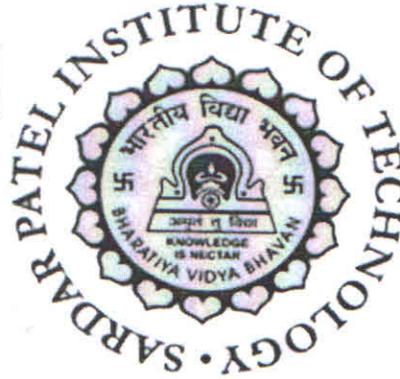


Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-3-18



Bachelor of Engineering/Technology (B.E./B.Tech)
in
Computer Engineering
(Program Code: UCE)
Third Year Engineering
(Sem. V and Sem. VI)
Effective from Academic Year 2018 -19

Board of Studies Approval: 14/12/2017

Academic Council Approval: 20/01/2018

Dr. D. R. Kalbande
Head of Department

Dr. Surendra Rathod
Dean Academics

Dr. Prachi Gharpure
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SEM V						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits Total
			L	T	P	
CE51	Data Communication and Computer Networks	PC	3	-	-	3
CE52	System Analysis and Design	PC	-	2	--	1
CE53	Data warehousing and Mining	PC	3	-	-	3
CE54	Embedded System & RTOS	PC	3	-	-	3
CE55	Theoretical Computer Science*	PC	3	1	-	4
CEL51	Data Communication and Computer Networks Lab	PC	-	-	2	1
CEL52	System Analysis and Design Lab	PC	-	-	2	1
CEL53	Data warehousing and Mining Lab	PC	-	-	2	1
CEL54	Embedded System & RTOS Lab	PC	-	-	2	1
CEL55	Enterprise Technology Lab	PC	-	-	2	1
CEP56	Minor Project- I	PR	-	-	2	1
MEC^	Mandatory Elective Course MEC1:French Language MEC2:German Language	MEC	2	--	--	2
SDX	SCOPE Courses (Optional)	SD	--	--	--	--
ABL3	Creative Thinking, Diversity and Workplace Etiquette (Noncredit)	ABL	--	--	--	--
CEP3	Problem solving module-II (Optional)	CEP	--	--	--	--
	Total		14	3	12	22

* Common with Information Technology



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

SEM VI						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits Total
			L	T	P	
CE61	System Programming and Compiler Constructions	PC	3	-	-	3
CE62	Cryptography and System Security	PC	3	-	-	3
CE63	Software Engineering	PC	3	-	-	3
CE64	Digital Signal Processing	PC	3	-	-	3
CEL61	System Programming and Compiler Constructions Lab	PC	-	-	2	1
CEL62	Cryptography and System Security Lab	PC	-	-	2	1
CEL63	Software Engineering Lab	PC	-	-	2	1
CEL64	Digital Signal Processing Lab	PC	-	-	2	1
CEL65	Machine Learning Lab	PC	-	-	2	1
CEP66	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 Courses (Optional)	SD	--	--	--	--
ABL4	Technical Paper and Patent Drafting (Noncredit)	ABL	--	--	--	--
CEP4	Problem solving module-III (Optional)	CEP	--	--	--	--
Total			16+1@	2	12+2@	23+2@

@

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Evaluation Scheme

B.E./B.Tech Computer Engineering (SEM V)					
Course Code	Course Name	Marks			
		ISE	MSE	ESE	Total
CE51	Data Communication and Computer Networks	20	20	60	100
CE52	System Analysis and Design	20	--	--	20
CE53	Data warehousing and Mining	20	20	60	100
CE54	Embedded System & RTOS	20	20	60	100
CE55	Theoretical Computer Science*	20	20	60	100
CEL51	Data Communication and Computer Networks Lab	40	--	--	40
CEL52	System Analysis and Design Lab	40	--	--	40
CEL53	Data warehousing and Mining Lab	40	--	--	40
CEL54	Embedded System & RTOS Lab	40	--	--	40
CEL55	Enterprise Technology Lab	40	--	--	40
CEP56	Minor Project-I	40	--	20	60
MEC^	Mandatory Elective Course MEC1:French Language MEC2:German Language	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL3	Creative Thinking, Diversity and Workplace Etiquette (Noncredit)	--	--	--	--
Total					730
B.E./B.Tech Computer Engineering (SEM VI)					
Course Code	Course Name	Marks			
		ISE	MSE	ESE	Total
CE61	System Programming and Compiler Construction	20	20	60	100
CE62	Cryptography and System Security	20	20	60	100
CE63	Software Engineering	20	20	60	100
CE64	Digital Signal Processing	20	20	60	100
CEL61	System Programming and Compiler Construction Lab	40	--	--	40
CEL62	Cryptography and System Security Lab	40	--	--	40
CEL63	Software Engineering Lab	40	--	--	40
CEL64	Digital Signal Processing Lab	40	--	--	40
CEL65	Machine Learning Lab	40	--	--	40
CEP66	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					880



Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Semester-V



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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE51	Data Communication and Networks	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes		CE31, CE32 and CE33.
At the End of the course students will be able to		
Course Outcomes	CO1	Use the fundamental concepts of Data Communication.
	CO2	Distinguish different layers of OSI and TCP/IP reference Model.
	CO3	Illustrate working and function of Layers in Reference Model.
	CO4	Describe functionality of protocols deployed in different layers.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Data Communication and Physical Layer		9
	1.1	Introduction 1) Data Communications 2) Networks 3) The Internet 4) Protocols and standards	1	
	1.2	Network Model 1) Layered tasks 2) OSI model 3) Layers in the OSI model 4) TCP/IP protocol suite	1,2	
	1.3	Data and Signals 1) Analog and Digital 2) Periodic analog signals 3) Digital signals 4) Transmission impairment 5) Data rate limits 6) Performance	1	
	1.4	Digital Transmission 1) Digital-to-Digital conversion 2) Analog-to-Digital conversion 3) Transmission modes	1	
	1.5	Analog Transmission 1) Digital-to-Analog conversion 2) Analog-to-Analog conversion	1	
	1.6	Transmission Media 1) Guided media 2) Unguided media: Wireless	1	



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

2		Data Link Layer		10
	2.1	Error Detection and Correction 1) Introduction 2) Block coding 3) Linear block codes 4) Cyclic codes 5) Checksum	1,2	
	2.2	Data Link Control 1) Framing 2) Flow and Error control 3) Protocols 4) Noiseless channels 5) Noisy channels 6) HDLC 7) Point-to-Point protocol	1,2	
	2.3	Multiple Access 1) Random access 2) Controlled access 3) Channelization	1,2	
3		Network Layer		9
	3.1	Logical Addressing 1) IPv4 addresses 2) IPV6 addresses	1,2,3	
	3.2	Internet Protocol 1) Internetworking 2) IPV4 3) IPV6 4) Transition from IPV4 to IPV6	1,2,3	
	3.3	Address Mapping, Error Reporting, and Multicasting 1) Address Mapping 2) ICMP 3) IGMP 4) ICMPv6	1,2,3	
	3.4	Delivery, Forwarding, and Routing 1) Delivery 2) Forwarding 3) Unicast routing protocols	1,2,3	
4		Transport Layer		8
	4.1	Process-to-Process Delivery: UDP AND TCP 1) Process-to-Process delivery 2) Service primitives and Berkley sockets 3) User Datagram Protocol (UDP) 4) TCP 5) Error and Flow control	1,2	
	4.2	Congestion Control and Quality of Service 1) Data Traffic 2) Congestion 3) Congestion control 4) Two examples	1,2,4	



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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		5) Quality of Service 6) Techniques to improve QoS 7) Integrated services 8) Differentiated services		
5		Application Layer		6
	5.1	Domain Name System 1) Name Space 2) Domain Name Space 3) Distribution of Name Space 4) DNS in the Internet 5) Resolution 6) DNS messages 7) Types of Records 8) Registrars 9) Dynamic domain name system (DDNS) 10) Encapsulation	1,2	
	5.2	Remote Logging, Electronic Mail, and File Transfer 1) Remote logging 2) Electronic mail 3) File transfer	1,2	
	5.3	WWW and HTTP 1) Architecture 2) Web documents 3) HTTP	1,2	
			Total	42

References:

[1] B.A. Forouzan, "Data Communications and Networking", TMH, Fourth Edition.

[2] A.S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition

[3] M. A. Gallo and W. M. Hancock, "Computer Communications and Networking Technologies", Cengage Learning (Indian Edition), First Edition.

[4] Natalia Olifer & Victor Olifer, "Computer Networks : Principles, Technologies & Protocols for Network Design", Wiley India, 2011.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE52	System Analysis And Design	--	2	--	--	1	--	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		-		--		20

Pre-requisite Course Codes		
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Create requirements document subsequent to problem analysis.
	CO2	Apply UML to analyze and design software project.
	CO3	Demonstrate the translation of a simple specification to an executable program.
	CO4	Use alternative architectural styles to create high quality application.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction:	1,2, 3,4	04
	1.1	System Overview, Characteristics of system, Types of System and stakeholders for each type		
	1.2	Drivers for Information systems: Business & Technology		
	1.3	Transform Business goal to Information system goal		
2		System Proposal & Feasibility Analysis	1,2, 3,4	04
	2.1	Problem Analysis & Fact finding		
	2.2	Feasibility Analysis & test, Scope, Problem, Check Point, Cost Benefit Analysis		
	2.3	Request for Proposal, Response for Proposal		
4		Analysis Model	1,2, 3,4	8
	4.1	Difference between Structured & Object Oriented analysis		
	4.2	Data Flow Diagrams, Functional Decomposition diagram, Structure Chart diagram, SRS		
	4.3	Structure and Behaviour diagrams, Uses Case, Class diagram, Interaction diagrams, Activity diagram, State Chart diagram, Component & Deployment diagram, Identifying input & output		
5		Design Model	1,2,	06



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

			3,4	
	5.2	Developing actual design, Boundary class, Analysis class, Controller class, Database schema from classes, User Interface Design and Prototyping, Designing for non-functional properties Efficiency, Complexity, Scalability		
	5.3	Design Pattern- Singleton, Strategy, Adapter		
6		Application Architecture	5	06
	6.1	Architecture types: Business, Application, Information		
	6.2	Architecture Styles – Distributed and Networked Architecture, REST Style, REST Style, Decentralized Architecture		
	6.3	Design System Interfaces, Controls and Security, Hardware and Software interfaces, Current trends in System development- Frameworks, Components, Services		
			Total	28

References:

- [1] Satzinger, Jackson and Burd, "System Analysis & Design" Cengage Learning, 2007
- [2] Alan Dennis, Barbara H. Wixom, Roberta M. Roth, "System Analysis and Design", Wiley India 4th edition
- [3] James a. Senn, "Analysis and Design of Information Systems", McGrawHill, 2nd Edition.
- [4] Jeffery I. Whitten, Lonnie D Bentley, "System Analysis and Design Methods", McGraw Hill, 7th edition.
- [5] Richard Taylor, "Software Architecture Foundations Theory and Practice", Wiley India



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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE53	Data Warehouse and Mining	3	-	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	DBMS CE42 and Web Technology CEL45		
At end of successful completion of this course, student will be able to			
Course Outcomes	CO1	Demonstrate understanding of Data Warehouse and its Architecture.	
	CO2	Build data warehouse for given case study and perform Dimensional modeling	
	CO3	Describe the ETL process and illustrate the OLAP operations	
	CO4	Apply algorithms in data mining and assess the strengths and weaknesses of the algorithms.	

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction to Data Warehouse	1	04
	1	The Need for Data Warehousing; Increasing Demand for Strategic Information; Inability of Past Decision Support System; Operational V/s Decisional Support System; Data Warehouse Defined; Benefits of Data Warehousing; Features of a Data Warehouse; The Information Flow Mechanism; Role of Meta data; Classification of Meta data; Data Warehouse Architecture; Different Types of Architecture; Data Warehouse and Data Marts; Data Warehousing Design Strategies.		
2		Dimensional Modeling		06
	2	Warehouse Modeling Vs Operational Database Modeling; Dimensional Model Vs ER Model; Features of a Good Dimensional Model; The Star Schema; How Does a Query Execute? The Snowflake Schema; Fact Tables and Dimension Tables; The Factless Fact Table; Updates To Dimension Tables: Slowly Changing Dimensions, Type 1 Changes, Type 2 Changes, Type 3 Changes, Large Dimension Tables, Rapidly Changing or Large Slowly Changing Dimensions, Junk Dimensions, Keys in the Data Warehouse Schema, Primary Keys, Surrogate Keys & Foreign Keys; Aggregate Tables; Fact Constellation Schema or	1	



