SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF INFORMATION TECHNOLOGY
COURSE CURRICULUM - 2019 PATTERN
THIRD YEAR B. TECH.

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute affiliated to SPPU, Pune)

DECLARATION

We, the Board of Studies **INFORMATION TECHNOLOGY**, hereby declare that, We have designed the Curriculum of **T.Y. B.Tech. Information Technology** of Pattern **2019** w.e.f. A.Y. **2021-2022** as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

BoS Chairman

Head
Department of Information Technology
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Approved by

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Sanjivani College of Engineering
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PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopargaon is one among the premier technical institutes in Maharashtra state in the un-aided sector established in 1983. Department of Information Technology is established in the year 2001 with an intake of 60 students. Department is acquainted with 8 well equipped laboratories with latest hardware and Software, 3 class rooms and one tutorial Hall equipped with modern teaching aids and computing facilities. UG Program in IT department is accredited by NBA New Delhi for Second time in Academic Year 2019-2020 for three Years.

There are 15 experienced & well qualified teaching staff members & 6 supporting staff members who carry out the regular academic activities as well as curricular & extracurricular activities as per the plans prepared in advance at the beginning of every semester.

In the academic year 2019-2020 strength of students in department is 275. Apart from regular academic activities students take part in curricular & co curricular activities conducted by department organization ITERA as well as other department's organization & professional bodies in the institute like CSI, ISTE, and IEEE etc. Apart from the central library the department has its own library with a very good collection of reference book, text books and CSI magazines, IEEE magazines.

Along with regular academics Department of IT has started value added courses like SAP Certification Training Programme in collaboration with Primus Techsystems Pvt. Ltd. Pune and REDHAT Academy Centre, MBPS Infotech Pune.

IT Department has started capsule courses to improve technical skill sets of students. Department is having very good placements in various renowned and multi-national companies like TCS, Infosys, Persistent, Cognizant Wipro and many more.

Also to form well balanced Industry Interaction connect and bridge the gap between Industry and institution Department of IT has organized different events like Sanjivani Though Leader, Sanjivani I-connect and Sanjivani My Story Board.

Various personal and professional skill development programs like Communication and Soft Skill programs, Aptitude Training, Technical Skill enhancement programs, Foreign Language Certification Courses, Personal and Spiritual Development Programs, Entrepreneurship Development Activities, and Preparation courses for competitive Examinations (Gate/GRE/CAT etc.) are made available in campus. Students are given opportunities to develop and nurture their leadership qualities through Student Associations, Student Council, Professional Body activities and working as volunteers in various events organized at Department/ College level.

VISION AND MISSION

Vision of Institute

To develop world class professionals through quality education.

Mission of Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of Department

To develop world class IT professionals through quality education.

Mission of Department

To create Academic Excellence in the field of Information Technology through Education, Industry Interaction, Training and Innovation to improve quality of life of people.

We are committed to develop industry competent technocrats with life-long learning capabilities and moral values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1:

Graduates of IT program should possess knowledge of fundamental concepts in mathematics, science, engineering and technology as well as skills in the field of Information Technology for providing solution to complex engineering problem of any domain by analyzing, designing and implementing.

PEO 2:

Graduates of IT program should possess better communication, presentation, time management and teamwork skills leading to responsible and competent research, entrepreneurship and professionals, will be able to address challenges in the field of Information Technology at global level.

PEO 3:

Graduates of IT program should have commitment to societal contributions through communities and life-long learning.

PROGRAM OUTCOMES

PO1:Engineering knowledge

Apply the knowledge of mathematics, science,engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3:Design/development of solutions

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4:Conduct investigations of complex problems

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:The engineer and society

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7:Environment and sustainability

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9:Individual and team work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10:Communication

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12:Life-long learning

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES
PSO1:
Attain the ability to provide software solutions by applying knowledge of Data Structures & Algorithms, Databases, Web Technology, System Software, Soft Computing and Cloud Computing.
PSO2:
Apply the knowledge of Computer Hardware & Networking, Cyber Security, Artificial Intelligence and Internet of Things to effectively integrate IT based solutions.
PSO3:
Apply the knowledge of best practices and standards of Software Engineering for Project Management.

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

COURSE STRUCTURE- 2019 PATTERN
THIRD YEAR B. TECH. INFORMATION TECHNOLOGY

SEMESTER- V

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
Cat.	Code		L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PRJ	IT301	Professional Internship-II	-	-	-	2	-	-	-	50	-	-	50
PC	IT302	System Programming and Operating System	4	-	-	4	30	50	20	-	-	-	100
PC	IT303	Computer Network	3	-	-	3	30	50	20	-	-	-	100
PC	IT304	Internet of Things	3	-	-	3	30	50	20	-	-	-	100
PC	IT305	Theory of Computation	3	-	-	3	30	50	20	-	-	-	100
PEC	IT306	Professional Elective-I	3	-	-	3	30	50	20	-	-	-	100
PC	IT307	System Programming and Operating system	-	-	2	1	-	-	-	-	50	-	50
PC	IT308	Computer Network Laboratory	-	-	2	1	-	-	-	50	-		50
PC	IT309	Internet of Things Laboratory	-	-	2	1	-	-	-	-	-	50	50
PRJ	IT310	Skill Based Credit Course	1	-	-	1	-	-	50	-	-	-	50
MC	MC311	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	18	-	6	22	150	250	150	100	50	50	750

IT310	Skill Based Credit Course	Minimum 12 week course to be conducted in association with the industry on software product development.
MC311	Mandatory Course-V	Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

Professional Elective- I	
Course Code	Course
IT306A	Cloud Computing
IT306B	Foundation of Data Science
IT306C	Data Mining Techniques
IT306D	Compiler Design

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SEMESTER- VI

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
Cat.	Code		Theory				Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CIA				
PC	IT312	Cryptography and Cyber Security	3	-	-	3	30	50	20	-	-	-	100
PC	IT313	Artificial Intelligence	3	-	-	3	30	50	20	-	-	-	100
PE	IT314	Professional Elective-II	3	-	-	3	30	50	20	-	-	-	100
OE	IT315	Open Elective-I	4	-	-	4	30	50	20	-	-	-	100
PRJ	PR316	IPR & EDP	2	-	-	1	15	25	10	-	-	-	50
PRJ	PR317	IPR & EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PC	IT319	Cyber Security Laboratory	-	-	2	1	-	-	-	-	50	-	50
PC	IT320	Artificial Intelligence Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
		Total	17	-	08	20	135	225	90	50	50	100	650

Professional Elective- II		Open Elective-I	
Course Code	Course	Course Code	Course
IT316A	Software Testing and Quality Assurance	IT315 OE1	Object Oriented Programming with JAVA/ C++
IT316B	Big Data Analytics	Equivalent courses for IT315: 1. NPTEL Course: "Object Oriented Programming with C++". 2. NPTEL Course: "The Joy of Computing using Python". 3. NPTEL Course: "Programming in Java". 4. NPTEL Course: "Blockchain and it's Applications".	
IT316C	Natural Language Processing		
IT316D	Optimization Techniques		

Mandatory Course-VI	
MC320	Suitable Technical / Non-Technical Activities finalized by Department

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T.Y. B. Tech Information Technology Semester V

IT 301 : Professional Internship-II

Teaching Scheme	Examination Scheme	
Lectures: NA	Oral Exam:	50 Marks
Credits: 2	Total :	50 Marks

Course Objectives
1. To get opportunity to observe current technological developments relevant to the program.
2. To get opportunity to learn, understand and sharpen the real time technical skills.
3. To get exposure of the industrial environment.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** the current technological developments relevant to the program.	2	Understand
CO2	**Apply** technical skills to propose solution to real-time problems.	3	Apply
CO3	**Acquire** professional competency in Information Technology.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	3	2	3	2	3	2	3	3	2	2	-	-	3
CO2	-	2	2	-	3	-	-	-	3	3	2	2	-	-	3
CO3	2	--	2	-	3	2	2	-	3	3	-	2	-	-	3

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Course Contents
Guidelines for Internship

Minimum of six weeks in an Industry in the area of Information Technology. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report.

1	Two guides shall supervise the internship project work, one from the department and another one from industry.
2	Industry shall submit the month-wise satisfactory attendance of the students to the institute/department
3	Student must regularly use daily diary which is to cultivate the habit of documenting.
4	The presentation is way to evaluate student performance, so student must be ready as they are evaluated by institute guide, internal and external examiner.
5	Student must submit a comprehensive report to the department before presentation.

Steps to apply for internship	
1	Students shall ask for permission letter from IT Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot various slots of 4 to 6 weeks during as internship periods.
2	Students on joining Training at the concerned Industry must submit the permission letter from the office of Training & Placement cell of the college.
3	Students must regularly use dairy to record the details and submit attendance in internship report.
4	Students shall be obtained Training Certificate from industry.
5	Students shall submit training report after completion of internship to guide.

Evaluation process for internship	
1	Students must submit training report and training certificate from industry after completion of internship to guide.
2	Guide will access performance of student through presentation which is evaluated by institute guide and external examiner from institute itself.

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IT302: System Programming and Operating System

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 4	Total:	100 Marks

Prerequisite Course: Computer Fundamentals & Programming.

Course Objectives
1. To understand the basics of System Programming.
2. To provide an understanding of basics of Compiler design.
3. To study the concepts of process management.
4. To study the concepts of process synchronization.
5. To learn and understand memory management techniques.
6. To learn and understand I/O management techniques.

Course Outcomes (COs):
After successful completion of the course, student will be able to

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Analyze** and synthesize the System Software.	4	Analyze
CO2	**Evaluate** the phases of Compiler.	2	Understand
CO3	**Evaluate** the Processes management.	3	Apply
CO4	**Use** of the Synchronization concepts.	3	Apply
CO5	**Apply** the concept of memory management techniques in Operating System.	3	Apply
CO6	**Understand** the I/O management.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	1	-	-	2	3	-	-	1	1	3	2	1
CO2	1	1	3	1	-	-	2	3	-	-	1	1	3	2	1
CO3	1	1	3	1	-	-	2	3	-	-	1	1	3	2	1
CO4	1	1	3	1	-	-	2	1	-	-	1	3	3	2	1
CO5	1	1	3	1	-	-	2	1	-	-	1	3	3	2	1
CO6	1	1	3	1	-	-	2	1	-	-	1	3	3	2	1

	Course Contents		
Unit-I	**INTRODUCTION TO SYSTEM SOFTWARE**	**No. of Hours**	**COs**
	Introduction to components of System Software: Text editors, Loaders, