Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-3-18

Bachelor of Engineering/Technology (B.E./B.Tech) in Information Technology (Program Code: UIT)

Third Year Engineering (Sem. V and Sem. VI) Effective from Academic Year 2018 -19

Board of Studies Approval: 13/12/2017

Academic Council Approval: 20/01/2018

Dr. Radha Shankarmani   *Dr. Surendra Rathod*   *Dr. Prachi Gharpure*
Head of Department   *Dean Academics*   *Principal*

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Scheme for B.E./B.Tech Information Technology (SEM V/ SEM VI)						
SEM V						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
IT51	Software Engineering	PC	3	1	--	4
IT52	Computer Networks	PC	3	1	--	4
IT53	Advanced Database Systems	PC	3	--	--	3
IT54	Theoretical Computer Science*	PC	3	1	--	4
ITL51	Software Engineering Lab	PC	--	--	2	1
ITL52	Computer Networks Lab	PC	--	--	2	1
ITL53	Advanced Database Systems Lab	PC	--	--	2	1
ITL54	Internet Technology Lab	PC	--	1	2	2
ITP55	Minor Project I	PR	--	--	2	1
MEC5^	Mandatory Elective Course MEC1:French Language MEC2:German Language	MC	2	--	--	2
SDX	SCOPE Course (Optional)	SD	--	--	--	--
ABL3	Technical Presentation Skill (Noncredit)	ABL	--	--	--	--
CEP3	Problem solving module-II (Optional)	CEP	--	--	--	--
	Total		14	4	10	23
SEM VI						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
IT61	Distributed Systems	PC	3	--	--	3
IT62	Data Warehousing and Mining	PC	3	1	--	4
IT63	Information and Network security	PC	3	1	--	4
ITL61	Distributed Systems Lab	PC	--	--	2	1
ITL62	Data Warehousing and Mining Lab	PC	--	--	2	1
ITL63	Information and Network security Lab	PC	--	--	2	1
ITL64	Machine Learning Lab	PC	--	1	2	2
ITP65	Minor Project II	PR	--	--	2	1
HSS61	Advance Communicative English	HSS	2	2	--	3
OE^	Open Elective	OE	1@	--	2@	2@
MEC^	Mandatory Elective Course MEC3:Industrial and Organizational Psychology MEC4: Law for Engineers	MEC	2	--	--	2
SDX	SCOPE Course (Optional)	SD	--	--	--	--
ABL4	Technical Paper and Patent Drafting (Noncredit)	ABL	--	--	--	--
CEP4	Problem solving module-III (Optional)	CEP	--	--	--	--
	Total		13+1@	5	10+2@	22+2@

* Common to Computer Engineering Department

@OE1: Consumer Electronics (ETRX)   OE5:Fundamentals of Computational Intelligence (COMP)
OE2: Robotic Vision (ETRX)   OE6: Fundamentals of Data Structures and Algorithms (COMP)
OE3: Cyber Security and Digital Forensics (EXTC)   OE7:Software Testing (IT)
OE4: Internet of Things (EXTC)   OE8:Database Management Systems (IT)

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Evaluation Scheme

Course Code	Course Name	Marks			
B.E./B.Tech Information Technology (SEM V)					
		ISE	MSE	ESE	Total
IT51	Software Engineering	20	20	60	100
IT52	Computer Networks	20	20	60	100
IT53	Advanced Database Systems	20	20	60	100
IT54	Theoretical Computer Science*	20	20	60	100
ITL51	Software Engineering Lab	40	--	--	40
ITL52	Computer Networks Lab	40	--	--	40
ITL53	Advanced Database Systems Lab	40	--	--	40
ITL54	Internet Technology Lab	40	--	--	40
ITP55	Minor Project I	40&	--	20	60
MEC5^	Mandatory Elective Course MEC1:French Language MEC2:German Language	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL3	Technical Presentation Skill (Noncredit)				
	Total				**670**

Course Code	Course Name	Marks			
B.E./B.Tech Information Technology (SEM VI)					
		ISE	MSE	ESE	Total
IT61	Distributed Systems	20	20	60	100
IT62	Data Warehousing and Mining	20	20	60	100
IT63	Information and Network security	20	20	60	100
ITL61	Distributed Systems Lab	40	--	--	40
ITL62	Data Warehousing and Mining Lab	40	--	--	40
ITL63	Information and Network security Lab	40	--	--	40
ITL64	Machine Learning Lab	40	--	--	40
ITP65	Minor Project II	40&	--	20	60
HSS61	Advance Communicative English	100	--	--	100
OE^	Open Elective	40	10	20	70
MEC^	Mandatory Elective Course MEC3:Industrial and Organizational Psychology MEC4: Law for Engineers	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL4	Technical Paper and Patent Drafting (Noncredit)	--	--	--	--
	Total				**740**

@OE1: Consumer Electronics (ETRX)   OE5:Fundamentals of Computational Intelligence (COMP)
OE2: Robotic Vision (ETRX)   OE6:Fundamentals of Data Structures and Algorithms (COMP)
OE3: Cyber Security and Digital Forensics (EXTC)   OE7:Software Testing (IT)
OE4: Internet of Things (EXTC)   OE8:Database Management Systems (IT)

& Phase-I:20 Phase-II:20

Semester V

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT51	**Software Engineering**	3	1	-	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	IT43: Database Management Systems
	IT34: Object Oriented Programming

At the end of the course students will be able to

Course Outcomes	IT51.1	Analyze requirements and choose appropriate process model.
	IT51.2	Design system models with respect to traditional and the object oriented approach.
	IT51.3	Develop umbrella activities on system (RMMM, SQA, SCM).
	IT51.4	Evaluate system design with test cases.

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	**Introduction**	**1.1**	Software Engineering Process Paradigms, Process Models – Incremental and Evolutionary models	1,2,4	2
		1.2	Typical Application for each model, Agile methodology, Process and Project Metrics		2
2	**System Analysis**	**2.1**	System Requirement, Stakeholders, Techniques for information gathering, Validating the requirements	1,2,6	2
		2.2	Feasibility Analysis, Tests for feasibility, Cost Benefit Analysis, Feasibility report. The system Proposal		2
		2.3	Data flow diagram and UML analysis diagrams		9
3	**Software Design**	**3.1**	Software Design Specification– Abstraction, Modularity– Effective modular design, Cohesion and Coupling, Example of code for cohesion and coupling	1,2,7	3
		3.2	User Interface Design – Human Factors, Interface standards– User Interface Design Process		2
		3.3	Application Architecture for Information System, Deployment using UML diagrams, Component and deployment diagram for various architectures		2
		3.4	Design Patterns – Gang of four patterns		2

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4	SQA	4.1	Software estimation – Empirical estimation models – Cost/Effort estimation Planning – Work breakdown Structure, Gantt Chart. Evaluate schedule and cost variance	1,3	5
		4.2	Risk Management Risk Identification, Risk Assessment, Risk Projection, RMMM		2
		4.3	Software Configuration Management, SCM process, version and change control		2
		4.4	Quality metrics		1
5	Software Testing	5.1	Software Testing Basic concept and terminology, Verification & validation, White Box Testing-, Black Box Testing, Integration, Validation and system testing	1,2,5	4
		5.2	OO testing methods-Class Testing, Interclass testing, testing architecture, Behavioral testing		2
				Total	**42**

Recommended Books:

1. Roger Pressman, "*Software Engineering: A Practitioners Approach*", 6[th]Edition, McGraw Hill, 2010.
2. Ian Somerville, "*Software Engineering*",9th Edition, Addison Wesley, 2011
3. James F. Peters and WitoldPedrycz, "*Software Engineering – An Engineering Approach*", Wiley, 2000.
4. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI, 2014
5. Pankaj Jalote "*An Integrated Approach to Software Engineering*", 3rd Edition, Narosa Publication, 2005.
6. James a. Senn, "*Analysis and Design of Information Systems*", 2nd Edition, McGrawHill, 2009.
7. Craig Larman, "*Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development* ", 3rd Edition, Pearson Education, 2005

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT52	**Computer Networks**	**3**	**1**	**-**	**3**	**1**	**--**	**4**
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		**20**		**60**	**100**	

Pre-requisite Course Codes	ITL36: Open Source Operating Systems Lab	
At the end of the course students will be able to		
Course Outcomes	IT52.1	Explain the process of communication in computer network.
	IT52.2	Simulate the computer network.
	IT52.3	Design the subnet for the given ip address.
	IT52.4	Illustrate the protocols of TCP/IP.

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	**OSI reference model and network architecture**	**1.1**	Types of communication (simplex, half duplex, full duplex), types of connections, network topology types	1,2,3	1
		1.2	Types of networks: peer to peer and client server networks, network hardware- transmission technology-broadcast links and point-to-point links and scale–PAN, LAN, MAN, WAN, Internet		2
		1.3	Network software: protocol hierarchies, protocol, peers, interface, network architecture, protocol stack, Connection oriented and connectionless services, service primitives		1
		1.4	Reference model: OSI,TCP/IP		2
2	**Physical layer**	**2.1**	Guided Transmission Media	1,2,3	1
		2.2	Unguided transmission media		2
3	**Data link layer**	**3.1**	Services provided by Data link layer to network layer, Framing	1,2,3	1
		3.2	Error detection – checksum, parity CRC		1
		3.3	Error correction: hamming codes		2
		3.4	Flow control- elementary data link protocols, Sliding window protocols		2
		3.5	HDLC- high level data link control protocol		1

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4	**Medium Access Sub layer**	4.1	The Channel Allocation Problem, Multiple Access Protocols	1,2,3	1
		4.2	Multiple access Aloha system, CSMA–CSMA/CD,CSMA/CA		2
		4.3	Controlled access – reservation system, polling, token passing		2
		4.4	Channelization–FDMA,TDMA,CDMA Traditional Etheet- frame, addressing		2
5	**Network layer**	5.1	IPV4 addresses – address space, notations, classful, classless addressing	1,2,3	2
		5.2	Need for network layer, ipv4 datagram, fragmentation		2
		5.3	Routing table: Static, Dynamic, Routing protocol: Intradomain – Distance vector-RIP,link state-OSPF, interdomain – path vector-BGP.		4
6	**Transport layer**	6.1	Process to process delivery- client server paradigm, multiplexing, demultiplexing, connection less vs connection oriented service.	1,2,3	2
		6.2	UDP: user datagram, UDP operation: connectionless services, flow and error control, encapsulation and decapsulation, queuing.	1,2,3	2
		6.3	TCP: TCP services: process to process communication, stream delivery service, sending and receiving buffers, segments, full duplex communication.	1,2,3	2
		6.4	TCP features: sequence numbers and acknowledgement number,TCP segment, TCP connection, flow control, error control, congestion control.	1,2,3	2
7	**Application layer: Remote logging**	7.1	TELNET	1,2,3	2
		7.2	FTP	1,2,3	1
				Total	**42**

Recommended Books:
1. B. F. Ferouzan, "*Data and Computer Communication*", 4th Edition, Tata McGraw Hill, 2010.
2. S. Tanenbaum, "*Computer Networks*", 4th Edition, Prentice Hall, 2012.
3. William Stallings, "*Data and Computer Communication*", 10thEdition, 2014.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT53	**Advanced Database Systems**	3	-	-	3	--	--	3
		Examination Scheme						
		Theory Marks						
		ISE		**MSE**		**ESE**		**Total**
		20		20		60		100

Pre-requisite Course Codes	IT43: Database Management Systems	
At the end of the course students will be able to		
Course Outcomes	IT53.1	Design parallel, distributed, Object oriented database
	IT53.2	Demonstrate the optimized query processing and indexing over the database
	IT53.3	Design the integration of database schemas using XML technology
	IT53.4	Explore Advanced Data management Techniques