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		Families of Star.		
3		ETL Process		04
	3	ETL Process Challenges in ETL Functions; Data Extraction; Identification of Data Sources; Extracting Data: Immediate Data extraction, Deferred Data Extraction; Data Transformation: Tasks Involved in Data Transformation, Data Loading: Techniques of Data Loading, Loading the Fact Tables and Dimension Tables Data Quality; Issues in Data Cleansing.	1	
4		On line Analytical Processing (OLAP)		03
	4	Need for Online Analytical Processing; OLTP V/s OLAP; OLAP and Multidimensional Analysis; Hypercubes; OLAP Operations in Multidimensional Data Model; OLAP Models: MOLAP, ROLAP, HOLAP, DOLAP;	1,2,3	
5		Introduction to data mining		02
	5	Introduction to data mining What is Data Mining; Knowledge Discovery in Database (KDD), What Data can be Mined, Related Concept to Data Mining, Data Mining Technique, Application and Issues in Data Mining		
6		Data Exploration		02
	6	Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and dissimilarity.	1,2,3	
7		Data Preprocessing		04
	7	Why Preprocessing? Data Cleaning; Data Integration; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation.	1,2,3	
8		Classification		06
	8	Basic Concepts; Classification methods: Decision Tree Induction: Attribute Selection Measures, Tree pruning, Bayesian Classification: Naïve Bayes" Classifier, Prediction: Model Evaluation & Selection: Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap; Comparing Classifier performance using ROC Curves, Combining Classifiers: Bagging, Boosting, Random Forests.	2,3	
9		Clustering		05
	9	What is clustering? Types of data, Partitioning Methods (K-Means, K-Medoids) Hierarchical Methods (Agglomerative, Divisive, BRICH), Density-Based Methods (DBSCAN, OPTICS)	2,3	
10		Mining Frequent Pattern and Association Rule		06
	10	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules; Frequent Pattern Mining, Efficient and Scalable Frequent Itemset Mining Methods, The Apriori Algorithm for finding Frequent Itemsets Using Candidate	1	



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, A pattern growth approach for mining Frequent Itemsets; Mining Frequent itemsets using vertical data formats; Mining		
			Total	42

References:

- (1) Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", Wiley India
- (2) Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition
- (3) M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE54	Embedded System & RTOS	3	-	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes

At end of successful completion of this course, student will be able to

Course Outcomes	Code	Description
	CE54.1	Discuss the fundamentals of embedded systems.
	CE54.2	Choose hardware required for an embedded system.
	CE54.3	Design real time embedded systems using the concepts of RTOS.
	CE54.4	Create embedded systems software for given application.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction:	1,2,3	08
	1.1	Brief history of Real Time Systems, A brief history of Embedded Systems.		
	1.2	Embedded Systems Philosophy, Embedded Design and Development Process, Comparison – General purpose CPU versus ASIC.		
	1.3	Embedded system components -Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components.		
2		Real-Time Operating System	1,2,3	14
2.1		Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, differences between general purpose OS & RTOS, basic architecture of an RTOS, scheduling systems, inter-process communication, performance metric in scheduling models, interrupt management in RTOS environment, memory management, file systems, I/O systems, advantage and disadvantage of RTOS. POSIX standards, RTOS issues – selecting a Real Time Operating System, RTOS comparative study.		
	2.2	Free RTOS Scheduling and Task Management – Real-time		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		scheduling, Task Creation, Inter task Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts.		
3		CPU for Embedded System	4,5,6, 7,8	14
	3.1	Introduction to ARM instruction set, addressing modes, operating modes with ARM core, ARMTDMI modes, ADC, Timers, Interrupt structure. Byte ordering (LE, BE), Thumb mode normal mode instructions changes, Pipeline utilization with all register allocations. Compare with ARM7, ARM9, and ARM11 with new features additions. System design with ARM processor.		
	3.2	Case study-Embedded system such as vending machine, temperature Controller, automatic cruise control system, antilog braking system and traction control in vehicles		
4		Performance Analysis and Development Environment	4,5,6, 7,8	06
	4.1	Efficiency Measures, Complexity Analysis, Analyzing code, Response Time, Time Loading, Memory Loading		
	4.2	Evaluating Performance, Performance Optimization, Hardware Accelerators		
	4.3	The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler /Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.		
			Total	42

References:

- (1) Andrew N Sloss, ARM system developer's guide
- (2) Rajkamal , Embedded Systems, TMH, Edition 2008.R
- (3) Jean J. Labrosse ,”MicroC/OS-II: The Real Time Kernel”
- (4) Wayne Wolf,Computers as Components, Principles of Embedded Computing Systems Design, 2 nd Edition, Elsevier, 2008.
- (5) Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill, 2009
- (6) James K. Peckol, Embedded Systems, A contemporary Design Tool, Wiley India, 2008
- (7) Frank Vahid , Embedded Systems , Wiley India, Edition 2002
- (8) Steve Furber, ARM System-on-Chip Architecture Pearson Edition 2005
- (9) Tammy Neorgaard, Embedded Systems Architecture, Elsevier, 2005.
- (10) K.V.K Prasad, Embedded / Real-Time Systems: Concepts, Design and Programming Black Book
- (11) J R Gibson, ARM Assembly Language



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE55	Theoretical Computer Science *	3	1	-	3	1	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	CE33 (Discrete Structures)	
At the end of the course students will be able to		
Course Outcomes	CE55.1	Design finite automaton for a regular languages.
	CE55.2	Identify regular and non-regular languages.
	CE55.3	Construct the grammar for a language and convert it into normal forms.
	CE55.4	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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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 languages	8.1	Recursively Enumerable and recursive	3	1
		8.2	Enumerating a language		1
		8.3	Context sensitive languages and the Chomsky hierarchy		2
				Total	42

References:

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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL51	Data Communication and Networks Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	CE31, CE32, CE33, CEL35 and CE51.
At the End of the course students will be able to	
Course Outcomes	CEL51.1 Develop prototype of protocols residing in different layers of Reference Model.
	CEL51.2 Demonstrate the functions defined by different layers of Reference Models.
	CEL51.3 Use Client-Server paradigm.

