Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Course Contents (Syllabus) for

Final Year B. Tech.
(Information Technology)
Sem – VII to VIII

AY 2020-21

Professional Core (Theory)

Title of the Course: Cryptography & Network Security 3IT 401	L	T	P	Cr
	3	1	-	4

Pre-Requisite Courses:
Computer Networks

Textbooks:
1. WilliamsStallings, "Cryptography and Network security Principles and Practices",5th edition, Pearsom pub.

References:
1. Menezes, A. J., P. C. Van Oarschot, and S. A. Vanstone, "Handbook of Applied Cryptography", 2nd edition, CRC Press.
2. Schneier, Bruce, "Applied Cryptography: Protocols & Algorithms", 2nd edition, Wiley Pub.

Course Objectives :
1. To describe the fundamental concepts of information system security.
2. To impart various Encryption techniques.
3. To apprise security mechanisms and services against threats.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Generalize information security aspects and outline the requirements.	2	Understanding
CO2	Exploit and practice various encryption algorithms.	3	Applying
CO3	Compare and verify appropriate security mechanisms and authentication services.	4, 5	Analyzing, Evaluating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3				2							
CO2		2	3									
CO3						2					1	3

Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
Overview:	**7**

Services, Mechanism and Attacks, The OSI security Architecture, A model for Network security. Classical Encryption techniques: Symmetric Cipher model, Substitution techniques, Transposition techniques, Steganography.	
Module 2	**Hrs.**
Block Cipher: Block cipher principles, The Data Encryption Standard, The strength of DES, Block Cipher Design Principles, The AES Cipher.	**6**
Module 3	**Hrs.**
Public Key Encryption and Integrity Public Key Cryptography: Principles of Public-Key Cryptosystem, RSA Algorithm, Key Management: Distribution of public Keys, Deffie-Hellman Key Exchange, Cryptographic hash functions, Message authentication code, Digital signature.	**7**
Module 4	**Hrs.**
Network SecurityPractice: Authentication Applications - Kerberos, X.509Certificates Electronic Mail Security - Pretty Good Privacy, S/MIME,	**6**
Module 5	**Hrs.**
IP & Web Security: IP security Overview, Architecture, Authentication Header, Encapsulating security Payload, Combining Security Associations, Key Management **WEB Security-** Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.	**7**
Module 6	**Hrs.**
System security Intruders, Intruder Detection, Password Management, Viruses and Related Threats, Worms, Virus Countermeasures. Firewall - Firewall Design Principles, Trusted systems	**6**

Module wise Measurable Students Learning Outcomes :

Module 1: Apply classical cryptographic techniques with knowledge of fundamental concepts of security.

Module 2: Test and compare block ciphers.

Module 3: Experiment of different Public-Key Cryptography techniques.

Module 4: Demonstrate the use of authentication protocols for network security.

Module 5: Plan and setup of protocols for web security.

Module 6: Discuss various measures to protect the system.

Title of the Course: Data Mining 3IT 402	L	T	P	Cr
	3	-	-	3

Pre-Requisite Courses:
Statistics, Discrete Mathematics, Database management and data warehouse systems

Textbooks:

1. "Data Mining – Concepts and Techniques" Jiawei Han and MichelineKamber, 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", RajanChattamvelli, , Narosa Publishing House , International Publisher, 2010
2. "Data Mining Multimedia, Soft Computing and Biometrics", SushmitaMitra, TinkuAcharya, WILEY Publication, 2003
3. "Data Mining & Warehousing", S.Prabhu, N. Venkatesan, New Age Publishers, 2010

Course Objectives :

1. To introduce basic concepts, principles and techniques of data mining.
2. To make students to develop skills to use and implement data mining tools.
3. To impart different approaches to handle real world problems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	To summarize the basic concepts, techniques and algorithms of Data Mining.	2	Understanding
CO2	To develop, modify and apply skills of using data mining techniques and algorithms (software) for solving real life problems.	3	Applying
CO3	To recognize real world problems, design solution to it and start independent study and research.	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	2						1				
CO2	3										2	2
CO3			2		3			2				

Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	**Hrs.**
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**
Module 2	**Hrs.**
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**
Module 3	**Hrs.**
Association Rule mining, mining 1-dimensional & Multilevel Ass. Rulefrom transactional Database and Data Warehouse Association mining tocorrelation analysis, constraint based Association mining, Algorithms for association rules	**6**
Module 4	**Hrs.**
Classification & Prediction, Issues, Decision Tree, Bayesian classifier, Back propagation, Classification methods, Prediction, ensemble classification	**6**
Module 5	**Hrs.**
Cluster analysis Clustering, analysis, methods, (partitioning based, hierarchical based, density based, grid based, model based), similarity metrics, cluster validation techniques, clustering high dimensional data, constraint based cluster analysis, outlier analysis, applications	**7**
Module 6	**Hrs.**
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**

Module wise Measurable Students Learning Outcomes :

Module 1: To understand data pre-processing to handle raw data having different anomalies.
Module 2: To grasp the fundamental knowledge of Data Mining Primitives and Architecture.
Module 3: To understand frequent pattern mining and apply Association Rule mining for different types of data sets.
Module 4: To construct data mining solution for different Classification.
Module 5: To analyse and validate clustering techniques.
Module 6: To find data mining solution to real life applications.

Professional Core (lab)

Title of the Course: Open Source Software Lab 3IT451	L	T	P	Cr
	2	--	2	3

Pre-Requisite Courses:

Basic knowledge of Operating Systems, Computer Network, Software Engineering and free and open source tools and software's.