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	**Indexing in Database**	**1.1**	Basic Concepts, Ordered Indices	1	2
		1.2	B-Tree Index Files, B+-Tree Index Files		2
2	**Object and Object Relational Databases**	**2.1**	Concepts for Object Databases: Object Identity, Object structure, Type Constructors	1,2	2
		2.2	Complex Objects, ODMG Model, ODL, OQL, Object Relational features in SQL / Oracle, Case Studies		2
3	**Concept and Overview of Parallel and Distributed Database system**	**3.1**	Architectures for parallel database, Parallel query Evaluation, Parallelizing individual operation, Parallel Query Optimization, Distributed Database System (DDBS), Architectures, Features of DDBS, Design issue in DDBS, Advantages, disadvantages, transparencies in DDBMS, three tier architecture case study	3,6	5
	Distributed Database Design	**3.2**	Distributed database Design concepts, objective of data distribution, Data Fragmentation, the allocation of Fragments, replication		5

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	Distributed concurrency control and Recovery	3.3	Locking-Based Concurrency Control Algorithms, Introduction to distributed deadlock, Deadlock avoidance, prevention, detection and recovery, 2 phase and 3 phase commit protocol		5
	Query Processing in Distributed database	3.4	Characterization of Query Processors, Layers of Query Processing, Query Decomposition and Data Localization		4
4	**XML Databases**	4.1	XML Databases: XML-Related Technologies, XML Schema	1,2.6	2
		4.2	XML Query Languages, Storing XML in Databases, XML and SQL		2
5	**NOSQL And Graph Databases**	5.1	No SQL, Weaknesses of the Relational Data Model, Inadequate Representation of Data, Semantic Overloading, Weaknesses of RDBMSs	6	2
		5.2	Graph database: Graphs and Graph Structures, The Property Graph Model, Storing Property Graphs in Relational Tables, Advanced Graph Models, Neo4J, HyperGraphDB		4
6	**Advanced Data Management technique**	6.1	Overview of Advanced Database models : Mobile databases, Temporal databases, Spatial databases	4,5	2
		6.2	Overview of Multimedia Databases : Image Databases, Video Databases, Audio Databases		3
				Total	**42**

Recommended Books:

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, *"Database System Concepts"*, 6[th]Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, *"Fundamentals of Database Systems"*, 5[th]Edition, Pearson Education/Addison Wesley, 2007.
3. M. Tamer Ozsu, Patrick Valduriez, *"Principles of Distributed Database"*, Pearson Education, India,2011.
4. Subramaniam, *"Principles of Multimedia Database Systems"*, Morgan Kauffman Publishers, 2008.
5. Carlo Zanalio, StefenoCeri, Christo Faloutsos, V. S. Subrahmanaian, Roborto Zicari, Richard T. Snodgrass, *"Advanced Database Systems"*, Morgan Kaufmann Publishers, Inc. San Fransico.
6. Lena Wiese *"Advanced Data Management: For Sql, Nosql, Cloud And Distributed Databases"*, De Gruyter, 2015

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT54	**Theoretical Computer Science***	3	1	-	3	1	--	4
		Examination Scheme						
		ISE		**MSE**	**ESE**		**Total**	
		20		20	60		100	

Pre-requisite Course Codes		IT33: Discrete Structures	
At the end of the course students will be able to			
Course Outcomes	IT54.1	Design finite automaton for a regular languages.	
	IT54.2	Identify regular and non regular languages.	
	IT54.3	Construct the grammar for a language and convert it into normal forms.	
	IT54.4	Design pushdown automata and Turing machine for a language.	

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	**Sets, Relations and Languages**	**1.1**	Relations and functions	2,3,4	1
		1.2	Alphabets and languages		1
		1.3	Types of proof		1
2	**Finite Automata**	**2.1**	Regular languages and regular expressions	1,3,5	1
		2.2	Finite Automata		2
		2.3	Nondeterministic Finite Automata		1
		2.4	Nondeterministic Finite Automata with ϵ - transitions		1
		2.5	Kleene's theorem		1
		2.6	NFA to DFA Conversion		1
3	**Regular language**	**3.1**	The pumping lemma for regular languages, Applications of the pumping lemma	1,4	2
		3.2	Closure properties for regular languages		1
		3.3	Equivalence and minimization of automata: Testing equivalence of states, Minimization of DFA's		3

4	Context free grammars and languages	4.1	Context free grammars: Definition of context free grammars, Derivations using a grammar, The language of a grammar, Sentential forms	1,5	1
		4.2	Parse trees: Constructing parse trees, From inferences to trees, From trees to derivations, From derivations to recursive inferences		2
		4.3	Ambiguity in grammars and languages: Ambiguous grammars, Removing ambiguity from grammars		2
5	Pushdown automata	5.1	Definition of the pushdown automaton: The formal definition of pushdown automata, A graphical notation for PDA's, Instantaneous descriptions of a PDA	1, 2	1
		5.2	The languages of a PDA: Acceptance by final state, Acceptance by empty stack, From empty stack to final state, From final state to empty stack		2
		5.3	Equivalence of PDA's and CFG's: From grammars to pushdown automata, From PDA's to Grammar		2
		5.4	Deterministic pushdown automata: Definition of a deterministic PDA, Regular languages and deterministic PDA's, DPDA's and context free languages		1
6	Normal forms for context free grammars	6.1	Eliminating useless symbols, Computing the generating and reachable symbols, Chomsky normal form, Greibach normal form	1,2,3	3
		6.2	The Pumping lemma for context free languages: Applications of the pumping lemma for CFL's		2
7	Introduction to Turing Machines	7.1	Turing machines: Formal definition of a Turing machine, Examples of Turing machines	1,2	2
		7.2	Halting Problem, Post Correspondence Problem (PCP)		2
		7.3	Variants of Turing machines: Multitape Turing Machines		1
		7.4	Church-Turing hypothesis		1
8	Recursively Enumerable	8.1	Recursively Enumerable and recursive	3	1
		8.2	Enumerating a language		1

languages	8.3	Context sensitive languages and the Chomsky hierarchy		2
			Total	**42**

Recommended Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "*Introduction to Automata Theory, Languages and Computation*", 3rd Edition, Pearson, 2008.
2. Michael Sipser, "*Introduction to the Theory of computation*", 3rd Edition, Cengage Learning Publication, 2013.
3. John C. Martin, "*Introduction to Languages and the Theory of Computation*",4th Edition, McGraw-Hill Publications, 2010.
4. Harry Lewis, Christos H. Papadimitriou, "*Elements of the Theory of Computation*", 2nd Edition, Pearson, 1998.
5. Dexter C. Kozen, "*Automata and Computability*", Springer Verlag Publications, 1997.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
ITL51	**Software Engineering Lab**	--	--	**2**	--	--	**1**	**1**
		Examination Scheme						
		ISE		**MSE**		**ESE**		**Total**
		40		--		--		**40**

Pre-requisite Course Codes	IT43: Database Management Systems
	IT34: Object Oriented Programming

At the end of the lab students will be able to		
Course Outcomes	ITL51.1	Create software requirements specification (SRS) document.
	ITL51.2	Construct data flow diagram (DFD) and UML diagrams for the case study.
	ITL51.3	Create work breakdown structure and schedule the activities using Gantt chart.
	ITL51.4	Develop Risk Mitigation, Monitoring and Management Plan.
	ITL51.5	Design test cases for a given case study.
	ITL51.6	Illustrate version of software using version control tool.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Gather requirements and prepare SRS document.	1,5	5
2	Create Context level diagram and DFD up to 2 levels.	1,2,5	5
3	Draw use case diagram and class diagram. Prepare UC specification document.	3,4	5
4	Prepare component and deploy according to the prescribed architecture.	3,4	5
5	Plan for development of software using Gantt chart.	1,2,5	5
6	Prepare test cases for all the scenarios taken in sequence diagram in Exp.3.	1,2,5	5
7	Identify risk, assess impact and assign priority Prepare RMMM plan for highest priority risk.	5	5
8	Create versions of software using version control tool.	1,2,5	5
		Total	**40**

Experiments 1-5 to be done based on the case study.

Recommended Books:

1. James a. Senn, "Analysis *and Design of Information Systems*", 2nd Edition, McGrawHill, 2009.
2. Ali Behforooz Fredrick Hudson, "*Software Engineering Fundamentals*", Oxford University Press, 2006.
3. James Rumbaugh, Ivar Jacobson, GraddyBooch, "*The unified modeling language Reference manual*", 2ndEdition, Addison Wesley, 2004.
4. James Rumbaugh, Ivar Jacobson, GraddyBooch "*The unified modeling language User manual*", 2ndEdition, Addison Wesley, 2000.
5. Roger Pressman, "*Software Engineering: A Practitioners Approach*", 6th Edition, McGraw Hill, 2010.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL52	Computer Networks Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ITL36: Open Source Operating Systems Lab	
At the end of the Lab course students will be able to		
Course Outcomes	ITL52.1	Illustrate topology.
	ITL52.2	Test various protocol for given scenario.
	ITL52.3	Build VLAN.
	ITL52.4	Experiment application layer protocol.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Write a tcl script for network simulation using ns2.	1,2,3	5
2	Create network topologies using ns2.	1,2,3	5
3	Implement socket programming.	1,2,3	5
4	Simulate MAC protocol (Stop and Wait Protocol, Sliding Window Protocol) using ns2 simulator for the given scenario.	1,2,3	5
5	Write a C/C++ program for the simulation of Cyclic Redundancy Check and Hamming codes for the given scenario.	1,2,3	5
6	Simulation of routing protocol (Link state routing protocol/ Distance vector routing protocol).	1,2,3	5
7	Create VLAN for the given scenario.	1,2,3	5
8	To setup FTP server on Ubuntu.	1,2,3	5
		Total	**40**

Recommended Books:

1. B. F. Ferouzan, "*Data and Computer Communication*", 4th Edition, Tata McGraw Hill,2010.
2. S. Tanenbaum, "*Computer Networks*", 4th edition, Prentice Hall, 2012.
3. William Stallings, "*Data and Computer Communication*", 10thEdition, 2014.

Course	Course Name	Teaching Scheme	Credits Assigned

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Code		(Hrs/week)						
		L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
ITL53	**Advanced Database Systems Lab**	Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes		IT43: Database Management System
At the end of the lab students will be able to		
Course Outcomes	ITL53.1	Design Parallel, Distributed and Object Oriented database.
	ITL53.2	Analyze the effect of indexing, query processing and optimization over the database
	ITL53.3	Demonstrate working of Cloud and Multimedia Databases.
	ITL53.4	Design the integration of database schemas using XML technology.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Create an index on a database and Analyze the effect of indexing over the database for different operation on it.	1,2	5
2	Create an Object relational database and query the same.	1,2	5
3	Design a distributed database by applying the concept of fragmentation.	4,5	5
4	Demonstrate the concept of the 2-phase commit protocol.	4,5	5
5	Demonstrate the concept of deadlock in distributed systems.	4,5	5
6	Design an XML schema for the given scenario and query the same.	1,2	5
7	Demonstration of Cloud Database.	6,7	5
8	Demonstration of Multimedia database.	3	5
		Total	**40**

Experiments 1-6 to be done based on the case study and scenario.

Recommended Books:

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, *"Database System Concepts"*, 6[th]Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, *"Fundamentals of Database Systems"*, 5[th]Edition, Pearson Education/Addison Wesley, 2007.
3. Subramaniam, *"Principles of Multimedia Database Systems"*, Morgan Kauffman Publishers, 2008.
4. M. Tamer Ozsu, Patrick Valduriez, *"Principles of Distributed Database Systems"* (Pearson Publication).
5. Saeed K Rahimi, Frank SHaug, *"Distributed Database Management Systems – A Practical Approach"* (Wiley Publication).
6. Carlo Zanalio, StefenoCeri, Christo Faloutsos, V. S. Subrahmanaian, RobortoZicari. Richard T. Snodgrass, *"Advanced Database Systems"*, Morgan Kaufmann Publishers,Inc. San Fransico.
7. Lena Wiese *"Advanced Data Management: For Sql, Nosql, Cloud And Distributed Databases"*, De Gruyter,2015

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL54	Internet Technology Lab	--	1	2	--	1	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	IT45: Web Technology	
At the end of the lab students will be able to		
Course Outcomes	ITL54.1	Demonstrate the use of web engineering concepts such as class diagram, data flow diagram, requirement specification.
	ITL54.2	Create web mashups of REST based web services using AJAX, JSON.
	ITL54.3	Implement security features in web project using JSON Webtokens/ Auth2.0.
	ITL54.4	Test the deployment of web project.

