO2		2												3	
CO3	2		2		1								2	2	
CO4	3	2											1		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6IT445
Course Name	Professional Elective-6: Data Analysis and Visualization
Desired Requisites:	linear algebra, probability theory, statistics and programming .

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	Introduce R as a programming language
2	Introduce the mathematical foundations required for data science
3	Introduce the first level data science algorithms

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Classify data science problems into standard typology	III	Applying
CO2	Develop R codes for data science solutions	III	Applying
CO3	Correlate results to the solution approach followed	IV	Analysing
CO4	Classify various regression techniques data analysis	V	Evaluating

Module	**Module Contents**	**Hours**
I	**R programming for Analysis:** Introduction, Data operators, Data Types and Operations, Vectors, Matrices , Arrays, Factors, Data Frames in R.	06
II	**Flow control and Functions in R** Decision Making, Loops, Loop control statements, Function definition, Built in Functions, Recursive functions in R.	06
III	**Elementary Statistics** Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)	07
IV	**Regression & ANOVA** Simple linear regression and verifying assumptions used in linear regression Multivariate linear regression, model assessment, assessing importance of different variables, subset selection .	07
V	**Classification** Classification using logistic regression, Classification using KNN and k-means clustering.	06
VI	**Charts and Graphs** Bar charts, Histogram, Line Graph, Pie charts, Boxplots, Scatterplots, Strip charts, Density Plots in R.	07

Textbooks	
1	Data Analysis using R, Dr Jeeva Jose, Khanna Publications
References	
1	Data Science for Engineers, PROF. RAGHUNATHAN RENGASAMY,PROF. SHANKAR NARASIMHAN, NPTEL
2	
Useful Links	
1	Data Science for Engineers, https://nptel.ac.in/courses/106106179
2	https://nptel.ac.in/courses/110106064
3	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2	2									3	
CO2		2			2									2
CO3	2	1											2	1
CO4	3		1										3	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6IT446
Course Name	Professional Elective – 6: Software Reliability and Testing
Desired Requisites:	Software Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To elaborate Software Reliability and Testing
2	To illustrate project management cycle for software quality assurance
3	To use various techniques to fault detection

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Summarize the concepts of Software Reliability and Testing in software development life cycle	Understanding
CO2	Apply various testing techniques to assure software quality and reliability	Applying
CO3	Analyze software fault detection techniques	Analyzing
CO4	Evaluate software system for fault tolerance	Evaluating

Module	**Module Contents**	**Hours**
I	**Basic of Software Testing:** Software Testing, Testing types, Flow graph, Cyclomatic complexity, Graph Matrices, Debugging & Test Case Strategies	7
II	**Software Quality:** Software Quality Assurance, Software Reuse, Documentation Requirements, Standards, Software Configuration Management, Version Control, Baselines	7
III	**Software Reliability:** Software Reliability, Software Reliability Issues, Statistical Testing and Software Quality Management, ISO 9000, Case Tools, Characteristics of Case Tools	7
IV	**User Interface and Design**: Concept of user Interface and Design, Types of user Interface, Component Based GUI Development	7
V	**Software Fault Detection:** Basic terminology of Fault tolerant, Fault detection using fault tree, Fault tolerant in SRE, Techniques for Fault tolerant: Recovery blocks, N- version programming	5
VI	**Software Fault Analysis:** Fault tree modelling, Fault tree analysis, Analysis of fault tolerant software system, Quantitative analysis of fault tolerant system	6

Text Books

1	Jalote Pankaj, *"An Integrated Approach to Software Engineering",* Narosa Publication, 3rd Edition, 2010.
2	Sommerville, *"Software Engineering"*, Pearson Education India, New Delhi,2nd Edition, 2006

References

1	Musa John D., *"Software Reliability Engineering"*, Tata McGraw Hill, 2nd Edition, 1999
2	Lyu, *"Software Reliability Engineering"*, IEEE Computer Society Press, 1st Edition, 1996

Useful Links	
1	Module I, II, III, IV, V - https://onlinecourses.nptel.ac.in/noc21_cs15/preview

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3	2	1										2		
CO2	2	3												2	
CO3			2	3	1								2	3	
CO4	3	1	2	2									1		
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.															

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