Textbooks:

1. "The complete Reference Networking" by Craig Zacker TMH Publication.
2. "Distributed Systems and Networks "by William Buchanan TMH Publication.
3. "The complete reference Linux" by Richard L. Peterson Tata Mc-graw Hill Publication.

References:

1. "Introduction to Free Software" - by SELF project.
2. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications, New York, 2003.
3. Peter Wainwright, "Professional Apache", Wrox Press, USA, 2002.
4. RasmusLerdorf and Levin Tatroe, "Programming PHP", O' Reilly Publications, USA 2002.
5. Wesley J Chun, "Core Python Programming", Prentice Hall of India, New Delhi, 2001.

Course Objectives :

1. To configure the open source software.
2. To contribute /develop software (system) for open source environment.
3. To use FOSS for software engineering.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Exercise the FOSS tools in software development.	3	Applying
CO2	Analyze the economics of FOSS.	4	Analyzing
CO3	Create new FOSS or Contribute to existing FOSS in FOSS environment.	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1					3							1
CO2				2					3			
CO3					3							3

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities,	By Course	During week 10 to week 14	25

	attendance, journal	Faculty	submission at the end of week 14	
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments

Course Contents:

Module 1	**Hrs.**
Introduction Introduction to open sources- Need of Open Sources- Advantages of Open Sources- Applications of Open Sources- commercial aspects of Open source movement, Installing different distributions of GNU/Linux, FreeBSD.	**8**
Module 2	**Hrs.**
Open source development Proprietary software development model vs. Open Source software development model, models for FOSS- Cathedral model and Bazaar model. Introduction to collaborative development (Developer communities, mailing lists, IRC, wiki, version control, bug tracking, handling non-technical issues, localization, accessibility, documentation by doxygen). Software package management (RPM, DEB - building, and creating software repositories) Open Standards, Licensing and legal aspects in detail.	**10**
Module 3	**Hrs.**
Configuration of Network communication services and File system DHCP, DNS, WINES, NFS, NIS, Web server, Ftp Server, E-mail Server, Telnet Server, etc. Configuration through webmin or usermin, Installing and configuring of Cygwin, Installing and configuring of CMS – moodle, druple, etc.	**8**
Laboratory Experiment: Minimum ten assignments should be based on above topics like: **Module 1:** Compare the various Linux Distributions and their purpose with comparisons: **Module 2:** Comparison of various Open Source tools. **Module 3:** Excise the Open Source Software Development for Ubuntu **Module 4:** Compilation and installation of various Linux Kernel Version: **Module 5:** Experimentation Of RPM/DEB package building:- **Module 6:** Development of Open Source Software :-Develop a simple software for basic needs such as calculator, editor or any small noticeable contribution in GIT version control, SVN	

Title of the Course: Software Testing & Quality Analysis Lab 3IT452	L	T	P	Cr
	2	--	2	3

Pre-Requisite Courses:

Software Engineering & Design

Textbooks:

1. Desikan, Ramesh, "Software Testing: principles and Practices", Pearson Education.

References:

1. Marnei L Hutcheson,"Software testing fundamentals- Methods & Metrics", Wiley Publication
2. Fenton, Pfleeger"Software Metrics: A Rigourous and practical Approach", , Thomson Brooks/Cole, ISBN 981-240-385-X

Course Objectives :

1. To introduce fundamentals of software testing
2. To familiarize test case design for IT based application
3. To impart different software testing tools.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Implement different software testing metrics	3	Applying
CO2	Evaluate manual as well as automated testing types.	5	Evaluating
CO3	Design application specific test cases for automated testing tools	6	Creating

CO-PO Mapping :

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1		3			2							
CO2	1										3	
CO3								1	2			3

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	**Based on**	**Conducted by**	**Conduction and Marks Submission**	**Marks**
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and

other suitable activities as per the nature of lab course.
The experimental lab shall have typically 8-10 experiments

Course Contents:

Module 1	**Hrs.**
Software Measurement Measurement in software engineering, Classifying software measures, applying the framework, software measurement validation	**6**
Module 2	**Hrs.**
Software Testing Process Purpose of testing, difference between inspection and testing, testing v/s debugging, testing life cycle, Roles and responsibility in testing, test artifacts, test plan, the V model for testing, techniques, Metrics, Risk based testing, Test Automation, Types of testing, Testing-Black Box & White Box.	**7**
Module 3	**Hrs.**
Software Testing tool's Need for Automated Testing tools, Taxonomy, Functional, Regression, Performance, Test Management, Source Code Testing and How to select testing tools.	**2**
Module 4	**Hrs.**
Study of testing tools J-unit, Test director, Testuff, UFT and others.	**4**
Module 5	**Hrs.**
Software Quality Assurance Quality Concepts, Software Quality Assurance, Planning for SQA, Six Sigma Principles, Malcolm Baldridge Assessment ISO 9000,Edward Deming's Principles, Total Quality Management, Product Quality Metrics, In-Process Quality Metrics, Software Maintenance	**6**