Module No.	Topics	Ref.	Hrs.
1	**Introduction:** Web Engineering, Motivation, Categories of Web Applications, Web Applications Characteristics. Evolution and Need for Web Engineering, Web Engineering Models.	1,5	1
2	**Rich Internet Application:** XML, JSON.	4,7	2
3	**Rich Internet Application:** AJAX, Web mashup.	4	2
4	**Rich Internet Application:** Web service – REST, SOAP.	4	2
5	**Security in web application:** JSON Webtokens, Auth2.0, OAuth.	4,7	2
6	**Introduction to search engine:** Web Crawlers/ spiders, optimizing web sites, black and white practices of SEO.	2,3	2
7	**Web architecture:** MVC.	6,8	1
8	Web server and Website Deployment: Introduction to Web Servers, Configuring web servers case study – Apache Domain registration, Domain hosting, parking websites, uploading data using FTP.	5	2
		Total	**14**

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Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Design a web development project by defining functional requirements class diagram, data flow diagrams.	1,5	5
2	Demonstrate use of REST API using different HTTP methods.	1,5	5
3	Create a a. A web mashup of any existing live web applications using AJAX, JSON. b. A web mashup of your own web services. Create your own web services(such as currency converter, time zone converter, calculator service) and mashup them.	4	5
4	Design a web page implementing security features using JSON Webtokens / Auth2.0 or OAuth.	4,7	5
5	Write a python code to demonstrate the behavior of Web Crawlers/ spiders (use XPATH,CSSPATH),extract information and store it in database.	2,3	5
6	Implement the MVC architecture given in exp 1 to separate frontend, business logic and backend. Demonstrate the use database connectivity along with validation and security using NodeJS framework.	6,8	5
7	Test the Web Application: a. functionality testing b. Performance testing c. Regression testing	5	5
8	Setup a wordpress account on your computer, study the ways to write articles, manage users and data, configure site and deploy the website on a server.	5	5
		Total	40

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Recommended Books:

1. Eric van der Vlist, Danny Ayers, Erik Bruchez, Joe Fawcett, Alessandro Vernet, "*Professional Web 2.0 Programming*", WROX press, February 2011.
2. Eric Enge, Stephan Spencer, Jessie Srricchiola, Rand Fishkin, *"The Art of SEO"*, 2nd Edition, OReilly Publication, 2012.
3. Kristopher B. Jones, "*Search Engine Optimization*", 3rd Edition, Wiley publication, 2012.
4. Dana Moore, Raymond Budd, Edward Benson "*Rich Internet Application AJAX and Beyond*", ISBN: 0470082801, WROX Publisher, 2007.
5. Srinivasan, "*Web Technology*", Pearson, 2012.
6. NodeJS - https://developer.mozilla.org/
7. JSON - http://shop.oreilly.com/produc
8. https://developer.mozilla.org/en-US/Apps/Fundamentals/Modern_web_app_architecture/ MVC_architecture

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITP55	Minor Project - I	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		Phase 1 -20 Phase 2- 20		--		20		60

Pre-requisite Course Codes	--	
At the end of the lab students will be able to		
Course Outcomes	ITP55.1	Identify the requirements for the project.
	ITP55.2	Develop a prototype to confirm technical requirement.
	ITP55.3	Design and implement the project.
	ITP55.4	Test the product.

Minor Project-I is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the study and decisions about it. Minor project is based on small research project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Minor Project-I are:
✓ To make students sensitive towards societal issues
✓ To learn scientific principles from day-to-day experiences
✓ To develop psychotechnological skills through observation, classification, statement of hypothesis etc.
✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
✓ To develop ability to correlate science, technology and society
✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real life challenges

Steps of Minor Research:
✓ Keen observation of the surrounding/society
✓ Identification of the problem
✓ Analysis of the problem
✓ Collection of relevant information by formulating research questions
✓ Suggesting plan of action
✓ Conducting experiments
✓ To draw conclusion
✓ To find the possible solution to rectify the problem
✓ To execute experiments and remedial measures wherever possible

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Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them.

Students must ensure that problem to be manageable in one semester.

Teachers must follow the below mentioned principles:
- ✓ Make student confront problem solving
- ✓ Develop methods and techniques of handling problems. Teach how to use the methods and not directly give solution to the problem.
- ✓ Emphasize positive thinking
- ✓ Lead the students to the peak of their powers for improvement of better learning.

Criteria of a good project:
- ✓ Appropriate idea, clear understanding and proper presentation of the concept
- ✓ Quality of work
- ✓ Project plan and its execution
- ✓ Credibility of the work
- ✓ Probable impact of the work on the attitude of students and society
- ✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation
- ✓ Utility and innovation of the remedial measures
- ✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Minor Project-I may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on
- • Learning additional skills
- • Development of ability to define and design the problem and lead to its accomplishment with proper planning
- • Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

Evaluation:
Project report should be submitted on A-4 size pages. Use both printing. Report must carry project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis ("If I do….then I may get…."), plan, observations, and analysis of results, conclusion and references along with other sections related to technology.

The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. ISE marks will be based on the performance of the individual student in two phases of evaluation. The evaluation of the Phase-I will be based on presentation of the market/environment/context/literature survey, problem formulation, Problem definition and project title finalization. Phase-II evaluation is based on Feasible solutions for the problem, Remedial measures and its demonstration, presentation and technical report.

The ESE marks will be based on demonstration in front of the expert appointed by the Department. In the ESE examination each individual student would be assessed for his/her contribution in selecting the originality of the problem statement, understanding and knowledge gained about the task completed through presentation/demonstration, work done, and preparing the technical report/poster/technical paper of the project in the standard format provided by the department.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MEC1	French Language	2	-	-	2	-	-	2
		Examination Scheme						
		ISE1		ISE2		Attendance		Total
		20		20		10		50

Pre-requisite Course Codes		--
Course Outcomes	CO1 Self introduction	Student will be able to Introduce themselves in a meeting and converse with people from different countries. Speak about themselves, their professions, their family, family names, first names, nationalities, ages. Have a discussion on the whereabouts and identities of people they interact with such as their nationalities, the countries they come from, the languages they speakGreet people and take leave
	CO2 General Topics	Student will be able to Count numbers from 0 to 69 To know how to talk about dates, seasons, time of the day, days of the week and months of the year. Know how to describe a noun using qualitative adjectives. ask price of something
	CO3 Dialogue with professor or any other interlocutor	Student will be able to Communicate in class and understand instructions such as :repeat/answer/listen/look/tick the rightanswer/write/underline/close/how is it pronounced/how is it written/how does one say/work in groups/I don't know/I do not understandrequest for directions using interrogatives like where/who speaks/to whom/whyshare /to give personal information: telephone numbers/ date of birth/ postal address/filling out documents and ability to comprehend the details on important identity papers such as passports or registration forms.
	CO4 Exposure to French Culture Life and Social Norms.	Student will be able to get from the Airport in France to his destination in city. To understand directions. To move around the city understanding road signs, maps. Will be acquainted with French Culture and hence understand their behaviour and communicate appropriately with them.

Module No	Unit No	Topics	Ref	Hrs
1.	1.1	Alphabet		15mins
	1.2	Accents		30 mins
	1.3	Greetings: Good morning/ good afternoon/ good evening/ good night		15 mins
	1.4	Verb conjugation Ētre" (To be)		30 mins
	1.5	Gender : Masculine Feminine		30 mins
2.	2.1	Articles: Definite article:le / la / l'/ les Indefinite article :un/une/des Articles: Definite article:le / la / les		60 mins
	2.1	List of some Masculine and Feminine Nouns		30 mins
	2.2	List of Qualitative Adjectives (Describing big/small/adventurous/timid/pessimist/optimist)		30 mins
3.	3.1	Adjectives of colour and the rules: de quellecouleur?		60 mins
	3.2	Agreement of Number and Gender of the qualifying adjective with the noun		60mins
4.	4.1	3 groups of verbs depending on how they end. Conjugation of Regular "ER"		45 mins
	4.2	List of: commonly used "ER" and "ER" verbs used for student teacher communication.		15 mins
	4.3	Conjugation of "ALLER" which is an Irregular "ER" verb.		60mins
5.	5.1	Conjugation of Reflexive ER verb S'APPELER'		60 mins
	5.2	Conjugation of GER / CER verbs that are tricky		60 mins
6.	6.1	Frequently used expressions (thank you/glad to meet you/ sorry/please)		30 mins
	6.2	Singular and Plural		90 mins
7.	7.1	Nationalities		30 mins
	7.2	Languages		30 mins
	7.3	Days of the week		30 mins
	7.4	Months of the year		30 mins
8.	8.1	Forms of Membership/Admission/Candidature/registration "Formularizedinscription" Hotel Reservation		60 mins
	8.2	Dialogue development from arriving at the Airport to getting to your destination by Metro/RER/Taxi/Bus Directions to move around the city / Metro Maps / Reaching Hotel or Youth Hostel		60 mins

9.	9.1	Theory for the 10 marks Project work. Paris, the capital of 1.Topography/Geography 2.History 3.Transport 4.Political and Financial / 5.Gastronomy 6. Current Affairs 7.Culture –Fashion/Literature/Art/Theatre/Films 8. Trade and Service Industries 9. Tourism and Monuments10. Ecological concerns		120 mins
10.	10.1	Professions		30 mins
	10.2	Family relations		30 mins
	10.3	Number counting: 0 to 69 Cardinal numbers Question: Combien de		60 mins
11	11.1	Possessive adjective: Mon/Ma/Mes Ton/Ta/Tes Son/Sa/Ses Notre/Notre/Nos Votre/Votre/Vos Leur/Leur/Leurs		120 mins
12.	12.1	Verb conjugation "AVOIR" to haveUsed to express age		120 mins
13.	13.1	Verb Conjugation of "FAIRE – to make / to do / to describe weather conditions Comment fait-ilaujourdhui? Quel temps fait-il? Il fait beau / Il fait chaud / Il fait froid / Il fait frais / Il fait du vent		60 mins
	13.2	Seasons: L'été /L'hiver / L'automne /Le printemps		60 mins
14.	14.1	Weather Comment fait-ilaujourdhui? Quel temps fait-il? Il fait beau / Il fait chaud / Il fait froid / Il fait frais / Il fait du vent		60 mins
	14.2	Ordinal Numbers		60 mins
			Total	**28 hours**

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Recommended Books:

1. ALTER EGO – Méthode de Français A1 (PUBLICATION: HACHETTE FRANÇAIS LANGUE ÉTRANGÈRE)
2. Annie Berthet / Catherine Hugot / Véronique M. Kizirian / Beatrix Sampsonis / Monique Waendendries
3. NOUVEAU TAXI: Méthode de Français - HACHETTE
4. GRAMMAIRE PROGRESSIVE DU FRANCAIS – NiveauDébutant- MaïaGrégoire – CLE International
5. OUI, JE PARLE FRANCAIS – 1 Méthode de Français MANAK BOOKS Prochy Master
6. A Revision French Grammar and Composition Book – BLACKBURN AND MORRIS
7. BLACKIE & SON PUBLISHERS PVT. LTD.
8. G. MAUGER – COURS DE LA LANGUE ET DE CIVILISATION FRANÇAISES

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MEC2	German Language	2	-	-	2	-	-	2
		Examination Scheme						
		ISE1		ISE2		Attendance		Total
		20		20		10		50

Pre-requisite Course Codes		---
Course Outcomes	CO1	Student will be able to able to greet the other person, say good bye, introduce oneself and the partner, to be able to talk about the others, to be able to count upto 20, make use of knowledge of numbers as regards understanding telephone numbers, to be able to recognize alphabets, speak about countries and languages
	CO2	Student will be able to speak about hobbies, take leave of someone, name the days of the week, to be able to talk about work, jobs, and office timings, to be able to count beyond 20, to be able to talk about seasons, to be able to register own data on internet site
	CO3	Student will be able to name places and important buildings like the marketplace, to be able to ask questions regarding places, to be able to relate texts to a picture story, ask for things, name the means of public transport, ask for directions
	CO4	Student will be able to identify food items and to talk about them, to be able to write a shopping list, understand conversations in a supermarket, understand W-questions
	CO5	Student will be able to understand time, plan time table as per required time, to be able to speak about family, to excuse oneself for being late, to be able to fix an appointment telephonically
	CO6	Student will be able to plan something together, to be able to speak about birthday, to understand and draft an invitation, to be able to order and pay food items in a restaurant, to be able to talk about routine events, understand event information on radio

Module No.	Topics	Ref.	Hrs.
1	Guten Tag!	1,2	4
2	Freunde, Kollegen und ich	1,2	5
3	In der Stadt	1,2	5
4	GutenAppetit!	1,2	4
5	Tag fuer Tag	1,2	5
6	ZeitmitFreunden	1,2	5
Total			28

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Recommended Books:

1. Netzwerk A1:Authors - Stefanie Dengler, Paul Rausch, Helen Schmitz, Tanja Sieber
2. Studio D A1:Authors - Funk, Kuhn, Demme

ABL3: Creative Thinking, Diversity and Workplace Etiquette

I. Creative Thinking:

Organizations thrive on innovative ideas and new answers to old problems. To become successful not only these approaches be fresh, they must also be sound. This activity shall inspire students to push them for critical thinking and decision making. Students may be asked to provide innovative solutions to specific issues within the organization to meet business needs. Through this activity students shall learn how to step out of their comfort zone, able to isolate problems, recognize differences between left brain and right brain thinking, and apply creative thinking techniques to business problems.