Exp. No.	Experiment Details	Ref.	Marks
1	Illustrate Data Encoding for the given scenario.	1,2	5
2	Simulate basic network topology for the given scenario.	1,2,3	5
3	Demonstrate Framing Mechanism for given scenario.	1,2,3	5
4	Use the Channelization for access control in given scenario.	1,2,4	5
5	Develop Error Control Code for given scenario.	1,2,4	5
6	Calculate the IPv4 Address for the given scenario.	1,2,5	5
7	Illustrate the Intra Domain routing protocol for given scenario.	1,2,5	5
8	Use Socket Programming in the given scenario.	1,2	5
Total Marks			40

References:

- [1] B.A. Forouzan, "Data Communications and Networking", TMH, Fourth Edition.
- [2] A.S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition
- [3] Larry L.Peterson, Bruce S.Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann, Second Edition.
- [4] James F. Kurose , Keith W. Ross, "Computer Networking", 6th Edition.
- [5] Keshav, "An Engineering Approach To Computer Networking: ATM Networks, The Internet"



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL52	System Analysis And Design Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		-		-		40

Pre-requisite Course Codes		--
At the End of the course students will be able to		
Course Outcomes	CEL52.1	Create requirement specification for a given problem.
	CEL52.2	Create analysis and design models.
	CEL52.3	Demonstrate a system prototype created from requirement modeling
	CEL52.4	Work effectively in team.

Exp. No.	Experiment Details	Ref.	Marks
1	Document System Requirement Specification.	1,2,3,4	5
2	Create DFD for given scenario.	1,2,3,4	5
3	Create Use case diagram along with Use Case description for given scenario.	1,2,3,4	5
4	Create Activity diagram for given scenario.	1,2,3,4	5
5	Create Class Diagram for given scenario.	1,2,3,4	5
6	Create interaction diagram and state chart diagram for given scenario.	1,2,3,4	5
7	Create prototype – stage 1	1,2,3,4	5
8	Create prototype – stage 2	1,2,3,4	5
Total Marks			40

References:

- [1] Satzinger, Jackson and Burd, "System Analysis & Design" Cengage Learning, 2007
- [2] Alan Dennis, Barbara H. Wixom, Roberta M. Roth, "System Analysis and Design", Wiley India 4th edition
- [3] James a. Senn, "Analysis and Design of Information Systems", McGrawHill, 2nd Edition.
- [4] Jeffery I. Whitten, Lonnie D Bentley, "System Analysis and Design Methods", McGraw Hill, 7th edition.
- [5] Richard Taylor, "Software Architecture Foundations Theory and Practice", Wiley India.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL53	Data Warehouse and Mining Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	CEL42 (Database Management System Lab)
At the End of the course students will be able to	
Course Outcomes	CO1 Create dimensional modeling and implement dimension table, fact table
	CO2 Demonstrate ETL and OLAP operations.
	CO3 Develop Classification, Clustering and Association Mining algorithms using languages any like Java, C#
	CO4 Use WEKA tool to implement Classification, Clustering and Association Mining.
	CO5 Use R tool to implement Clustering/Association Rule/Classification Algorithms.

Sr. No.	Experiment Details	Ref.	Marks
1	One case study given to a group of 3 /4 students, of a data mart/ data warehouse. a. Write Detail Statement Problem and creation of dimensional modeling(creation star and snowflake schema) b. Implementation of all dimension table and fact table	1,2	5
2	Implement ETL operations and OLAP operations.	1,2	5
3	Implementation of classifier like Decision tree, Naïve Bayes, Random Forest using any languages like Java	2,3	5
4	Use WEKA to implement like Decision tree, Naïve Bayes, Random Forest	2,3	5
5	Implementation of clustering algorithm like K-means, K-Medoids, Agglomerative, Divisive using languages any like Java, C# , etc.	2,3	5
6	Use WEKA to implement the following Clustering Algorithms –K-means, Agglomerative, and Divisive.	2,3	5
7	Implementation Association Mining like Apriori, FPM using languages like Java, C#, etc. and using WEKA Tool	2,3	5
8	Use R tool to implement Clustering/Association Rule/ Classification Algorithms	4,5	5
Total Marks			40

References:

- (1) PaulrajPonniah, "Data Warehousing: Fundamentals for IT Professionals", Wiley India
- (2) Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition
- (3) M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL54	Embedded System & RTOSLab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		-		-		40

Pre-requisite Course Codes	--								
At the End of the course students will be able to									
Course Outcomes	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">CEL54.1</td> <td>Set-up simulation environment for programming microcontroller architectures.</td> </tr> <tr> <td>CEL54.2</td> <td>Interface various peripherals with the microcontrollers.</td> </tr> <tr> <td>CEL54.3</td> <td>Design and develop embedded system applications.</td> </tr> <tr> <td>CEL54.4</td> <td>Test and debug embedded system applications.</td> </tr> </table>	CEL54.1	Set-up simulation environment for programming microcontroller architectures.	CEL54.2	Interface various peripherals with the microcontrollers.	CEL54.3	Design and develop embedded system applications.	CEL54.4	Test and debug embedded system applications.
CEL54.1	Set-up simulation environment for programming microcontroller architectures.								
CEL54.2	Interface various peripherals with the microcontrollers.								
CEL54.3	Design and develop embedded system applications.								
CEL54.4	Test and debug embedded system applications.								

Exp. No.	Experiment Details	Ref.	Marks
1	Write an Assembly program for ARM-7 LPC2148 processor and simulate various operating modes of the controller using compiler and debugger.	1-11	5
2	Interface LED matrix, Segment display to ARM-7 LPC2148 processor write a Embedded "C" program to display decimal numbers on the display	1-11	5
3	Interface 16x2 LCD Character display using ARM-7 LPC2148 processor and display data by using various modes.	1-11	5
4	Interface 4x4 Hex KBD to ARM-7 LPC2148 processor and display the scanned keyboard data on LCD	1-11	5
5	Write ADC and DAC program for ARM-7 LPC2148 processor and display the data on DSO, LCD.	1-11	5
6	Write a program for Serial Communication using UART and display the data on PC serial terminal	1-11	5
7	Interface a Stepper motor to ARM-7 LPC2148 and write a program to rotate the motor in forward and reverse direction with various speed modes.	1-11	5



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

8	Interface Wi-Fi module to ARM-7 LPC2148 and implement Station mode and Access point for remote data (cloud/server) transfer of a Temperature sensor.	1-11	5
9	Free RTOS implementation on LPC2148 and demonstrate various kernel objects utilization.	1-11	**5
10	Interface SDCARD and create a File and store the data from ADC	1-11	**5
Total Marks			40

****Note:** Additional Two experiments are for fast learners.

References:

- [1] Jean J. Labrosse ,”MicroC/OS-II: The Real Time Kernel”
- [2] Wayne Wolf,Computers as Components, Principles of Embedded Computing Systems Design, 2 nd Edition, Elsevier, 2008.
- [3] Andrew N Sloss, ARM system developer's guide
- [4] Rajkamal , Embedded Systems, TMH, Edition 2008.
- [5] Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill, 2009
- [6] James K. Peckol, Embedded Systems, A contemporary Design Tool, Wiley India, 2008
- [7] Frank Vahid , Embedded Systems , Wiley India, Edition 2002
- [8] Steve Furber, ARM System-on-Chip Architecture Pearson Edition 2005
- [9] Tammy Neorgaard, Embedded Systems Architecture, Elsevier, 2005.
- [10] K.V.K Prasad, Embedded / Real-Time Systems: Concepts, Design and Programming Black Book
- [11] J R Gibson, ARM Assembly Language



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL55	Enterprise Technology Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	CEL45 (Web Technology Lab)
At the End of the course students will be able to	
Course Outcomes	CO1 Understand the user experience design principles.
	CO2 Understand No-Sql Concept and implement them for a specific user.
	CO3 Understand MVC Architecture and use it.
	CO4 Use of an open source server framework to enhance user experience[UX]
	CO5 Develop user-centric app for mobile device

Exp. No.	Experiment Details	Ref	Marks
1	Title: Designing for User 1.1 Understand User Interface Designing for Web Interfaces with Databases; Understand the core elements of User Experience Design [UXD] (five planes) Design a Map based UI (Web User) [Example: Transport applications like Ola,Uber etc.]	8,9,10	05
	1.2 Learn to set UX goals, evaluate the prototype and test usability.		
2	Title: Understanding Database Concepts. 2.1 Understanding No-Sql databases and use No- Sql databases such as Cassandra, HBase, Apache CouchDB, Couchbase, MongoDB etc. to perform CRUD and JOIN operations on No- Sql Databases.	1,6	05
	2.2 Understanding real time databases such as Firebase, RethinkDB etc.		
3	Title: Understanding MVC Architecture and Prototype design 3.1 Installation of MVC Architecture by using any one of the open source framework in Python – Django, Flask, Pyramid etc. or Java- Spring MVC, Struts 2, Hibernate etc.	2	05
	3.2 Understand to select a device and define a prototype using wireframes and storyboarding; To Study of open source UX tools (Justinmind Prototype, Pidoco, Marvel Prototype) and create UX design for a given problem definition.		
	3.3 Creating basic web app by using these framework which include database connectivity, user authentication.		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

4	Title: use of an open source server framework 4.1 Understanding and use of Nodejs, Anuglarjs, Reactjs etc.	4,5	05
	4.2 Perform operations by using this framework such as file management, database connectivity, email sending operations.		05
5	Title: Develop app for mobile device 5.1 Create and map the database design in the five planes of UXD	6,7, 9,1 0	05
	5.2 Design App for any differently abled users.		05
Total Marks			40

References:

- (1) Adam Fowler ,NoSQL for Dummies Paperback by John Wiley & Sons.
- (2) GennadiyZlobin , Exploring Model View Controller , packt publications.
- (3) Bill Phillips ,Android Programming: The Big Nerd Ranch Guide , By Big Nerd Ranch
- (4) <https://nodejs.org/>
- (5) <https://angularjs.org>
- (6) <https://firebase.google.com/>
- (7) Nish Tahir ,Android Development with Kotlin , packt publications.
- (8) Wilbert O. Galitz, "The Essential Guide to User Interface Design", Wiley publication.
- (9) Rex Hartson and PardhaPyla, The UX Book, MK publications.
- (10) Russ Unger and Carolyn Chandler ,A Project Guide to UX Design, Peachpit Press



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL56	Minor Project-I	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		Phase-I:20 Phase-II:20		-		20		60

Pre-requisite Course Codes	All the Courses till Vth Semester.
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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

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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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 Marks
		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 speak Greet 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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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 Être” (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		120 mins



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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		concerns		
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 have Used to express age		120 mins
13.	13.1	Verb Conjugation of "FAIRE – to make / to do / to describe weather conditions Comment fait-il aujourd'hui? 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-il aujourd'hui? 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

References:

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 FRANÇAIS – Niveau Débutant- Maïa Grégoire – CLE International
5. OUI, JE PARLE FRANÇAIS – 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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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 Marks
		20		20		10		50

Pre-requisite Course Codes		---
Course Outcomes	CO1	Student will be 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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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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References:

- [1] NetzwerkA1:Authors - Stefanie Dengler, Paul Rausch, Helen Schmitz, TanjaSieber
- [2] Studio D A1:Authors - Funk, Kuhn, Demme



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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 preferences 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.

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

3. Poster Presentation
4. Project Presentation
5. Physical Model Presentation
6. Scientific Case Study



Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Semester-VI



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE61	System Programming and Compiler construction	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	(CE43) Operating System (CE55) Theoretical Computer Science
At end of successful completion of this course, student will be able to	
Course Outcomes	CO1 To understand the basics of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger.
	CO2 To understand concepts of assemblers and write macros as and when required to increase readability and productivity.
	CO3 To understand the various phases of compiler and working of parsers.
	CO4 To understand role of Intermediate Code Generation in connection with language designing and apply optimization principles on given code.
	CO5 To analyze the role of Operating System functions such as memory management as pertaining to run time storage management.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction to System Programming and Assemblers		4
	1.1	Concept, introduction to various system programs such as assemblers, loaders, linkers, macro processors, compilers, interpreters, operating systems, device drivers, debuggers.	1	
	1.2	Basic Assembler Functions, Assembler features	1	
	1.3	Assembler Design Options: One-pass assemblers, Multi-pass assemblers	1	
2		Loaders, Linkers and Macro processors		9
	2.1	Basic Loader Functions, Loader Features, Loader Design Options: Machine Dependent and Machine Independent, Linkage Editors, Dynamic Linking and Bootstrap Loaders, Implementation Examples: MS-DOS Linker, SunOS Linker.	1	
	2.2	Basic Macro processor Functions, Macro processor Features, Macro processor design options, ANSI C Macro processor.	1	
	2.3	Software Tools- Software Tools for Program development, Editors: Types of Editors, Design of Editor, Debug Monitors.	1	
3	3.1	Compilers- The Structure of a Compiler, Phases of Compiler, difference of compiler and interpreter.	2	13



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

	3.2	Lexical Analysis- The Role of a Lexical analyzer, Input buffering, specification and recognition of tokens, Designing a lexical analyzer generator- LEX, Optimization of DFA-Based Pattern Matchers.	2,3,4	
	3.3	Syntax Analysis- The Role of Parser, Top down parsing- Recursive descent and predictive parsers (LL), Bottom Up parsing - Operator precedence parsing, LR, SLR and LALR parsers, Parser Generators.	2,3,4	
4	4.1	Syntax Directed Translation - Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs , S attributed Definitions , L attributed Definitions	2	10
	4.2	Intermediate Code Generation - Intermediate languages: declarations, Assignment statements, Boolean expression, case statements, back patching, procedure calls	2,5	
	4.3	Code Generation - Issues in the design of Code Generator , Basic Blocks and Flow graphs, code generation algorithm, DAG representation of Basic Block	2	
5	5.1	Code Optimization - Principal sources of Optimization, Optimization of Basic Blocks, Loops in Flow graph, Peephole Optimization	2,5	6
	5.2	Run Time storage - Storage Organization, storage allocation strategies, parameter passing, Symbol table, introduction to garbage collection and compaction	2,5	
			Total	42

References:

- [1] Leland L. Beck, "System Software", Pearson Education, 3rd Edition.
- [2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques, & Tools , Pearson Education ,2nd Edition
- [3] John R. Levine, Tony Mason & Doug Brown, "lex&yacc", O" Reilly, 2nd Edition
- [4] K Cooper, L Torczon, Engineering a Compiler, 2nd Ed., Morgan Kaufmann, 2011
- [5] AW Appel, M Ginsburg, Modern Compiler Implementation in C, Cambridge University Press, 2004.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE62	Cryptography and System Security	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	CE51	
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Understand principles and practices of cryptographic techniques and variety of generic security threats and vulnerabilities, and identify & analyze particular security problems for given application.
	CO2	Understand and apply Cryptographic techniques to secure real time applications and data.
	CO3	Creating digest for data and evaluating the digest for Authenticating respective authorized user
	CO4	Design security protocols and methods to solve the specific security problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction Security Attacks, Security Goals, Computer criminals, Methods of defense, Security Services, Security Mechanisms	1,2	04 CO1
	1.2	Basics of Cryptography Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers.	1,3	06 CO1
2	2.1	Secret Key Cryptography Data Encryption Standard(DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, International Data Encryption algorithm, Blowfish, CAST-128.	1,2,3	6 CO2
	2.2	Public Key Cryptography Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange	1,3	4 CO2
3	3.1	Cryptographic Hash Functions Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Authentication Protocols, Digital Signature Standards.	1,3,5	06 CO3
	3.2	Authentication Applications	1.4.	06



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		Kerberos, Key Management and Distribution, X.509 Directory, Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME	5	CO3
4	4.1	IDS and Firewalls Intrusion Detection System, Types of IDS, Firewalls- Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted systems.	3.4. 5	04 CO4
	4.2	IP Security Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange, Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment, Non-cryptographic protocol Vulnerabilities, DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities-Phishing, Buffer Overflow, Format String Attacks, SQL Injection.	1,3, 4,5, 6	06 CO4
			Total	42

References

- (1). William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, 5th edition.
- (2). Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2nd edition.
- (3). Behrouz A Fourouzan, Debdeep Mukhopadhyay, "Cryptography and Network", TMH, 2nd edition.
- (4). Behrouz A. Forouzan, "Cryptography and Network Security", TMH
- (5). Charles P. Pfleeger, "Security in Computing", Pearson Education.
- (6). Matt Bishop, "Computer Security Art and Science", Addison-Wesley



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE63	Software Engineering	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	CE52 (System Analysis and Design)	
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Evaluate alternative process models for a given problem.
	CO2	Use project management tools for estimation and scheduling of project.
	CO3	Analyze risks in software project and improve software quality.
	CO4	Apply advance software methodology to create high quality application.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction:		05
	1.1	Software Engineering Challenges, Process Models and its applications, Agile view of Process		
	1.2	Component Based Development – Impact on quality, productivity and cost		
	1.3	Software Architecture and its importance		
2		Project Planning & Control		08
	2.1	Scheduling – Work Breakdown Structure, Gantt Chart, Pert Chart, Critical Path		
	2.2	Earned Value Analysis, Schedule & Cost slippage		
	2.3	Estimation – Decomposition techniques, Emperical estimation models		
3		Risk Management		05
	3.1	Risk Identification		
	3.2	Risk Projection, Risk Refinement		
	3.3	RMMM Plan		
4		Software Quality		08
	4.1	Quality Assurance, Quality Control, Formal Technical Reviews		
	4.2	Product Metrics – McCall's Quality Factor, Metrics for Analysis Model and Design Model, Project Metrics, Process Metrics		
	4.3	Metrics for Source Code		
5		Software Testing		08
	5.1	Verification & Validation, White Box Testing – Basis Path Testing, Control Structure Testing, Black Box Testing		
	5.2	Object Oriented testing – Class testing, Interclass testing		
	5.3	Testing strategies – Unit testing, System testing		
6		Software Change Management		08
	6.1	SCM Repository, SCM Process, Configuration Audit, SCM tools,		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		SCM standards & issues		
	6.2	Software Maintenance – Reengineering, Reverse Engineering, Refactoring		
	6.3	Software Engineering with Aspects		
			Total	42

References:

- (1) Roger Pressman, Software Engineering: A Practitioners Approach, McGraw Hill
- (2) Ian Sommerville, Software Engineering, 9th edition, Addison Wesley.
- (3) Eric J. Braude and Micheal E. Bernstein, Software Engineering Modern Approach, Wiley
- (4) James F. Peters and WitoldPedrycz, “ Software Engineering – An Engineering Approach”, Wiley.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE63	Digital Signal Processing	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Course outcomes: After successful completion of the course, student will be able to

Pre-requisite Course Codes	Applied Mathematics IV
At the End of the course students will be able to	
Course Outcomes	CE63.1 Understand the concept of DT Signal and perform signal manipulation.
	CE63.2 Compute Convolution and Correlation operations.
	CE63.3 Illustrate DFT and FFT algorithms
	CE63.4 Discuss the need of DSP Processors and Applications of DSP

Module No.	Unit No.	Topics	Ref.	Hrs.
1.0		Discrete-Time Signal	1,2,3,4,5	14
	1.1	Introduction to Digital Signal Processing, Discrete Time Signals and Representation of DT signal, The Sampling theorem. Some elementary discrete time signals, Classification of Discrete Time Signals, Simple Manipulations of Discrete Time Signals.		
	1.2	Linear Convolution formulation (without mathematical proof), Circular Convolution /Cyclic Convolution /Periodic Convolution formulation (without mathematical proof), Matrix Representation of Circular Convolution, Linear Convolution using Circular Convolution. Auto and Cross Correlation formula evaluation. Carls' Correlation Coefficient Algorithm		
2.0		Discrete Fourier Transform	1,2,3	06
	2.1	Introduction, Relation between DFT and DTFT, DFT of DT signal, Inverse DFT.		
	2.2	Properties of the DFT (without mathematical proof): Periodicity, Linearity and Symmetry.		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		Multiplication of two DFTs: Circular Convolution property. Linear and Circular Convolution DFT-IDFT Technique.		
3.0		Fast Fourier Transform	1,2,3	08
	3.1	Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm,		
	3.2	Flow graph for N=4 and 8 using Radix-2 DIT-FFT , Inverse FFT algorithm.		
4.0		DSP Algorithms	1,3	08
	4.1	Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm.		
	4.2	Linear FIR filtering using Fast Overlap Add Algorithm and Fast Overlap Save Algorithm.		
5.0		Digital Signal Processors and Applications of DSP	1,2,3	06
	5.1	Introduction to digital signal processors, Need for Special architecture of DSP processor, Difference between DSP processor & microprocessor, TMS320C54X Digital Signal Processors.		
	5.2	DSP applications to Speech Signal Processing and Biomedical Signal Processing.		
		Total		42

References:

- [1] John G. Proakis, Dimitris and G. Manolakis, 'Digital Signal Processing: Principles, Algorithms, and Applications' 4th Edition 2007, Pearson Education, ISBN-978- 81-317-1000-5.
- [2] S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, 'Digital Signal Processing' Tata McGraw Hill Publication 1st Edition (2010). ISBN- 978-0-07-066924.
- [3] A. NagoorKani, "DIGITAL SIGNAL PROCESSING", McGraw Hill Education (India) Pvt Ltd, Second Edition.
- [4] Ashok Ambaradar, 'Digital Signal Processing', Cengage Learning, 2007, ISBN: 978-81-315-0179-5.
- [5] SanjitMitra, 'Digital Signal Processing: A Computer Based Approach', Tata McGraw Hill, 3rd Edition



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL61	System Programming and Compiler Construction Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	(CE43) Operating System (CE55) Theoretical Computer Science
At the End of the course students will be able to	
Course Outcomes	CEL62.1 To implement the working of assembler and Macros.
	CEL62.2 To use Flex or similar tools to create a lexical analyzer and Yacc /Bison tools to create a parser.
	CEL62.3 To implement different types of handwritten parsers.
	CEL62.4 To demonstrate linkers and loaders.

Exp. No.	Experiment Details	Ref.	Marks
1	To implement two pass assembler.	1	5
2	To implement two pass MASM macro processor.	1	5
3	To create user defined library in open source environment and use it for particular functions.	1	5
4	To write Lexical analyzer specification for C language.	4,3,5	5
5	Program to remove left recursion for the given grammar. Program should accept the grammar from user, detect left recursion and eliminate it by generating a new non-terminal.	2,4	5
6	To implement different types of Parsers for the given grammar.	2,4,5	5
7	Program to find first and follow sets for the given grammar. Program should accept the grammar from user and output the first and follow sets for each of the grammar symbol.	2,4	5
8	Program to generate Quadruple table for the given postfix String.	2,4	5
Total Marks			40

References:

- [1] Leland L. Beck, "System Software", Pearson Education, 3rd Edition.
- [2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques, & Tools", Pearson Education, 2nd Edition
- [3] John R. Levine, Tony Mason & Doug Brown, "lex&yacc", O'Reilly, 2nd Edition.
- [4] Allen I. Holub, "Compiler Design in C", Prentice Hall.
- [5] AW Appel, M Ginsburg, Modern Compiler Implementation in C, Cambridge University Press, 2004.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL62	Cryptography and System Security Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes		CE51
At the End of the course students will be able to		
Course Outcomes	CO1	Understand working of Public key Cryptographic technique.
	CO2	To develop and Secure any application using different methods
	CO3	To implement different session hijacking techniques
	CO4	To analyze different SQL injection attacks on application

Exp. No.	Experiment Details	Ref.	Marks
1	Simulation of RSA algorithm.	1,3	5
2	Implementation of Diffie-Hellman key exchange algorithm.	1,3,4	5
3	Implement Blowfish attack.	1,3,4	5
4	Implement MD5 algorithm	1,4	5
5	Implement Pretty Good Privacy (PGP) security method.	1,3,4	5
6	Implement SNORT Intrusion Detection System	1,2,4	5
7	Implement of SQL injection	1,3,4	5
8	Implement of session Hijacking attack.	1,3,4	5
Total Marks			40

References:

- (1) Cryptography and Network Security: Principles and Practice 5th edition, William Stallings, Pearson.
- (2) Network Security and Cryptography 2nd edition, Bernard Menezes, Cengage Learning.
- (3) Cryptography and Network, 2nd edition, Behrouz A Fourouzan, Debdeep Mukhopadhyay, TMH.India.
- (4) Cryptography and Network Security by Behrouz A. Forouzan, TMH
- (5) Security in Computing by Charles P. Pfleeger, Pearson Education.
- (6) Computer Security Art and Science by Matt Bishop, Addison-Wesley.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL63	Software Engineering Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	CEL52 (System Analysis and Design Lab)	
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Select process model for a given problem.
	CO2	Plan, design, develop and validate software project.
	CO3	Use project management tools for estimation and scheduling of project and risk analysis.
	CO4	Apply advance software methodology to create high quality WebApps.
	CO5	Work in team to complete project.

Exp. No.	Experiment Details	Ref.	Marks
1	Create SRS in IEEE format for a case study.	1,2,3,4	05
2	Apply process model to a case study.	1,2,3,4	05
3	Create Work Breakdown Structure and schedule using project management tool for the case study.	1,2,3,4	05
4	Risk estimation.	1,2,3,4	05
5	Develop test plan. (Acceptance test plan, White box test cases)	1,2,3,4	05
6	Estimation using function point.	1,2,3,4	05
7	Implement prototype.	1,2,3,4	10
Total Marks			40

References:

- [1] Roger Pressman, Software Engineering: A Practitioners Approach, (6th Edition), McGraw Hill, 2010
- [2] Ian Somerville, Software Engineering, 9th edition, Addison Wesley, 2011
- [3] Eric J. Braude and Micheal E. Bernstein, Software Engineering Modern Approach, 2nd edition, Wiley, 2011.
- [4] Ali Behforooz Fredrick Hudson, Software Engineering Fundamentals, Oxford University Press, 2006.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL64	Digital Signal Processing Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	Digital Signal Processing < CE63 >		
At the End of the course students will be able to			
Course Outcomes	CEL63.1	Sample and reconstruct the signal.	
	CEL63.2	Implement signal manipulations, convolution and correlation Operations	
	CEL63.3	Develop DFT and FFT algorithm	
	CEL63.4	Develop DSP application.	

Exp. No.	Experiment Details	Ref.	Marks
1.	Sampling and Reconstruction	1,4	5
2.	Signal Operations	1,2,3,4	5
3.	Discrete Convolution	1,2	5
4.	Discrete Correlation	1,2	5
5.	Discrete Fourier Transform	1,2,3	5
6.	Fast Fourier Transform	1,2,3	5
7.	Overlap Add Method / Overlap Save Method	1,2,3	5
8.	Digital Signal Processing Application	1,3	5
Total Marks			40

References:

- [1] John G. Proakis, Dimitris and G. Manolakis, 'Digital Signal Processing: Principles, Algorithms, and Applications' 4th Edition 2007, Pearson Education, ISBN-978- 81-317-1000-5.
- [2] S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, 'Digital Signal Processing' Tata McGraw Hill Publication 1st Edition (2010). ISBN- 978-0-07-066924.
- [3] A. NagoorKani, "DIGITAL SIGNAL PROCESSING", McGraw Hill Education (India) Pvt Ltd, Second Edition.
- [4] Ashok Ambardar, 'Digital Signal Processing', Cengage Learning, 2007, ISBN: 978-81-315-0179-5.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL65	Machine Learning Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40					40	

Pre-requisite Course Codes		Python Programming
Course Outcomes	CO1	To understand NumPy and SciPy Libraries for Machine learning.
	CO2	To understand Matplotlib and Pandas Libraries for Machine learning.
	CO3	To understand Jupyter and Scikit-learn Libraries for Machine learning.
	CO4	To understand regression using libraries
	CO5	To understand classification for Machine learning

Exp. No.	Experiment Details	Ref.	CO	Marks
1	Perform following operations <ul style="list-style-type: none"> • Indexing • Handling non-existing values • Comparing runtime behaviours By using Numpy Library		CO1	5
2	Perform following operations <ul style="list-style-type: none"> • Reading in the data • Pre-processing and cleaning the data By using SciPy Library		CO1	5
3	Pandas Libraries and Matplotlib Libraries		CO2	5
4	Jupyter and Scikit-learn Libraries		CO3	5
5	Regression <ul style="list-style-type: none"> • Features and Labels • Forecasting and Predicting 		CO4	5
6	Logistic regression		CO4	5
7	Classification and Learning		CO5	5
8	Classification using KNN		CO5	5
Total Marks				40

References:

- [1] Peter Harrington "Machine Learning In Action", DreamTech Press.
- [2] Tom M. Mitchell "Machine Learning", McGrawhill Publication
- [3] Michael Bowles "Machine Learning in Python", Wiley Publication
- [4] Willi Richert Luis Pedro Coelho. "Building Machine Learning Systems with Python" PACKT Publication
- [5] Stephen Marsland "Machine Learning an algorithmic Perspective" CRC Press



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEP66	Minor Project-II	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		Phase-I:20 Phase-II:20		-		20		60

Pre-requisite Course Codes	All the Courses till VIth Semester.
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Minor Project-II is continuation of work done in Minor Project-I. Minor Project 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-II 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 Project-II:

- ✓ 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

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 solved in manageable in one semester.

Teachers must follow the below mentioned principles:



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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

- ✓ 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
- ✓ Efforts taken towards implementation and testing
- ✓ 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, 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 Selected approach, Justification and Design. Phase-II evaluation is based on demonstration of implementation, testing, 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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

References:

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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	



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		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

References:

- [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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
HSS61	Advance Communicative English	2	2	--	2	1	--	3
		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 competitive 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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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.		
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		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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

References:

- [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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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	EL 42: 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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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

References:

- [1] Robert Shilling, Fundamentals of Robotics - Analysis and control, Prentice Hall of India Fourth 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]



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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
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	7,8, 10	1



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		Assessment.		
	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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Exp. No	Experiment Details	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] Kenneth 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>



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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[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/>



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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:	7,8	1



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

		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.		
	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, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, 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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of 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,Raspberrry	1,2, 3,4	5



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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	Development Board.. Home automation using Voice Commands & Bluetooth.		
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 . 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.	1,2, 3,4	5
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	1,2, 3,4	5



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

	App Inventor.		
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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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.

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	04



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

	3.1	Crisp Logic, Fuzzy logic, Fuzzy Membership functions and operators	,7,8	
	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 References	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

References:

- [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.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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		
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		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

	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

References:

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 Gopaldaswamy Ramesh, “*Software Testing – Principles and Practices*”, Pearson education, 2006.



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

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

References:

1. Korth, Silberchatz, 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.