Laboratory Content	**Hours**
1. Code Test **a.** Write programs in „Language to demonstrate the working of the following. constructs: i) do...while ii) while….do iii) if…else iv) switch v) for b. A program written in „Language for Matrix Multiplication fails‖ Introspect the causes for its failure and write down the possible reasons for its failure c. Take any system (e.g. ATM system) and study its system specifications and report the various bugs	**6**
2. Design Test cases a. Write the test cases for any known application (e.g. Banking application b. Create a test plan document for any application (e.g. Library Management System)	**4**
3. Demonstrate following testing tool: a. Win runner, b. Selenium, c. Bugzilla, d. bugbit e. Test Director f. Test Link	**16**

Title of the Course: Data Mining Lab 3IT453	L	T	P	Cr
	-	-	2	1

Pre-Requisite Courses:
Statistics, Discrete Mathematics, Database management and data warehouse systems and Programming languages

Textbooks:

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

Course Objectives :

1. To demonstrate basic concepts, principles of data mining techniques.
2. To guide students to develop programming skills of data mining tools.
3. To apply data mining approaches to handle real world datasets.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	To modify and apply skills of choosing appropriate data preprocessing and mining techniques	3	Applying
CO2	To study and integrate various data mining algorithms	4	Analyzing
CO3	To build a data mining solution to solve real word problems.	5	Creating

CO-PO Mapping :

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1	2				1							
CO2		3									1	2
CO3			3		2			2				

Lab Assessment
There are four components of lab assessment LA1, LA2, LA3 and Lab ESE
IMP: Lab ESE is a separate head of passing

Assessment	**Based on**	**Conducted by**	**Conduction and Marks Submission**	**Marks**
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities,	By Course	During week 10 to week 14	25

	attendance, journal	Faculty	submission at the end of week 14	
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments

Course Contents:

Programming assignments based on following broad topics :

1. Perform data pre-processing tasks.
2. Implement and carryout association rule analysis.
3. Implement similarity measures, Correlation coefficient measures, regressions and statistical measures for any dataset and analyze the results.
4. Implement various clustering algorithms.
5. Implement various classification algorithms.
6. Perform various data mining tasks using WEKA and KNIME API.
7. Perform data transformations using an ETL Tools.
8. Perform advance data mining tasks on text, spatial and image dataset.
9. A small case study involving all stages of KDD. (Datasets are available online like UCI Repository etc.)
10. Using some sample data sets implement and test data mining techniques.

Title of the Course: Project I 3IT491	L	T	P	Cr
	--	--	4	2

Pre-Requisite Courses: -

Textbooks: -

References: -

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Summarize software engineering and development skills.	2	Understanding
CO2	Demonstrate and implement appropriate software tools and prototypes for project execution.	3	Applying
CO3	Organize and manage the teamwork for effective execution of the task.	4	Analyzing

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1										3		2
CO2		2			3						3	
CO3				2			2					1

Assessments :

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, Report	By Course Faculty/Guide	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, Report	By Course Faculty/Guide	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, Report	By Course Faculty/Guide	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation/ Report	By Course Faculty/Guide	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, Project/mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

Project/Mini-project is to be carried out in a group of maximum 3 to 5 students.

Each group will carry out Project/mini-project on developing any application software based on

following areas.

1. SCI or scopus index journal paper based topic.
2. Society /Industry Problem Statement(Sponsored Project)
3. Problem statements based on current or previously learned Technology.

Open Elective (OE)

(List OE (MOOC/NPTEL) will be published per semester/year)

Professional Electives IV

Title of the Course: Professional Electives IV: High Performance Computing 3IT 411	L	T	P	Cr
	2	1	-	3

Pre-Requisite Courses:

Computer Algorithms

Textbooks:

1 AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, *"Introduction to Parallel Computing"*, Pearson Education, Second Edition

2 Michel Quinn, *"Parallel Programming in C with MPI and Open MP"*, Tata McGraw Hill Publication

References:

1. David B. Kirk, Wen-mei W. Hwu, *"Massive parallel Programming with GPGPU"* Morgan Kaufmann Publication.

Course Objectives :

1. To introduce the current trends in parallel computer architectures and programming model.
2. To acquaint with parallel program design methodologies.
3. To devise various parallel algorithms for matrices and graphs.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain different parallel architectures anddesign methodologies.	2	Understanding
CO2	Choose parallel algorithms to optimized real world problems.	3	Applying
CO3	Study the parallel algorithms for matrices, graphs, sorting algorithm etc.	4	Analyzing

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3											
CO2		2	3									1
CO3					3							

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

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MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
Introduction What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network.	7
Module 2	**Hrs.**
Parallel programming models and paradigms. Introduction, A cluster computer and architecture, parallel applications and development, code granularity and level of parallelism, parallel programming models and tools, methodical design of parallel algorithm, parallel program paradigm, programming skeleton and templates.	7
Module 3	**Hrs.**
Performance and scalability of parallel systems Performance Metrics for parallel systems. The effect of Granularity and Data Mapping on Performance. The Scalability of parallel systems, ISOefficiency metric of scalability, sources of parallel overhead, Minimum execution time and minimum cost-optimal execution time.	6
Module 4	**Hrs.**
Tools for parallel programming OpenMP, MPI, CUDA/OpenCL, Chapel, etc. , Thread basics ,Work Sharing constructs, Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers, The MPI Programming Model, MPI Basics, Global Operations , Asynchronous Communication, Modularity, Other MPI Features, Performance Issues	6
Module 5	**Hrs.**
Hybid parallelism and accelerators. MPI + CUDA, Basic of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or OpenCL for GPGPU hardware, case study.	6
Module 6	**Hrs.**
Algorithms Dense matrix algorithms, sorting, graph algorithms.	7

Module wise Measurable Students Learning Outcomes :

- **Module 1:** Module 1: Understand basics of parallel computing platform.
- **Module 2:** Module 2: Comprehension of parallel algorithm design methodology.
- **Module 3:** Module 3: Computing performance of parallel algorithm.
- **Module 4:** Module 4: Classify various programming tools.
- **Module 5:** Module 5: Explain CUDA Memory model and Architecture.
- **Module 6:** Module 6: Design of parallel algorithm for different data structures.

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Electives IV :Mobile Ad-hoc Networks & Sensors 3IT 412	L	T	P	Cr
	2	1	-	3

Pre-Requisite Courses:
Wireless Networks

Textbooks:

1. C.K Toh,*"Ad hoc Mobile Wireless Networks Protocols and Systems", Pearson Education*
2. KazemSoharby, Daniel Minoli,, TaiebZnati,*"Wireless Sensor Networks, Technology, Protocols and applications*",Wiley

References:

1. Xiang-Yang Li, "Wireless Ad Hoc and Sensor Networks", Cambridge University press.
2. C.S.Raghvendra, Krishna M. Sivalingam&TajebZanati, "Wireless sensor networks", Springer.
3. Samuel Pierre, Michel Brabeau&EvengelosKranakis, "Ad-Hoc, Mobile, and Wireless Networks", Springer

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Illustrate different wireless network issues through ad-hoc concepts.	3	Applying
CO2	Integrate MAC and network layer protocols for ad-hoc and sensor network applications	4	Analyzing
CO3	Recommend different protocol of MANS	5	Evaluating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2	1										
CO2					3							2
CO3				3							1	

Assessment:

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Course Contents:

Module 1	**Hrs.**
Introduction to Wireless Networks Evolutions of mobile cellular network, GSM, GPRS, Ad-hoc Packet radio network: Architecture of PRNET, Routing in PRNET, Route calculation.	**7**
Module 2	**Hrs.**
Ad-hoc wireless media access protocol Problem in ad-hoc channel access, sender initiated and receiver initiated MAC protocol, Existing Ad-hoc MAC protocol: MACA, MACA-BI, PA-MAS, DBTMA, MARCH.	**6**
Module 3	**Hrs.**
Ad-hoc routing protocol Table Driven Approach: DSDV, CGSR; On Demand Approach: AODV, DSR; Hybrid: Zone Routing Protocol.	**6**
Module 4	**Hrs.**
Associativity Based Long Lived Routing Protocol ABR Protocol Description: Route Discovery phase, Route reconstruction phase, Alternate route, Route Deletion phase, ABR header and tables; Implementing ABR routing function; Experiment and protocol performance.	**7**
Module 5	**Hrs.**
Ad-hoc Multicast Routing Multicasting in wired network, multicast routing in mobile Ad-hoc network, DVMRP, AODV multicast, CAMP, ODMRP.	**7**
Module 6	**Hrs.**
Wireless Sensor Network Introduction and overview of wireless sensor network, Application of wireless sensor network, Architecture of wireless sensor network, Routing protocol for wireless sensor network, Transport control protocol for wireless sensor network.	**6**

Module wise Measurable Students Learning Outcomes :

Module 1: Describe wireless Technologies
Module 2: Understand different adhoc network protocol
Module 3: Classify different routing protocol for MANS
Module 4: Compare different multicast routing protocol
Module 5: Evaluate wireless Sensor Networks protocols
Module 6: Apply different WSN scenarios to solve engineering problems

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Electives IV Deep Learning: 3IT413	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses

1. Working knowledge of Linear Algebra, Probability Theory. It would be beneficial if the participants have done a course on Machine Learning.

Textbooks:

1. Ian Goodfellow, YoshuaBengio and AoronCourville "Deep Learning", The MIT Press Cambridge, Massachusetts London, England, 2017
2. AurelienGeron, " Hands-On Machine Learning with Scikit-Learn &TensorFlow", O'REILLY, Dec 2017

References:

1. Prof.Mitesh M. Khapra,"Deep Learning", course on NPTEL, July 2018
2. Andrew Ng, "Deep Learning Specialization", Coursera online course.

Course Objectives:

1. To inculcate the paradigm shift technique, deep Learning into students.
2. To discuss the applications of different Deep Learning technology.
3. To present the research scope of Deep Learning.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Discuss the fundamentals of Deep Learning.	II	Understand
CO2	Investigate the application of Deep Learning for Natural Language Processing and Computer Vision.	IV	Analyse
CO3	Defend the Deep Learning architectures.	V	Evaluate

CO-PO Mapping:

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				1									
CO2		2												3
CO3				2										1

Assessments:

Teacher Assessment:

Two components of in Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks

ISE 1	10
MSE	30
ISE 2	10
ESE	50
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc. MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.	

Course Contents:

Module 1 : Fundametals of Neural Networks	**Hrs.**
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. Back-propagation algorithm.	**7**
Module 2: Optimizations in Gradient Descent	**Hr**
Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Bais correction in Adam.	**6**
Module 3:Regularization	**Hr**
Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout. Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization.	**7**
Module 4:Deep Learning for Natural Language Processing	**Hrs.**
Principal Component Analysis and its interpretations, Singular Value Decomposition, Learning Vectorial Representations Of Words: One hot representation of words, SVD for learning word representation, Continues bag of word model, Skip gram model.	**6**
Module 5:Deep Learning for Computer Vision	**Hrs.**
Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Object Localization, Object Detection using Convolutional Implementation of Sliding Windows, Bounding Box Predictions, Intersection Over Union, Non-max Suppression, Anchor Boxes, YOLO Algorithm, Region Proposals.	**7**
Module 6:Recurrent Neural Networks	**Hrs.**
Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs. Encoder Decoder Models, Attention Mechanism, Attention over images.	**7**

Module wise Measurable Students Learning Outcomes:

Module 1: To understand the basics of Neural Networks.
Module 2: To be able to optimize the basic Gradient Descent algorithm.
Module 3: To report regularization technique in Deep Learning.
Module 4: To appreciate the Deep Learning for Natural Language Processing problem.
Module 5: To study modern Computer Vision aspects.
Module 6: To build basic Recurrent Neural Networks.

Title of the Course: Professional Electives IV :Digital Image Processing 3IT 414	L	T	P	Cr
	2	1	-	3

Pre-Requisite Courses :

Data Structure, Mathematics (Matrices), Any programming language like C

Textbooks:

1. Gonzalez ,woods"Digital Image Processing" , pearson education Second Edition.
2. S.Anandd urai, "Fundamentals of digital Image Processing" ,Pearson Edition.

References:

1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition
2. S.Jayaraman,T.Veeerkumar,"Digital Image Processing",MGH

Course Objectives :

1. To introduce the student to various image processing techniques.
2. To develop skills of learners to develop engineering skills and intuitive understanding of the tools used in Image Processing.
3. To encourage to apply image processing algorithms to real problems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Summarise image processing algorithms	2	Understanding
CO2	Apply Image segmentation and Compression Techniques to extract various features of the image.	3	Applying
CO3	Simulation of Image Processing Algorithm using tools(MATLAB/SCILAB/Python/OPenCV)	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2											
CO2				1								
CO3					3							1

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Content :

Module 1	**Hrs.**
Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image.	**7**
Module 2 :Image Convolution & Correlation	**Hrs**
Computation of 2D Convolution & correlation through Graphical methods, Determination of 2D convolution and correlation through Matrix methods, Significance of 2D convolution.	**7**
Module 3	**Hrs.**
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.	**6**
Module 4	**Hrs.**
Image Restoration: A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms.	**6**
Module 5	**Hrs.**

Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.	**6**
Module 6	**Hrs.**
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	**7**

Module wise Measurable Students Learning Outcomes :

Module 1: Able to identify and represent suitable data structure for image.

Module 2: Apply different image preprocessing and filtering techniques to enhance the image quality.

Module 3: Apply image transforming techniques.

Module 4: Apply image enhancement and restoration techniques.

Module 5: Know different techniques for image compression.

Module 6: To extract features in the image using segmentation techniques.

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Electives IV :Software Defined Network 3IT 415	L	T	P	Cr
	2	1	-	3

Pre-Requisite Courses: Computer and wireless network

Textbooks:

1. Chuk Black, Timothy Culver "Software Defined Networks:A Comprehensive Approach", 2nd Edition, Wiley publication, 2016.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson Publication.

References:

1. Thomas D. Nadeau, "Software Defined Networks, An Authoritative Review of Network Programmability Technologies", Ken Gray Publisher, August 2013, ISBN: 978-1-4493-4230-2.
2. Behrouz A. Forouzan , "Data Communication and Networking" TMGH 4th edition.

Course Objectives :

. 1. To provide fundamental knowledge of Software Defined Network.

2. To acquaint SDN operation in Data center

3. To appraise the network administration through virtualization and open flow.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Comprehend the concept of abstracting and centralizing the control plane in SDN	2	Understanding
CO2	Analyze the implications of shifting from traditional network architectures to SDN	4	Analyzing
CO3	Evaluate the network virtualizationfunctions.	5	Evaluating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3				2							
CO2										2	1	
CO3	2											1

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one

End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module1: Basic Networking Device and SDN	**Hrs.**
Basic Packet Switching Terminology, Historical Background, The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Packet Forwarding IQ.	**7**
Module2: Introduction to SDN	**Hrs.**
SDN Implications:Research and Innovation, Cost, Industry, Data Center Innovation, Data Center Needs, Real Time Case Study of Data Center, Virtualization, Network Virtualization, Network Function Virtualization	**7**
Module3: Open Flow Protocol and SDN	**Hrs.**
OpenFlow: Flow Table structure, Flowtable Actions, Flow messages, Legacy Mechanisms Evolve Toward SDN, SDN Applications, Alternate SDN Methods.	**6**
Module4: SDN in Data Center	**Hrs.**
Data Center Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations.	**6**
Module5: SDN in Other Environments	**Hrs.**
Consistent Policy Configuration, Global Network View,8.1 Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks.	**7**

Module 6: : Network Function Virtualization	**Hrs.**
Existing Network Virtualization Framework (VMWare and others), Mininet based examples, Virtualization and Data Plane I/O, Services Engineered Path.	**6**
Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: Module 1: Understand the origin of SDN and medium of access. Module 2: Comprehend the control plane and data plane structure of SDN. Module 3: Analyze the SDN operation in smart network. Module 4: Scrutinize the SDN in Data Center and web applications. Module 5: Examine various standards of SDN in real-time environment. Module 6: Design the network function for virtualization	
Tutorial Content: Tutorial can be conducted as12 Assignments based on module 1 to 6.	

Syllabus for Final Year IT SEM VIII

Professional Core (Lab)

Title of the Course: Project II 3IT 492	L	T	P	Cr
--		--	20	10

Pre-Requisite Courses: -

Textbooks: -

References: -

Course Objectives :

1. To help students to address real life challenges 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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Integrate project at each stage of the software development life cycle	4	Analyzing
CO2	Recommend project plans that address real-world challenges.	5	Evaluating
CO3	Develop successful software projects that support program's strategic goals and satisfies the customer needs	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1		3					2					
CO2					2			2			1	
CO3			3	1								3

Lab Assessment

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, Report	By Course Faculty/Guide	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, Report	By Course Faculty/Guide	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, Report	By Course Faculty/Guide	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation/ Report	By Course Faculty/Guide	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, Project/mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

Note: Project –I continued in this semester.

Project/Mini-project is to be carried out in a group of maximum 3 to 5 students.

Each group will carry out Project/mini-project on developing any application software based on following areas.

4. SCI or scopus index journal paper based topic.

5. Society /Industry Problem Statement(Sponsored Project)
6. Problem statements based on current or previously learned Technology.

Project group should submit workable project at the end of second semester.

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 online github.

Students should maintain a project log book containing weekly progress of the project.

Title of the Course: Techno-Socio Outreach 3 IT493	L	T	P	Cr
	-	1	-	1

Pre-Requisite Courses: --

References: The students may refer/undergo: Online open source courses, social services, club activity, sport activities, team activity and industry interaction

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Engage the programme for welfare of society and environment	3	Applying
CO2	Appraise pragmatic skills for national and international competitions	4	Analyzing,
CO3	Recommend and propose engineering solution for industry and community	5, 6	Evaluating Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1							3			2		
CO2					3						2	
CO3						2		1				3

Assessments :

Teacher Assessment:

Student will be assessed based on defined parameters/ rubrics at the department. The assessment rubrics will be shared to students well in advance. The performance and progress will be assessed occasionally by the department mentors/panel. However, the final gradation will be carried out in 8th semester based on the cumulative performance over eight semesters.

Course Contents:

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

Professional Elective V

Title of the Course: Professional Elective V: Soft Computing 3IT431	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses:
Artificial Intelligence, Programming Languages and tool like Matlab/Scilab

Textbooks:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, and EijiMizutani "Neuro Fuzzy and Soft computing: A Computational Approach to Learning and Machine Intelligence", Prentice Hall, New Delhi, 1986.
2. Goldberg, David E, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, New Delhi, 1989.
3. Sivanandam S N and Deepa S N, "Principles of Soft computing", Wiley India Edition., 2008.

References:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Application", Tata McGraw Hill, New Delhi, 2004.
2. Robert J Schalkff, "Artificial Neural Networks", McGraw Hill, New Delhi, 1997.
3. Sivanandam S N and Deepa S N," Introduction to Genetic algorithms ", Springer Verlag, Heidelberg, 2008.

Course Objectives :

1. To introduce various component of soft computing.
2. To impart soft computing concepts to solve engineering and optimization problems.
3. To familiarize with the swarm intelligence methods.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Classify hard and soft computing concepts	3	Understanding
CO2	Compare the working of swarm intelligence methods.	4	Analyzing
CO3	Justify the soft computing technique for given problem.	5	Evaluate

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2											
CO2		2		2								
CO3					3							1

Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last t modules) covered after MSE.

Course Contents:

Module 1	Hrs.

Introduction History, Scope of Soft Computing, components of Soft Computing- Neural Networks, Application scope of ANN, Fuzzy Logic, Genetic algorithm, Swarm Intelligence, Hybrid System, Hard vs. Soft Computing.	**5**
Module 2	**Hrs.**
Artificial neural network (ANN) Fundamental Concept, Evolution of Neural network, Basic models of ANN, important terminologies of ANN, Mc-Culloch Pitts Neuron, Linear separability, AND,OR, EXOR problem solving by ANN, Supervised Learning, Unsupervised Learning, Application to ANN to real world problem.	**7**
Module 3	**Hrs.**
Genetic algorithms (GA) Introduction, basic operators and Terminologies in GA, Genetic operators – Selection, cross-over, reproduction and mutation – fitness function, traditional vs. Genetic algorithm, simple genetic algorithm, general genetic algorithm, the schema theorem, classification of GA, Genetic programming. Application to GA to real world problem.	**7**
Module 4	**Hrs.**
Introduction to classical set and fuzzy sets Introduction, Classical set (crisp set) Fuzzy sets and their properties, Fuzzy models, Membership function, Defuzzification. Application to Fuzzy logic to real world problem.	**6**
Module 5	**Hrs.**
Swarm intelligence (SI) Ant colony optimization (ACO). Swarm as a multi-agent system, Distributed coordination and group communication, Particle Swarm Optimization (PSO), Differential Evolution (DE), Harmony search (HS), Bacteria Foraging Optimization (BFO), Artificial Bee Colony algorithm (ABC), Biogeography-Based Optimization (BBO), Gravitational Search Algorithm (GSA), Grenade Explosion Method (GEM) Teaching Learning Based Optimization Algorithm (TLBO).	**8**
Module 6	**Hrs.**
Applications of soft computing Hybrid System, Applications in image processing, optimization of TSP using GA/ANN, GA based Internet search technique, soft computing based hybrid fuzzy controller, Application of soft computing in multiple disciplines. Top research article in soft computing from high reputed journals.	**6**

Module wise Measurable Students Learning Outcomes :

Module 1: To differentiate between hard and soft computing.
Module 2: To study the fundamental concept ANN.
Module 3: To recognize basic operators and Terminologies in GA.
Module 4: To know fundamental like Classical set (crisp set) Fuzzy sets and their properties.
Module 5: To know swarm intelligent algorithm: ACO, PSO, DE, HS, BFO, ABC, BBO, GSA, GEM, TLBO.
Module 6: To understand the Hybrid System of soft computing.

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Elective V: Geographical Information System 3IT432	L	T	P	Cr
	2	1	--	3

Pre-Requisite Courses: None

Textbooks:

1. "An Introduction to Geographical Information Systems", Ian HeyWood, Sarah Cornelius and Steve Carver, , Pearson Education, 2nd Edition, 2006
2. "Introduction to Geographic Information Systems", Kang-tsung Chang, Tata McGrawHill, 4thEdition, 2007

References:

1. "Principles of Geographical Information System", Peter A. Burrough, Rachael A. McDonnell and Christopher D. LloydOxford University Press, 2016
2. "Geographical Information Systems and Environmental Modeling", Keith C. Clarke, Bradley O. Parks, and Michael P. Crane, Prentice-Hall India, 2001

Course Objectives :

1. To make students able to describe, GIS.
2. To introduce GIS data structures, data capture, storage, analysis and the appropriate use.
3. To impart typical uses of GIS in business, government, and resource management.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	distinguish spatial and non-spatial characteristics of GIS data model	2	Understand
CO2	examine the data quality issues and performance for GIS data set	4	Analyzing
CO3	design a GIS application	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2							1				
CO2			3		1						3	
CO3				2								2

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
GIS – An Overview and Spatial Data Modelling Introduction, Defining GIS, Components of GIS, Spatial Data, Maps & their Influence on the Character of Spatial Data, Thematic Characters, Other Sources of Spatial Data, Spatial Data Modelling, Entity Definition, Spatial Data Models, Spatial Data Structures, Modelling Surfaces, Modelling Networks, Building Computer Worlds, Modelling the Third Dimension, Modelling the Fourth Dimension.	**8**

Module 2	Hrs.
Database Management and Data Editing Database Approach, Attribute Data in GIS, Relational Model, Attribute Data Entry, Manipulation of Fields and Attribute Data, GIS Database Applications, Web GIS, Developments in Databases, Data Input and Editing, Methods of Data Input, Data Editing, Integrated Database.	**7**
Module 3	**Hrs.**
Data Analysis Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighbourhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis.	**6**
Module 4	**Hrs.**
Modelling and Output Analytical Modelling in GIS, Modelling Physical and Environmental Processes, Modelling Human processes, Modelling the Decision-Making Process, Output: from New Maps to Enhanced Decisions, Maps as Output, Non-Cartographic Output, Spatial Multimedia, Mechanisms of Delivery, GIS and Spatial Decision Support.	**8**
Module 5	**Hrs.**
Data Quality Data Quality Issues, Describing Data Quality and Errors, Sources of Errors in GIS, Finding and Modelling Errors in GIS, Managing GIS Error.	**5**
Module 6	**Hrs.**
GIS Project Management GIS Project Design and Management, Problem Identification, Designing a Data Model, Project Management, Implementation Problems, Project Evaluation.	**5**

Module wise Measurable Students Learning Outcomes :

- **Module 1:** Understand Fundamentals of GIS, Spatial data modelling.
- **Module 2:** Understand relational database design for spatial and non-spatial data modelling.
- **Module 3:** Relate different measures of GIS.
- **Module 4:** Apply data modelling for spatial decision support in GIS application
- **Module 5:** Classify different data quality issues in context of GIS.
- **Module 6:** Design GIS application through standard software engineering model

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Elective V: Business Intelligence 3IT433	L 2	T 1	P --	Cr 3

Pre-Requisite Courses:

Database management systems

Textbooks:

1. R.N. Prasad and SeemaAcharya, "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
3. Ponniah, "Data Warehousing Fundamentals" Wiley Publication, 2001

Course Objectives :

1. To familiarize students with the ETL and data processing techniques.
2. To make students awareto the basic issues in business&datamodelling techniques for business.
3. To compare various BI architectures and systems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Perceive the knowledge and skills for working as a business intelligence developer.	2	Understanding
CO2	Distinguish business tools and techniques to create visualizations and dashboards.	4	Analyzing
CO3	Design a BI application	6	Creating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1			3			2						
CO2				2	1							3
CO3				2								2

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
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

Module 2	Hrs.
Basics of BI 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
Module 3	**Hrs.**
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
Module 4	**Hrs.**
Data Processing Introduction to data quality, data profiling concepts and applications, introduction to ETL (Extract-Trensform-Loading) using Open Source Software.	6
Module 5	**Hrs.**
Data and Dimension Modeling Introduction, ER Modeling, multidimensional data modeling, concepts of dimensional, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPLs, creating OLAP using Application Software.	7
Module 6	**Hrs.**
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

Module wise Measurable Students Learning Outcomes :

Module 1: Differentiate between digital data and its types.
Module 2: Understand fundamentals of BI Process, Technology, Roles and Applications.
Module 3: Perform data integration through various approaches.
Module 4: Understand high quality data with data profiling concepts.
Module 5: Perform different data modelling for efficient handling of data.
Module 6: Do enterprise reporting using various methods.

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Elective V: Visual Computing 3IT434	L	T	P	Cr
	2	1	--	3

Pre-Requisite Courses:

Computer Graphics

Textbooks:

1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach with OpenGL, 4th edition Addison-Wesley, 2005
2. Gonzalez & Woods," Digital Image Processing" Thomson Press, 4th Edition.

References:

1. F. S. Hill Jr. and S. M. Kelley , "Computer Graphics using OpenGL (3/e)"
2. ShalliniGovil-Pai, Principles of computer Graphics , Springer
3. Rechard Wright &Sweet,OpenGLSuperBible, Techmedia, 2nd Edition

Course Objectives :

1. To introduce theory of data structure and levels for representation.
2. To discuss the principles of Animation and how to apply it.
3. To provide comprehensive introduction to computer modelling, animation and rendering

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Distinguish the levels of image data representation	2	Understanding
CO2	Interpret effects of rendering	3	Applying
CO3	Justify use of OpenGL for object visualization and manipulation	5	Evaluating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2											
CO2								3				2
CO3	1										3	

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1:	Hrs.
Introduction to Image Processing &Modelling Level of image data representation, Traditional & hierarchical data structure Image Enhancement in spatial domain, 3-D Modelling, Basic 3-D Programming principles	7
Module 2 :	**Hrs.**
Animation techniques Traditional Animation, Principles of Animation, Overview & low-level motion specification, Animating articulated structures, soft object animation, procedural animation	6

Module 3	Hrs.
The OpenGL OpenGL Architecture, OpenGL API, primitives and attributes, First program in OpenGL, Drawing lines and shapes in OpenGL.	**7**
Module 4	**Hrs.**
Geometric Objects & Transformations Scalars, points and Vectors, Three-dimensional primitives, coordinate systems, OpenGL transformation Translation, scaling, Rotation. Composition of Transformation.	**7**
Module 5	**Hrs.**
Lighting and surfacing Light and matter, the phong lighting model; computation of vectors; polygon shading; Approximation of sphere by recursive subdivision; Light sources in OpenGL; Specification of material in OpenGL.	**6**
Module 6	**Hrs.**
Rendering Display Lists, Texture mapping, Photon mapping, Radiosity, Ray Tracing, global illumination, shading of surfaces	**6**

Module wise Measurable Students Learning Outcomes :

Module 1: To explain how images are represented during processing and identify principles of 3-D modelling

Module 2: To apply different animation techniques using different animation structures

Module 3: To design and construct 3-D graphics applications program using OpenGL

Module 4: To apply the relevant mathematics of computer graphics.

Module 5: To apply lighting effect to the scene.

Module 6: To summarize the rendering pipeline architecture

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Elective V: Software Architecture and Design 3IT435	L	T	P	Cr
	2	1	--	3

Pre-Requisite Courses:

Database Management System, OS, Software Engineering, object-oriented language

Textbooks:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Addison Wisley, 2nd Edition, 2003.
2. Roger S Pressman, "Software Engineering – A Practitioner's Approach", McGraw Hill, USA, 2007.
3. PankajJalote, "An Integrated Approach to Software Engineering", Narosa Publication, 3rd Edition.

References:

1. Pfleeger, "Software Engineering", Pearson Education India, New Delhi, 1999.
2. Terry quatrain,"VisualModeling with Rational Rose 2002 And UML",Pearson,3rd Edition, 2006

Course Objectives :

1. To provide all aspects of the software design architecture
2. To acquaint with object oriented analysis and design using the Unified Modeling Language (UML)
3. To appraisesoftware architecture in SDLC

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Apprehend the software design architecture for real time application	2	Understanding
CO2	Apply software design methodology in development life cycle	3	Applying
CO3	Evaluate and reconstruct software architecture for real-time system	5	Evaluating

CO-PO Mapping :

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	2			3								
CO2	1				2							
CO3		3										2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction to software Architecture	Hrs.
Fundamental concepts and properties of system, software paradigm and model, roles	7

and responsibility of architect, levels of architecture, 4 + 1 Architecture view, Examples of Software Architecture	
Module 2: Quality Attributes & Software Architecture	**Hrs.**
Quality attributes, Quality requirements, Architecture in life cycle, Designing the Architecture, Forming team structure, Creating Skeleton System.	**7**
Module 3: Design Patterns	**Hrs.**
Creational design patterns, Structural design patterns, behavioral patterns, concurrency pattern, uses of design patterns.	**6**
Module 4: Documenting software architecture	**Hrs.**
Documentation of design patterns, Documenting Software Architecture Stakeholders, Views, View sets, View-based documentation.	**6**
Module 5: Software Architectures Reconstruction	**Hrs.**
Architecture Evaluation,Architecture Recovery Objectives, Information Extraction, Database Construction, View Fusion,Architecture Reconstruction, Analyzing Architectures.	**6**
Module 6: Software Architecture Standards and Applications	**Hrs.**
IEEE 1471, ISO 42010, Architecture Knowledge Management, Product line architectures, Enterprise Architecture.	**7**

Module wise Measurable Students Learning Outcomes :
After the completion of the course the student should be able to:
Module 1: Understand the software project frame works and team activity.
Module 2: Comprehend the software design for real-time applications.
Module 3: Analyze the software architecture in industry domain.
Module 4: Scrutinize the documentation of software architecture.
Module 5: Examine software architecture in real-time environment.
Module 6: Design the model of software design

Tutorial Content:
Tutorial can be conducted as12 Assignments based on module 1 to 6.