II. Diversity:

Nowadays students are becoming global and degree from an accredited institute is considered as 'Educational Passport' hence it is necessary to include training on diversity. Training on working in a culturally diverse team to prepare students for an international work is required. A better understanding of others can improve communication, encourage engagement, reduce inappropriate behavior and increase the strength of a team. A strategy of inclusion can also help employees realize their full workplace potential. Activities shall be planned for diversity awareness, unconscious bias, generational differences, communicational style pRecommended Books and tactics for managing heterogeneous teams. Igniting thought provoking questions and conversations related to diversity in race, gender, culture, age and other observable differences shall be fundamental to this activity. Activity shall also address cognitive biases which are influences that cause us to make decisions based on information outside of logic and rational thinking for example behavioral partiality and social favoritism.

III. Workplace Etiquette:

Organizations expect that employees are aware of workplace expectations and etiquette. While the use of good business etiquette will not make up for technical knowledge in the workplace but bad manners and poor etiquette can cost both employees and organizations for which they work. This activity shall focus on ins and outs of business etiquette by managing technology and social media effectively. Activity shall be based on Cell phone etiquette, Email etiquette, social media etiquette, board meeting etiquette, sales meeting etiquette, business dressing and dining skills, international manners along with exceptional etiquette like hosting corporate guests, interacting with public or customers and business networking.

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Methodology:

Guest lectures by professionals shall be arranged on Creative Thinking, Diversity and Workplace Etiquette. At least one lecture on each topic shall be taken. Assessment shall be based on performance in following activities:

1. Short Film Making
2. Skit Performance
3. Poster Presentation
4. Project Presentation
5. Physical Model Presentation
6. Scientific Case Study

Semester VI

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
IT61	Distributed Systems	3	-	-	3	--	--	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	IT42: Computer Organization and Architecture IT44: Operating Systems IT52: Computer Networks	
At the end of the course students will be able to		
Course Outcomes	IT61.1	Compare different distributed system architectures.
	IT61.2	Implement message communication techniques.
	IT61.3	Analyze the clock synchronization algorithm and consistency in distributed systems.
	IT61.4	Make use of CORBA components for case study
	IT61.5	Demonstrate the basic concepts of CUDA programs for performance measures.

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	Introduction	1.1	Introduction, Goals, Distributed Computing Models, Software Concepts, Issues in designing Distributed System	1,2,3,5	3
		1.2	Distributed System architectures- Layered, object based, data centered, Event based, multitier and Client Server, Cases Study – world wide web		3
2	Communi-cation in Distributed Systems	2.1	Multi Datagram Messaging, Group Communication	1,2,5	1
		2.2	Remote Procedure Call (RPC): Basic RPC Operations, Parameter Passing, Extended RPC Models, Case Study: SUN RPC		3
		2.3	Remote Object Invocation: Distributed Objects, Binding a Client to an Object, Static Vs Dynamic RMI, Parameter Passing, Case Study: Java RMI		3
		2.4	Message Oriented Communication: Persistence and synchronicity in communication, Message Oriented Transient and Persistent Communications		6

3	**Processes**	**3.1**	Threads, Code Migration: Approaches to Code Migration	1,2	2
		3.2	Migration and Local Resources, Migration in Heterogeneous Systems, Case Study : Viruses and Malware		2
4	**Synchroni-zation, Consistency and Replication**	**4.1**	Clock Synchronization, Physical and Logical Clocks	1,2,3, 5	2
		4.2	Global State, Election Algorithms, Mutual Exclusion, Distributed Transactions		3
		4.3	Deadlocks in Distributed Systems		2
		4.4	Introduction Data-Centric Consistency Models		2
		4.5	Client Centric Consistency Models, Distributed Protocols		2
5	**Distributed Technologies**	**5.1**	Introduction to CORBA, CORBA Components and architecture	1,2	2
		5.2	Method Invocation, Static and Dynamic Invocation in CORBA, CORBA IDL, Developing Application using CORBA		2
6	**CUDA**	**6.1**	Basics of GPGPU	4	1
		6.2	CUDA Programming, CUDA Memory Type and performance issues		3
				Total	**42**

Recommended Books:

1. Tanenbaum A.S. , Van Steen M., *"Distributed Systems: Principles and Paradigms"*, 2nd Edition, Pearson Education, 2007.
2. George Coulouris, Jean Dollimore and Tim Kindberg, *"Distributed Systems Concepts and Design"*, 5th Edition , Pearson Education , 2012.
3. Pradeep K. Sinha ,*"Distributed operating Systems: Concepts and Design"*, Prentice Hall of India, 2007.
4. Shane Cook, *"CUDA Programming: A developer's Guide to parallel computing with CPUs"*.
5. Ajay D. Kshemkalyani and Mukesh Singhal, "Distributed Computing" Cambridge.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
IT62	Data Warehousing and Mining	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	IT43: Database Management Systems
	IT53: Advanced Database Systems

At the end of the course students will be able to

Course Outcomes	IT62.1	Explain the importance of data mining and Data Warehousing.
	IT62.2	Identify the data needed for data mining algorithms in terms of attributes, class inputs, training, validating, and testing files.
	IT62.3	Apply Association mining on large data sets.
	IT62.4	Measure the performance of classification algorithms using metrics.
	IT62.5	Measure the performance of Clustering algorithms using large data sets.

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	Data Warehousing	1.1	Data Warehouse features, Data Warehouse Architecture	2,3	2
		1.2	Data Mart, Data Warehouse Schema, Dimension Modeling		2
		1.3	ETL process, Online Analytical Processing (OLAP), OLTP, Reporting tools		2
2	Introduction to Data Mining	2.1	Kind of patterns to be mined, Types of Attributes; Statistical Description of Data, Data Visualization; Measuring similarity and dissimilarity	1,4	4
3	Data Preprocessing	3.1	Data Preprocessing, Data Cleaning; Data Integration	1,4	2
		3.2	Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling		2
		3.3	Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation		2

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4	**Classification**	4.1	Basic Concepts, Classification methods: Decision Tree Induction, Attribute Selection Measures, Tree pruning. Bayesian Classification: Naïve Baye's Classifier, Support Vector Machine	1,3,4	3
		4.2	Prediction: Structure of regression models; Simple Linear regression, Multiple linear regression. Model Evaluation & Selection: Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap; Comparing Classifier Performance using ROC Curves		2
		4.3	Combining Classifiers: Bagging, Boosting, Random forests		1
5	**Clustering**	5.1	Cluster Analysis: Basic Concepts	1,3	1
		5.2	Partitioning Methods: K-Means, K-Mediods; Hierarchical Methods: Agglomerative, Divisive, BIRCH		3
		5.3	Density-Based Methods: DBSCAN, OPTICS		2
6	**Outlier Analysis**	6.1	Outliers Types, Challenges	1	1
		6.2	Outlier Detection Methods: Supervised, Semi-Supervised, Unsupervised, Proximity based, Clustering Based		1
7	**Frequent Pattern Mining**	7.1	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules	1,3	1
		7.2	The Apriori Algorithm		2
		7.3	The FP Growth algorithm		2
		7.4	Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules		1
8	**Data Mining Applications**	8.1	Data mining for business Applications like Fraud Detection, Click stream Mining, Time Series, Market Segmentation, retail industry, telecommunications industry, banking & finance CRM etc.	1,3	6
				Total	**42**

Recommended Books:

1. Han and Kamber, "*Data Mining Concepts and Techniques*", Morgan Kaufmann, 3rd Edition, 2012.
2. ReemaThareja, "*Data Warehousing*", Oxford Higher Education, 1st Edition, 2009.
3. VikramPudi&Radha Krishna, "*Data Mining*", Oxford Higher Education, 2009.
4. Michael Berry and Gordon Lin off , "*Data Mining Techniques*", 2nd Edition Wiley Publications, 2011.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT63	**Information and Network security**	3	1	-	3	1	--	4
		Examination Scheme						
		Theory Marks						
		ISE		**MSE**		**ESE**		**Total**
		20		20		60		100

Pre-requisite Course Codes	ITL36: Open Source Operating System Lab IT44: Operating Systems IT52: Computer Networks
At the end of the course students will be able to	
Course Outcomes	IT63.1 — Identify cryptographic algorithm to secure information.
	IT63.2 — Interpret concepts of security, authentication and authorization.
	IT63.3 — Illustrate the software security practices.
	IT63.4 — Categorize the attacks in each layer of OSI model.
	IT63.5 — Explain the different ways to secure a web.

Module No.	Module name	Unit No.	Topics	Ref.	Hrs.
1	**Cryptographic Techniques**	**1.1**	Security Goals, Threats and Attack on Information, Classic Cryptography.	1,2	2
		1.2	Symmetric Key Cryptography-DES, AES, Triple DES.	1,2	3
		1.3	Public and Private Key Cryptography – RSA, Diffie-Hellman, Hash Function – MD5, SHA-1, Digital Signature.	1,2	2
2	**Authentication**	**2.1**	Authentication Methods and Protocols, Password based authentication, Token Based Authentication, Biometric Authentication.	3,4	2
		2.2	Digital Certificates, X.509 Directory Services, PKI, Needham Schroeder ,Authentication Protocol, Single sign on, Kerberos, Authentication Protocol, Federated Identity Management.	3,4	4

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3	Access Control	3.1	Access control Policies: DAC, MAC, RBAC, Access control Matrix, ACLs and Capability Lists.	4	2
		3.2	Multiple level security model: Biba and Bell La Padula Models, Multilateral security, Covert channel, CAPTCHA.	4	2
4	Software security	4.1	Software Flaws, Buffer Overflow, Incomplete Mediation, Race conditions.	3	2
		4.2	Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits.	3	2
		4.3	Miscellaneous Software Attacks: Salami attack, Linearization Attacks, Trusted Computing: Software reverse engineering, Digital Rights management.	3	3
5	Network Security	5.1	Network security basics, TCP/IP vulnerabilities Layer wise.	4,5	2
		5.2	Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing, Internet Security Protocols: SSL, TLS, IPSEC, Secure Email and S/MIME, Denial of	4,5	4
		5.3	Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood,	4,5	2
		5.4	Distributed Denial of Service, Defenses against Denial of Service Attacks. Firewalls ,Intrusion Detection Systems: Host Based and Network Based IDS, Honey pots.	4,5	4
6	Web Security	6.1	User Authentication and session management, Cookies, Secure HTTP, SQL Injection Techniques, Cross Site Scripting.	4	3
		6.2	Cross-Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, Web Services Security.	4	3
				Total	**42**

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Recommended Books:

1. Ranjan Bose, *Information Theory, Coding and Cryptography",* 2nd Edition, Tata McGraw Hill, 2008.
2. Trappe and Washington, "Introduction to Cryptogrpahy with Coding theory", Pearson, 2007.
3. Behrouz A. Forouzan , Debdeep Mukhopadhyay "Cryptography and Network Security", McGraw-Hill Education, 2rd edition , July 2010.
4. Mark Stamp, "Information security Principles and Practice", Wiley publication, 2rd edition, November 2011.
5. Eric Cole, "Network security bible", Wiley ,2nd Edition, September 2009.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
ITL61	**Distributed Systems Lab**	**--**	**--**	**2**	**--**	**--**	**1**	**1**
		Examination Scheme						
		ISE		**MSE**		**ESE**		**Total**
		40		**--**		**--**		**40**

Pre-requisite Course Codes	IT42: Computer Organization and Architecture
	IT44: Operating Systems
	IT52: Computer Networks

At the end of the lab students will be able to		
Course Outcomes	ITL61.1	Apply message communication technique and develop the applications.
	ITL61.2	Implement clock synchronization algorithm in distributed system.
	ITL61.3	Develop a application using CORBA.
	ITL61.4	Develop application using MapReduce and performance measure using CUDA.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Design distributed application which consists of a client and server using threads.	1,2	5
2	Design a Distributed application (e.g. chat server) using socket.	1,2	5
3	Write a program for given scenario using RPC.	1,2	5
4	Design and implementation of RMI using JAVA.	1,2,4	5
5	Develop a Distributed Application using MapReduce.	1,2	5
6	Implement Lamport timestamp logical clock and Election Algorithm.	1,2,4	5
7	Develop a component for any real time scenario using CORBA. CORBA Mechanism:- (I) Implementing the Servant Class (II) Creating the Server (III) Implementing the Client	1,2	5
8	Write a program using CUDA.	3	5
		Total	**40**

Experiments 1-7 to be done based on the case study and scenario.

Recommended Books:

1. Tanenbaum A.S. , Van Steen M., *"Distributed Systems: Principles and Paradigms"*, Pearson Education, 2007.
2. Pradeep K. Sinha ,*"Distributed operating Systems: Concepts and Design"*, Prentice Hall of India, 2007.
3. Shane Cook ,*"CUDA Programming: A developer's Guide to parallel computing with CPUs"*.
4. Ajay D. Kshemkalyani and Mukesh Singhal, "Distributed Computing" Cambridge.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL62	Data Warehousing and Mining Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	IT44: Database Management Systems IT53: Advanced Database Systems
At the end of the course students will be able to	
Course Outcomes	ITL62.1	Identify the data needed for data mining algorithms in terms of attributes, class inputs, training, validating, and testing files.
	ITL62.2	Identify a problem having a dataset to do data visualization.
	ITL62.3	Measure the performance of classification algorithmson large data sets by applying metrics.
	ITL62.4	Measure the performance of Clusteringalgorithmsusing large data sets.
	ITL62.5	Analyze Association mining on large data sets.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Identify different Data Mining and Data Warehousing tools.	1	5
2	Choose any Company to understand the business model of the company. Objective of choosing this business is to find following:- i) Stakeholders ii) Revenue generation iii) Kind data generated iv) Tools they use	1	5
3	To implement Data preprocessing using Weka Tool.	2	5
4	To implement Regression using R Tool.	3	5
5	Identify a problem havinglarge Dataset and useit to visualize the result.	2,3,4	5
6	To implement classifier- Decision Tree, Naïve Bayes, Random Forest, Support Vector Machine using Weka Tool and Java/Python.	2,4	5

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7	To implement Clustering Algorithms- K-Means using Weka Tool and Java/Python.	2,4	5
8	To implement Association Mining Algorithm (Apriori, F-P Growth) in Weka and Java/Python.	2,4	5
		Total	**40**

Recommended Books:

1. P. N. Tan, M. Steinbach, Vipin Kumar, "*Introduction to Data Mining*", Pearson Education, 1st Edition, 2005.
2. A.B.M. Shawakat Ali, Saleh A. Wasimi, "*Data Mining: Methods and Techniques*", CENGAGE Learning, 2007.
3. Yanchang Zhao, "*R and Data Mining: Examples and Case Studies*", 1stEdition, Elsevier, 2013.
4. Robert Layton, "*Learning Data Mining with Python*", 1stEdition, Packt Publishing Ltd, 2015.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL63	Information and Network security Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ITL36: Open Source Operating System Lab
	ITL44: Operating Systems
	ITL52: Computer Networks

At the end of the lab students will be able to

Course Outcomes	ITL63.1	Interpret the concepts of security.
	ITL63.2	Illustrate the network vulnerability scanning process.
	ITL63.3	Demonstrate the different attacks involved in a network.
	ITL63.4	Illustrate attacks involved in web security.
	ITL63.5	Use digital forensics method to recover the deleted data.

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Foot printing a target network.	1,5,7	5
2	Scanning a network using: A. Nmap Network Mapper B. Nessus vulnerability scanner	1,5,7	5
3	Exploit Windows vulnerability to get unauthorized access.	1,5,4,7	5
4	Exploiting Client side vulnerabilities and establishing a VNC session.	1,5,7	5
5	Performing Man -in-the-Middle Attack using Wireshark & Etercap.	5,7	5
6	A. Creating a Trojan using Social-Engineer Toolkit. B. Implementing DoS attack.	5,7,2,3	5
7	Performing SQL injection. A. Manual SQL Injection, John the Ripper. B. Automate SQL Injection with Sql Map.	6	5
8	Digital forensics method to clone and recover the deleted data.	5	5
		Total	40

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Recommended Books:

1. William Stallings, *"Computer Security Principles and Practice",* Pearson Education, 3rd edition, July 2014.
2. Charles P. Pfleege, Shari Lawrence Pfleeger Jonathan Margulies*,"Security in Computing",* Prentice Hall; 5th edition, January 2015.
3. Dieter Gollman , *"Computer Security",* Wiley India ,3rd Edition, , February 2011
4. Behrouz A. Forouzan , Debdeep Mukhopadhyay *"Cryptography and Network Security",* McGraw-Hill Education, 2rd edition , July 2010.
5. Mark Stamp, *"Information security Principles and Practice",* Wiley publication, 2rd edition, November 2011.
6. OWASP TOP 10 :
   https://www.owasp.org/images/b/b0/OWASP_Top_10_2017_RC2_Final.pdf
7. Eric Cole, *"Network security bible",* Wiley ,2nd Edition, September 2009.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL64	Machine Learning Lab	--	1	2	--	--	2	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	IT53: Advanced Database Systems
	BS41: Applied Mathematics-II

At the end of the lab students will be able to		
Course Outcomes	ITL64.1	Apply Dimensionality reduction techniques to a given problem
	ITL64.2	Apply regression techniques on a large data set
	ITL64.3	Apply neural networks to solve pattern classification problems
	ITL64.4	Solve optimization problems using genetic algorithms.
	ITL64.5	Apply appropriate ML technique on a given domain

Module No.	Section	Topics	Ref.	Hrs.
1	1.1	Introduction to Machine Learning: Types of Machine Learning, Issues in Machine Learning, Applications of Machine Learning, How to choose Right Algorithm? Dimensionality Reduction: Dimensionality Reduction Techniques, Principal Component Analysis, Independent Component Analysis	2,4	02
2	2.1	Regression: Logistic Regression, Polynomial Regression, Time Series, autocorrelation	4	02
3	3.1	Introduction to neural networks:Supervised Learning algorithms, Perceptron (Single Layer, Multilayer), Linear separability, Back Propagation algorithm	3	02
	3.2	Unsupervised Learning Algorithms: Winner - take-all	3	02
4	4.1	Genetic Algorithms and its applications: Inheritance Operators, Cross-over types, Inversion and Deletion, Mutation Operator, Bit-wise Operators,Convergence of GA, Applications of GA.	5,6	03
5	5.1	Exploration of areas: Web mining, Text mining, Link Analysis, security, Image Analysis etc.	2,4	03
		Total		**14**

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List of Experiments:

Exp. No.	Experiment	Ref.	Marks
1	To implement PCA, t-SNE on a given data set.	2,4	05
2	To implement Regression on a large data set.	4	05
3	To implement Perceptron Learning on a problem.	3	05
4	To implement Supervised Learning algorithm: Backpropagation on standard data set e.g. Iris	3	05
5	To implement Unsupervised Learning algorithm: Winner-take-all algorithm.	3	05
6	Use time series data set for forecasting future trends.	7	05
7	Use Genetic Algorithms for a given scenario.	5,6	05
8	Choose an appropriate dataset and an algorithm to solve a problem of any of the domains as web mining, text mining, etc.	2,4	05
	Total Marks		**40**

Recommended Books:

1. Jacek M.Zurada,"Introduction to Artificial Neural Systems", Jaico Publishing House, 2005.
2. EthemAlpaydın, "Introduction to Machine Learning", MIT Press, 2010.
3. S.N. Sivanandam and S. N.Deepa, "Principles of Soft Computing", 2nd edition, Wiley India, 2007.
4. Sarah Guido, Andreas Müller, "Introduction to Machine Learning with Python-A Guide for Data Scientists", O'Reilly Media, October 2016.
5. Sivanandam, S.N., Deepa, S. N., "Introduction to Genetic Algorithms", Springer, 2008.
6. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", 1989.
7. Dr. PKS Prakash, "Practical Time Series Analysis", Packt, 2017.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
ITP65	Minor Project - II	Examination Scheme						
		ISE		MSE		ESE		Total
		Phase 1 -20 Phase 2- 20		--		20		60

Pre-requisite Course Codes	ITP55: Mini Project 1	
At the end of the lab students will be able to		
Course Outcomes	ITP65.1	Identify the problem that exists in the system.
	ITP65.2	List the requirements.
	ITP65.3	Select one from alternate solution.
	ITP65.4	Write survey paper.

ISE:
The main intention of Minor Project is to apply the software engineering principles and practices to solve social issues. Rigurous requirement gathering is done and documented. Hence the preliminary study of the final year project is done here.

Minor Project contains:-
1) Problem identification and analysis
2) Requirement gathering
3) Feasibility study
4) Alternate solution
5) Selection of technologies and tools
6) Prototype design
7) Architectural diagram

Evaluation:
The team will be maximum of 3 students. Project report should be submitted on A-4 size pages. Use both printing. Report must carry project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis ("If I do….then I may get…."), plan, observations, and analysis of results, conclusion and references along with other sections related to technology.
The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. ISE marks will be based on the performance of the individual student in two phases of evaluation. The evaluation of the Phase-I will be based on presentation of the market/environment/context/literature survey, problem formulation, Problem definition and project title finalization. Phase-II evaluation is

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based on Feasible solutions for the problem, Remedial measures and its demonstration, presentation and technical report.

The ESE marks will be based on demonstration in front of the expert appointed by the Department. In the ESE examination each individual student would be assessed for his/her contribution in selecting the originality of the problem statement, understanding and knowledge gained about the task completed through presentation/demonstration, work done, and preparing the technical report/poster/technical paper of the project in the standard format provided by the department.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	2	--	2	1	--	3
HSS61	**Advance Communicative English**	**Examination Scheme**						
		ISE*		MSE		ESE		Total
		100		--		--		100

* ISE will be evaluated on the basis of marks scored in tutorials, out of 100.

Pre-requisite Course Codes		The learners will be able to
Course Outcomes	CO1	Acquire skills for succeeding in job placements and ompetitive exams
	CO2	Encourage reading and evaluating critically
	CO3	Develop proficiency in the use of spoken and written communication for professional purposes
	CO4	Communicate using social media

Module No.	Unit No.	Topics	Ref.	Hrs.
1 **Placement Skills**	1.1	Verbal Ability skills for competitive exam		3
	1.2	Resume Writing& Cover Letter		2
	1.3	Group Discussions		3
	1.4	Team Building skills / Work		2
	1.5	Case studies / pitching a startup		2
	1.6	Interview skills		2
2 **Critical Thinking Skills**	2.1	Understanding news coverage and critical analysis of the same		2
	2.2	Critical Writing Skills – Argumentative Writing		2
3 **Communication through social media**	3.1	Sourcing information through digital media		2
	3.2	Oral and written communication using social media. Vlog and Blog		4
	3.3	Corporate communication using social media like messenger applications, etc.		2
			TOTAL	**26**

Tutorial No.	Tutorial Details	Ref.	Marks
1	Aptitude Test – Verbal Ability		10
2	Resume Writing		10
3	Cover Letter		10
4	Group Discussion		20
5	Presentation		20
6	Mock Interview		10
7	Social media writing		20
	TOTAL MARKS		**100**

Reference Books:

1. Michael McCarthy and Felicity O'Dell. *English Vocabulary in Use.* India: Cambridge University Press, 1999.
2. John Eastwood. *Oxford Practice Grammar.* India: Oxford, 1999.
3. Geoffrey Leech, Et al. *English Grammar for Today.* UK: Palgrave, 2005.
4. Malhotra, Ankur. *Campus Placement: A comprehensive guide.* McGraw Hill Education, 2016
5. Hayes, John. *Interpersonal Skills at Work.* McGraw Hill Education, 2002
6. Alda, Alan. *If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating.* Random House. 2017
7. West, Steven. *Critical Thinking Skills: Practical Strategies for Better Decision making, Problem-Solving and Goal Setting.*
8. Isaac, William. *Dialogue: The art of thinking together.* Crown Business. 2008
9. Chambers, Harry. *Effective Communication Skills for Scientific and Technical Professionals Paperback.* Basic Books. 2000
10. Hamper, Robert J. & Baugh, L. Sue. *Handbook for writing proposals.* McGraw-Hill Education. 2010.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE1	Consumer Electronics	1	--	2	1	--	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes	ES1: Basic Electrical and Electronics Engineering	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	List and classify devices used in consumer products based on their specifications, identify sub-systems of consumer electronic products,also choose and use proper interface standard for a given consumer electronic product
	CO2	Illustrate working principle of consumer electronic products and carry out basic tests to identify their correct operation.
	CO3	Experiment with Haptics, Multitouch devices, Device interconnects and peripherals and also suggest modification in consumer electronic product using modern tools to enhance user experience
	CO4	Assemble subsystem of Television set and analyze technology used in audio systems.
	CO5	Demonstrate working principal of Healthcare and home electronics consumer products.
	CO6	Demonstrate working principal consumer electronic products used in Occupational safety.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**1**	**Introduction to consumer Electronic.**	4	02
	1.1	Haptics and Multi-touch Devices: Introduction to Touch panel, Capacitive Touch screen, Light pen.		
	1.2	Displays for Consumer Electronics: OLED Display, Alphanumeric Display, LED Display, LCD Display.		
	1.3	Miscellaneous Devices: Mice, Trackballs, Virtual Reality.		
	1.4	Gaming Devices; Joystick.		
2	**2**	**Device Interconnects and Peripherals.**	3	02
	2.1	Introduction to Serial Interfaces, RS-232, I2C, SPI, USB.		
	2.2	Introduction to ZIG-BEE Standards, WI-FI, Bluetooth, Thunderbolt, JTAG and various Interconnection standards.		

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3	3	**Interactive and Immersive TV.**	1	02
	3.1	Introduction to Television, PAL TV System, NTSC TV System, SECAM TV System.		
	3.2	Advanced Television System: 3D TV, High Definition TV, Digital Satellite TV, 4K TV, Plasma Displays.		
4	4	**Audio System Technologies and Home electronics.**	1	02
	4.1	Introduction to Audio system and major components of Audio System, Microphone, Loudspeaker, HI-FI, Stereophony, Public Address System, Noise Cancelling Headphones.		
	4.2	Introduction to Home Electronics, Microwave Oven, Refrigerator, Air Conditioning System, Washing Machine.		
5	**5**	**Healthcare Electronics.**	6	02
	5.1	Wearable Devices: Activity Trackers Smart Watch, Smart Glass.		
	5.2	Fitness Devices: Blood Pressure Monitor, Digital Weighing Scale, Digital Glucometer.		
	5.3	Biomedical Devices: ECG Sensor, EKG Sensor, EMG Sensor, Respirators.		
6	6	**Consumer Electronics used in Occupational Safety.**	2	02
	6.1	Printers, Scanners, Projection System.		
	6.2	Bio-metric Devices: Finger Print Scanner, IRIS Scanner.		
	6.3	Security Devices: CCTV, Electronics Lock, Video Intercom System, Door bell.		
7	7	**New and Emerging Technologies.**	5	02
	7.1	E-platforms for Selecting Consumer Electronics.		
	7.2	E-payments.		
			Total	**14**

Teaching Learning Methodology in Laboratory: Role Play Model

a) **Instructor:**
   Responsibilities: Explanation of theoretical background
                        To provide required sample formats
                        To guide students in identification of appropriate online material.
                        Supervision and assessment of the overall activity

b) **First Group of students : Customer**
   Responsibilities: To finalize specifications of instrument to be purchased
                        Prepare request for quotations
                        Prepare the comparative statement
                        Preparation for purchase order

c) **Second Group of students: Manufacturer/Vendor**
   Responsibilities: To maintain the specifications of the manufactured instruments
                        To submit quotations including all applicable taxes

To prepare Invoice as per purchase order

d) Third Group of Students: Sales/Service Engineer

Responsibilities: To demonstrate capabilities of various instruments and convince customer to purchase a particular instrument

To prepare Delivery Challan

Install the instruments and prepare Installation Report,

Demonstrate all the functions and uses of the instrument

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Experiment on Haptics and Multi-touch devices.	4	5
2	Experiment on Device interconnects and Peripherals (USB and Bluetooth).	3	5
3	Experiment on assembly of parts used in Television set.	1	5
4	Experiment on Audio system technology.	1	5
5	Experiment on Home electronics Consumer products.	2	5
6	Experiment on Wearable and fitness devices.	6	5
7	Experiment on Biomedical data acquisition devices.	5	5
8	Experiment on occupational safety in electronic devices.	2	5
		Assessment Marks	**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:
1. S. P. Bali, "Consumer Electronics", Pearson Education, 1st Edition, 2005.
2. Peter H. Gregory, "*Biometrics for Dummies*", Wiley Publishing Inc., 2008.
3. N. Mathivanan, "*PC Based Instrumentation: Concepts and Practices*", Prentice Hall Learning India Pvt. Ltd., 1st Edition, 2007.
4. Deborah Morley, "*Understanding Computers: Today and Tomorrow*", Course Technology, 16th Edition, 2016.
5. N. Jilovec, "*E-Business: Thriving in Electronics Marketplace*", 29th Street Press, 1st Edition, 2000.
6. Sanjay Mishra, "Wearable Android: Android Wear and Google FIT App Development", Wiley Blackwell publication, 1st Edition, 2015.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE2	Robotic Vision	1	--	2	1	--	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes	EL42: Principle of Control Systems	
At the end of the course students will be able to		
Course Outcomes	CO1	Discuss the fundamentals of Robotics
	CO2	Apply direct and inverse kinematics algorithms
	CO3	Justify the need of vision algorithms

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**1**	**Fundamentals of Robotics**		4
	1.1	Robot Classification, Robot Components, Degrees of freedom, Joints, Coordinates, Coordinate frames		
	1.2	Transformation matrix, inverse Transformation matrix,		
	1.3	Screw Transformation, Link co-ordinates		
2	**2**	Forward and Inverse kinematic equation, D-H Representation		4
	2.1	The Arm Matrix		
3	**3**	**Introduction to Robot Vision**		3
	3.1	Image Representation, Edge Detection		
	3.2	3D image to 2D image Transformation		
	3.3	Stereo Vision		
4	**4**	Edge Detection , Template Matching,		3
	4.1	Object detection and recognition		
	4.2	Object Classification		
		Total		14

Expt. No.	Suggested List of Experiments	Ref.	Marks
1	Identify the types of robot based on configuration and application.	1,2	5
2	Using the information based on length of links and no. of joints, specified angles verify the DH algorithm for forward kinematics and also to determine the maximum and minimum position of links.	1,2	5
3	Design a robots drive system and its end effectors for a given application.	1,2,3	5

4	Verify the transformation (Position and orientation) with respect to gripper and the coordinate system using any simulation software.	1,2	5
5	Estimation of accuracy, repeatability and resolution of a given robotic manipulator.	1,2	5
6	Robot programming exercises (Point-to-point and continuous path programming)	1,2,3	5
7	Edge detection		4
8	Object Detection		4
9	Object recognition using Template Matching		4
10	Vision based Application development		4
	Eight Experiments Total Marks		40

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:

1. Robert Shilling, Fundamentals of Robotics - Analysis and control, Prentice Hall of IndiaFourth edition [ISBN-81-203-1047-0]
2. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E.
3. Mittal R.K. & J. Nagrath, "Robotics and Control",TataMcGraw Hill, 2003 [ISBN 0-07-048293-4]
4. Milan Sonka, Vaclav Hlavac and Roger Boyle,"Image Processing, Analysis and Machine Vision", Second Edition, Thomson Brooks/Cole 2004[ISBN: 981-240-061-3]

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE3	Cyber security and Digital Forensics	1	-	2	1	-	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes		Computer Basics, Networking basics
Course Outcomes	CO1	Identify and classify various cybercrimes with respect to organizational weaknesses in order to mitigate the security risk and estimate the impact on society and world
	CO2	Analyze the results of vulnerability scans of vulnerability assessment and generate report with penetration testing
	CO3	Apply Information Security Standards compliance during software design and development
	CO4	Interpret and apply Indian IT laws in various legal issues
	CO5	Describe the concept of Digital forensics and use various tools and techniques used for digital forensics investigations
	CO6	Integrate advanced security solutions and manage, provide policies, standards, procedures, guidelines, policy framework, assess and mitigate risk

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Cyber Security**	1,2	1
	1.2	Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime,	1,2	1
	1.3	Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	1,2	1
2	2.1	**Cyber offenses & Cybercrimes:** How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector,Credit Card Frauds in Mobile and Wireless Computing Era, Security,Challenges Posed by Mobile Devices	1,2	1
	2.2	Tools and Methods Used in Cybercrime: Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks,Identity Theft (ID Theft)	1.2	1

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3	3.1	**Security Risk Assessment and Risk Analysis:** Risk Terminology, Laws, Mandates, and Regulations,Risk Assessment Best Practices,The Goals and Objectives of a Risk Assessment, Best Practices for Quantitative and Qualitative Risk Assessment.	7,8, 10	1
	3.2	**Vulnerability Assessment and Penetration Testing (VAPT):** VAPT An Overview,Goals and Objectives of a Risk and Vulnerability Assessment,	7,8, 10	1
	3.3	Vulnerability Assessment Phases-Discovery,Exploitation/Analysis , Reporting Penetration Testing Phases-Discover/Map,Penetrate Perimeter,Attack Resources, Network and Web VAPT Process	7.8, 10	1
4	4.1	**Cyber Security Laws and Legal Perspectives**	1,2, 4,6	1
	4.2	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	1,2, 4,6	1
	4.3	Information Security Standard compliances: SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI-DSS	1,2, 4,6	1
5	5.1	**Digital Forensics:** Need for forensics, Cyberforensics and Digital Evidence	1,2	1
	5.2	Digital Forensics Life cycle, Computer forensics investigation, setting-up forensics laboratory, Special Tools and Techniques, Forensics Auditing and Compliance Requirements,Antiforensics	1,2	1
	5.3	Forensics of Hand-held devices,Tool-kits for Hand-held device forensics,Techno-Legal Challenges with Evidence from Hand-held Devices	1,2	1
		Total		**14**

Teaching Learning Methodology in Laboratory: Role Play Model

a) Instructor:
Responsibilities: Explanation of theoretical background
To provide required course material
To guide students in identification of appropriate online material.
Supervision and assessment of the overall activity
b) First Group of students: Offensive and Defensive
Responsibilities: To define cybercrime and classification of cybercrimes
List the tools and methods used in cybercrimes
Prepare the list best cybersecurity practices

c) Second Group of students: Vulnerability Assessor and Penetration Tester (VAPT)
Responsibilities: To assess the vulnerabilities of systems (OS,Network infrastructure etc)
To carry out penetration testing and reporting
To abide by regulatory compliance and security standards

d) Third Group of Students: Forensic Investigator (FI)
Responsibilities: To setup laboratory for forensics
To use tools and techniques of digital forensics
To preserve the evidence
Demonstrate the forensic investigation process

Exp. No	Suggested List of Experiments	Refer.	Marks
1	Network commands and utilities	13,15	5
2	Install and configure Virtual Environment	14	5
3	Information Gathering,Sniffing and scanning	13,15	5
4	Vulnerability Scanning and Vulnerability Assessment	13,15	5
5	Penetration Testing using Metasploit	16	5
6	Firewalls and Intrusion Detection System (IDS)	13	5
7	Encryption Tools	13	5
8	Forensics Tools and Utilities	13	5
		Assessment Marks	**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi.
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, NewDelhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, Information Systems Security, Wiley India, New Delhi
6. Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
7. Michael Gregg & David Kim,Inside Network Security Assessment: Guarding Your IT Infrastructure, Pearson Publication
8. M. L. Srinivasan, CISSP in 21 Days - Second Edition PACT Publication
9. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Publication

10. Douglas J. Landoll, The Security Risk,Assessment Handbook-Second Edition ,Auerbach Publications
11. Websites for more information is available on : The Information Technology ACT, 2008-TIFR : https://www.tifrh.res.in
12. https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538
13. Open Source Security Tools: A Practical Guide to Security Applications by Tony Howlett, Pearson Education
14. https://www.virtualbox.org
15. Hands-On Information Security Lab Manual by Michael Whitman, Cengage publication
16. https://www.offensive-security.com/metasploit-unleashed/

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE4	Internet of Things	1	-	2	1	-	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes		
Course Outcomes	CO1	Describe IoT value chain structure (device, data cloud), application areas, IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules.
	CO2	Describe the Architectural Overview of IoT, Reference Architecture and Real World Design Constraints and various IoT Protocols (Datalink, Network, Transport, Session, Service)
	CO3	Apply the concepts of big data analytics, Internet of things and implement smart systems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1[CO1]	1.1	**Internet of Things:** Internet of Things Promises–Definition–Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device.	1,2,3	1
	1.2	**Seven Generations of IoT sensors to Appear**:Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–IoT Generation Roadmap.	1,2,3	1
	1.3	**Technological Analysis:** Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module. IoT Development Examples: ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks - Focus on Wearable Electronics	1,2,3	2
2[CO2]	2.1	**IoT Architecture and Protocols:** IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals-Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.	5,6,8	2

	2.2	**IoT Data Link Layer & Network layer Protocols:** PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.	7,8	1
	2.3	**Transport & Session Layer Protocols:**Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT	7,8	2
	2.4	**Service Layer protocols & Security:** Service Layer - oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.	7,8	1
3[CO3]	3.1	Data Analytics for IoT Introduction	8,9	1
	3.2	**Apache Hadoop** MapReduce Programming Model Hadoop MapReduce Job Execution MapReduce Job Execution Workflow Hadoop Cluster Setup **Using Hadoop MapReduce for Batch Data Analysis** Hadoop YARN **Apache Spark** **Using Apache Storm for Real-time Data Analysis** REST-based approach WebSocket-based approach **Structural Health Monitoring Case Study**	8,9	3
Total				**14**

Recommended Books:

[1] Editors Ovidiu Vermesan Peter Friess,'Internet of Things – From Research and Innovation to Market.

[2] N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

[3] Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights ,2014

[4] Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014

[5] Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

[6] Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

[7] Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications

[8] Arshdeep Bahga and Vijay Madisetti Internet of Things: A Hands-on Approach
[9] Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.

Instructional Method and Pedagogy: At the start of course, the course delivery pattern, prerequisite of the subject will be discussed. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc. Attendance is compulsory in lecture and laboratory which carries 40 marks in overall evaluation. One internal exam will be conducted as a part of internal theory evaluation. Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation. Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of 10 marks in the overall internal evaluation. The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures. Experiments shall be performed in the laboratory related to course contents.

Exp. No	Experiment Details	Ref	Marks
1	Introduction to DHT11 Temperature and Humidity measurement, Ultrasonic Sensor,PIR Motion sensor. Introduction to Actuators (DC Motor, Servo Motor and Relay). Introduction to Bluetooth Technology.	1,2, 3,4	5
2	Outdoor Temperature & Humidity Monitoring using DHT11. Motion Detection using PIR sensor. Distance Measurement using Ultrasonic Sensor. Practical with Servo Motor and Relay. Interfacing HC-05 Bluetooth Device with Arduino,Raspberry Development Board.. Home automation using Voice Commands & Bluetooth.	1,2, 3,4	5
3	Introduction to NodeMCU (ESP8266-12E). Introduction to NodeMCU firmware. NodeMCU as Server and Client. NodeMCU as an Access Point. Mobile Communication using Sim800 (GSM/GPRS Module) Introduction to various Notification Servers.	1,2, 3,4	5
4	Control of equipment using ESP8266+NODE MCU Webserver. Automatic Phone/Email Notification based on Event trigger using IFTTT. NodeMCU as an Access Point. Mobile Weather Station using NodeMCU. Home automation using Sim 800 using Mobile Communication.	1,2, 3,4	5
5	Introduction to IOT Cloud Platforms and API TCP /IP/HTTP Protocol Client and Server Communication. Introduction Smart Bridge, ThingSpeak, Google Firebase IOT Cloud .	1,2, 3,4	5

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	Uploading sensor data to Cloud using API's. Data Visualization, Data Analytics, Plugins, Import & Export Sending and Receiving Data from IOT Cloud using ESP8266 Introduction to MIT App Inventor.		
6	Sending and Receiving Data from IOT Cloud using ESP8266 Uploading Temperature & Humidity data to ThingSpeak Cloud & Ubidots cloud using wifi.Building Mobile Application using MIT App Inventor.	1,2, 3,4	5
7	Prototyping and Building. Use cases: Smart City Smart Water Smart Environment Smart Health (Remote) Smart Waste Management Smart Agriculture Smart Safety Smart Supply Chain & Logistics Smart Manufacturing / Industrial Iot	1,2, 3,4	5
8	Prototyping and Building. Use cases: Smart City Smart Water Smart Environment Smart Health (Remote) Smart Waste Management Smart Agriculture Smart Safety Smart Supply Chain & Logistics Smart Manufacturing / Industrial Iot	1,2, 3,4	5
Assessment Marks			**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

References:
1.Raspberry Pi IoT Projects: Prototyping Experiments for Makers by John C. Shovic.
2.Internet of Things with ESP8266 by Marco Schwartz
3.IoT: Building Arduino-Based Projects by Brian Russell, Peter Waher, and Pradeeka Seneviratne.
4. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE5	**Fundamentals of Computational Intelligence**	**1**	**--**	**2**	**1**	**--**	**1**	**2**
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Course Overview (Theory):
This open elective course is designed to introduce the concepts of computational intelligence and its application. It is structured to give students an overview of three fundamental topics which form the basis of Computational Intelligence: neural networks, fuzzy logic, natural language processing, and statistics. Students will be able to understand the working of different types of models according to different types of training. Fuzzy logic is included to enable students to design their own fuzzy control systems using all the various concepts taught. They will also learn about the basics and steps involved in Natural Language Processing which can be employed in most applications. To learn about which method fits their data set best, they will be introduced to the application of statistics to computational intelligence. Thus this open elective is focus on inspiration, design, theory, and practical aspects of implementing procedures to solve real-world problems.

The concepts taught in the theory must be implemented in the form of various problem statements in the practical. There will be four experiments based on supervised learning, CNN, Fuzzy controllers and model-fit calculation techniques. Emphasis is given to the mini-project which carries a high weightage. Students are required to implement most of the concepts learned throughout the practical in the mini-project by selecting a suitable problem statement. The mini-project will be graded at two stages. Special emphasis is given to the mini-project at the end of the practical sessions which will be based on computational intelligence.

Pre-requisite Course Codes	Mathematics, Probability ,Programming languages - Java/C++	
Course Outcomes	CO1	Identify suitability of different learning types for different scenarios.
	CO2	To study Neural Networks and Convolutional Neural Networks
	CO3	To design fuzzy controllers for various applications.
	CO4	To study Natural Language Processing
	CO5	To apply computational intelligence technique to solve real world problems.

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Module No.	Unit No.	Topics	Ref.	Hrs.
1	1	**Introduction to Computational Intelligence** : Concepts	1,6	0.5
2	2	**Basics of Artificial Neural Networks and Convolutional Neural Networks**	1,2,7,8	2.5
	2.1	Short History of Neural Networks, Rosenblatt's Neuron, Types of Learning (Supervised, Unsupervised, Reinforcement), Activation Functions.		
	2.2	Basic terminologies and architecture of ANN		
	2.3	Basic architecture of CNN		
3	3	**Fuzzy Controllers**	1,2,3,7,8	04
	3.1	Crisp Logic, Fuzzy logic, Fuzzy Membership functions and operators		
	3.2	Fuzzy Inference System and its types, Fuzzification, Defuzzification, Designing Fuzzy logic control systems.		
4	4	**Basics of Natural Language Processing**	4	
	4.1	Basic terminologies and steps involved in NLP		
	4.2	Applications of NLP		
5	5	**Statistics in Computational Intelligence**	5	03
	5.1	Calculation of standard deviation, root mean square, mean absolute error etc for measuring the fitness of a model		
			Total	**14**

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Experiment on Supervised Learning (Back Propagation Neural Network)	1,2,7,8	5
2	Experiment on studying different CNN architectures	1,2	5
3	Experiment on designing a Fuzzy Controller	2,3,6,7,8	5
4	Experiment on measuring fit and error parameters for a model	5	5
5	Mini project	Online Recommended Books	20
		Assessment Marks	**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

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Recommended Books:

1. Russell Eberhart and Yuhui Shi - Computational Intelligence: Concepts to Implementations (2007).
2. FakhreddineKarray and Clarence de Silva - Soft Computing and Intelligent Systems Design (2004)
3. AndriesEngelbrecht - Computational Intelligence: an Introduction (2007)
4. Ela Kumar - Natural Language Processing (2013)
5. Peter Bruce and Andrew Bruce - Practical Statistics for Data Scientists (2017).
6. James M. Keller, Derong Liu, David B. Fogel, Fundamentals of Computational Intelligence: NeuralNetworks, Fuzzy Systems, and Evolutionary Computation, IEEE Press series on Computational Intelligence,Wiley Publication, July 2016.
7. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
8. Samir Roy and Chakraborty, "Introduction to soft computing", Pearson Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE6	**Fundamentals of Data Structures and Algorithms**	1	--	2	1	--	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes	ES4: Programming Methodology and Data Structures

After successful completion of the course student will be able to

Course Outcomes	CO1	Implement various operations of nonlinear data structures.
	CO2	Apply the concepts of Trees to a given problem.
	CO3	Analyze time and space complexity of an algorithm
	CO4	Apply divide and conquer strategy to solve problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Data Structures** Introduction, Review of Stack, Queue and Linked List.	1,2	01
2	2.1	**Searching And sorting:** Searching : Linear Search, Binary Search. Sorting: Insertion sort, Merge sort.	1,2	03
3	3.1	**Introduction to Algorithms** Algorithm development, Performance analysis, space and time complexity.	3,4	02
4	4.1	**Growth of function** Big –Oh ,Omega , Theta notation Analysis of insertion sort.	3,4	03
5	5.1	**Divide and Conquer Approach** Analysis of Merge sort	3,4	01
6	6.1	**Binary Trees** Representation, Binary Search Tree and its operations, Binary Tree Traversal, AVL Tree, B-tree	1,2	04
			Total	**14**

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Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Implementation of Linked List for a given scenario.	1,2	5
2	Implementation of Binary Search for a given scenario.	1,2	5
3	Implementation of Merge Sort for a given scenario.	1,2,3	5
4	Implementation of Tree Traversal for a given scenario.	1,2	5
5	Develop an application to explore the uses of an AVL tree	1,2	5
6	Develop Search application using B-Tree.	1,2	5
7	Sorting of 2 lacs elements using Insertion and Merge sort and do the analysis of algorithms.	3,4	10
	Total Marks		40

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:

1. Data Structures APsedocode Approach with C, Richard F. Gilberg&Behrouz A. Forouzan, second edition, CENGAGE Learning.
2. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson.
3. Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, Massachusetts, 2009.
4. Horowitz E, Sahni S andS.Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Galgotia Publications, New Delhi, 2010

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE7	Software Testing	1	--	2	1	--	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes		---
At the end of the lab students will be able to		
Course Outcomes	OE7.1	Analyze the principles in software testing to prevent & remove bugs.
	OE7.2	Design effective test cases suitable in testing.
	OE7.3	Describe the variety of ways to test software and indicate the trade-offs between various testing techniques.
	OE7.4	Implement various test cases.
	OE7.5	Apply the software testing techniques in commercial environments.
	OE7.6	Able to use software testing methods and modern software testing tools for their testing projects.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Software Testing**	2	2
	1.1	Software Quality		
	1.2	Verification and Validation		
	1.3	Failure, Error, Fault and Defect		
	1.4	Test Case		
	1.5	Test levels		
	1.6	Software Testing Life Cycle		
2.		**Black-Box Testing**	1	4
	2.1	Boundary Value Analysis		
	2.2	Equivalence class testing		
	2.3	State table based testing		
	2.4	Cause-effect graphing based testing		
	2.5	Error guessing		

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3.	**White Box Testing**		1	4
3.1	Need of White box Testing			
3.2	Logic coverage criteria			
3.3	Basis path testing			
3.4	Graph matrices			
3.5	Loop testing			
3.6	Data flow testing			
3.7	Mutation testing			
4.	**LEVELS OF TESTING**		3	4
4.1	Unit testing			
4.2	Integration Testing			
4.3	System Testing			
4.4	Acceptance testing			
4.5	Performance testing			
4.6	Regression Testing			
4.7	Ad-hoc testing, Alpha, Beta Tests			
			Total	**14**

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Write the test cases for any known application.	1	5
2	Create a test plan document for any application.	1	5
3	Design Test case using boundary value analysis.	1	5
4	Design a test cases using equivalent class partitioning.	1	5
5	Study of testing tool, Win runner.	2,3	5
6	Study of test management tool, Test Director.	2,3	5
7	Test Automation using Selenium IDE.	2,3	5
8	Test Automation using Selenium Web driver.	2,3	5
		Total	**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:

1. Naresh Chauhan , "*Software Testing Principles and Practices*", Oxford Higher Education.
2. Kshirasagar Naik and Priyadarshi Tripathy, "*Software Testing and quality assurance theory and practice*", Wiley Publication.
3. Srinivasan Desikan and Gopalaswamy Ramesh, "*Software Testing – Principles and Practices"*, Pearson education, 2006.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
OE8	Database Management Systems	1	-	2	1	--	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		10		20		70

Pre-requisite Course Codes	---	
At the end of the course students will be able to		
Course Outcomes	OE8.1	Design a database for real world system, choose real world problem and map it to the solution using database techniques.
	OE8.2	Construct a database using SQL.
	OE8.3	Create normalized database using functional dependencies.
	OE8.4	Analyze the effect of transaction over the database.
	OE8.5	Build secure and normalize database using SQL constructs.
	OE8.6	Apply the connectivity techniques of database.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction Database Concepts and ER Modeling** Characteristics of databases, File system V/s Database system, Users of Database system, DBMS system architecture, Database Administrator.	1,2,3	2
	1.2	Introduction to ER model, Benefits of Data Modeling, Types of Models, The Entity-Relationship (ER) Model, Generalization, Specialization and Aggregation, Mapping of ER to Relational model.		2
2	2.1	**SQL** Overview of SQL, Data Definition Commands, Set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Views in SQL, Trigger.	1,2	5
3	3.1	**Normalization** Design guidelines for relational schema, Function dependencies, Normal Forms- 1NF, 2 NF, 3NF.	1,2,3	3
4	4.1	**Transactions Management**: Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability.	1,2,4	2
			Total	**14**

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Identify the real world problem which can be mapped to the database using database concept. Design E-R model for the same.	1	5
2	Perform database administration DCL commands.	1,2	5
3	Build a database with related data using SQL.	2	5
4	Perform Data Manipulation using SQL.	2	5
5	Perform various nested queries on database.	2	5
6	Perform TCL operations over database.	2	5
7	Examine integrity of database using triggers.	2	5
8	Perform database connectivity using JDBC on a table.	1,2	5
		Total	**40**

ISE Evaluation: Continuous evaluation of experiments for 40 Marks

MSE Evaluation: Subjective evaluation for 10 Marks based on theory for one hour duration

ESE Evaluation: Subjective evaluation for 20 Marks based on theory for one hour duration

Recommended Books:

1. Korth, Slberchatz, Sudarshan, "*Database System Concepts*", 7th Edition, McGraw – Hill, 2010.
2. Elmasri and Navathe, "*Fundamentals of Database Systems*", 5th Edition, PEARSON Education, 2015.
3. G. K. Gupta, "*Database Management Systems*", McGraw – Hill, 2011.
4. Peter Rob and Carlos Coronel, "*Database Systems Design, Implementation and Management*", 8th Edition, Thomson Learning, 2007.
5. Sharaman Shah, "*Oracle for Professional*", SPD, 2008.
6. Dr. P.S. Deshpande , " *SQL &PLSQL for oracle*" Black Book, 2007.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MEC3	Industrial and Organizational Psychology	2	-	-	2	-	-	2
		Examination Scheme						
		ISE1		ISE2		Attendance		Total Marks
		20		20		10		50

Pre-requisite Course Codes		---	
Course Objectives	CO1	To impart knowledge and understanding of the basic concepts in and various facets of Industrial and Organizational Psychology	
	CO2	To create awareness about the role and importance of Psychological factors and processes in the world of work	
	CO3	To create a foundation for higher education and a professional career in Industrial Psychology and Organizational Behavior	

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Theories of Employee Motivation**	1, 2	**05**
	1.1	What is motivation? Work motivation theories, need theories		
	1.2	Other Theories - Reinforcement theory, expectancy theory and self-efficacy theory; Justice theories, goal-setting theory, control theory and action theory		
2		**Feelings about Work: Job Attitudes and Emotions**	1,2	**07**
	2.1	The nature of job satisfaction; how people feel about their jobs; the assessment and antecedents of job satisfaction		
	2.2	Potential effects of job satisfaction; organizational commitment and emotions at work		
3.		**Productive and Counterproductive Work Behavior**	1,2	**05**
	3.1	Productive work behavior: ability, motivation, personal characteristics and task performance; environmental conditions and task performance; organizational constraints; organizational citizenship behavior (OCB)		
	3.2	Counterproductive work behavior: withdrawal – absence, lateness, turnover; aggression, sabotage, and theft; labor unrest and strikes.		
4.		**Leadership and Power in Organizations**	1,2	**06**
	4.1	What is leadership? Sources of influence and power; abuse of supervisory power: sexual and ethnic harassment		
	4.2	Approaches to the understanding of leadership; women in leadership positions; cross-cultural issues in leadership		
5.		**Organizational Development and Theory**	1,2	**05**
	5.1	Organizational Development		
	5.2	Organizational Theories		
			Total	**28**

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Recommended Books:

1. Spector, P. E. (2012). Industrial and Organizational Psychology: Research and Practice. Singapore: John Wiley & Sons Pte. Ltd. (Indian reprint 2015)
2. Schultz, D., & Schultz, S. E. (2010). Psychology and Work Today.(10th ed.). Pearson Prentice Hall

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
MEC4	Law for Engineers	2	-	-	2	-	-	2
		Examination Scheme						
		ISE1		**ISE2**		**Attendance**		**Total Marks**
		20		20		10		50

Pre-requisite Course Codes		---
Course Outcomes	CO1	Student will be able to recognize the importance of the legal system, and the controls it exerts on the activities of engineers in practice.
	CO2	Student will be able to express the details of what the individual's responsibilities are to ensure legal behaviour in engineering practice.

This course is a survey of legal topics relevant to engineers, including basic of legal system, labor law, intellectual property, torts, and contracts. This is an introductory course, emphasizes on legal principles that can provide engineers with the ability to recognize legal issues that are likely to arise in the engineering profession.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	General Principles of Contract under Indian Contract Act, 1872.	1	4
	1.2	**Introduction to Human Rights.** Enforcement of Human Rights in India including Supreme Court, High Courts, Statutory Commissions– NHRC, NCW, NCM, NC-SC/ST etc.	1	
2	2.1	**Right to Information Act, 2005**: Evolution and concept; Practice and procedures; Official Secret Act, 1923; Indian Evidence Act, 1872.	1	4
	2.2	**Information Technology**– legislation and procedures, Cyber crimes – issues and investigations.	1	
3	3.1	**Labor Laws:** Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmens Compensation Act, 1923.	1	12
	3.2	Apprentices Act, 1961. Bonded Labor System (Abolition) Act, 1976. Child Labor (Prohibition and Regulation) Act, 1986. Contract Labor (Regulation and Abolition) Act, 1970.	2,3	
	3.3	Employees' Provident Funds and [Miscellaneous Provisions] Act, 1952. Employees' State Insurance Act, 1948. Equal Remuneration Act, 1976. Factories Act, 1948.	2,3	

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		Fatal Accidents Act, 1855. Industries (Development and Regulation) Act, 1951. Maternity Benefit Act, 1961. Minimum Wages Act, 1948. Payment of Bonus Act, 1965. Payment of Gratuity Act, 1972. Payment of Wages Act, 1936. Trade Unions Act, 1926.		
4	4.1	Law relating to Intellectual property Law relating to Copyright in India. Law relating to Trademarks under Trademark Act, 1999. Law relating to Patents under Patents Act, 1970.	1	4
5	5.1	**Corporate Law**: Meaning of corporation; Law relating to companies, public and private (Companies Act, 1956) general provisions; Law and multinational companies – International norms for control, FEMA 1999, Corporate liability, civil and criminal. Election provisions under Indian Constitution (Art.324–329): Representation of Peoples Act and Prevention of Corruption Act, 1988;	1	4
			Total	**28**

Recommended Books:

1. Nikita Agarawal and Rishi Kumar, "Laws for Engineers," Genius Publications.
2. P. L. Malik Handbook of Labour and Industrial Law, Eastern Book Company
3. Industrial labour and general laws, The Institute of Company Secretaries of India

'Activity Based Learning'

ABL4: Technical Paper and Patent Drafting

This is non-credit activity conducted in semester VI for all the branches of engineering. This course aims to encourage students to study advancement in engineering developments, prepare a technical paper based on the research topic and give holistic insight on the various aspects of patents that would be relevant to them. Attendance and participation are an integral part of the course

A. Technical Paper Drafting:

Invited talks and workshop on latex shall be conducted to impart the knowledge in technical paper drafting and presentation.

The primary learning outcomes expected are:

- Knowledge about importance of paper publication
- Key parts of a technical paper and drafting related issues
- Submission and review process of paper
- Paper presentation related issues
- Ethical issues

Students will have to give the presentation of the topics and submit the technical paper based on IEEE format. Students are expected to prepare and present a topic on engineering/ technology, for the duration of about 8 to 10 minutes. Group of two or three students will present the topic and will submit the technical paper based on the topic. Each student will be evaluated based on the presentation and draft of technical paper.

B. Patent Drafting:

Invited talks and workshop shall be conducted to impart the knowledge in patent drafting.

The primary learning outcomes expected are:

- Knowledge about Intellectual Property & Patents
- Patent Searching
- Patent Drafting
- Patent Commercialization & Case Studies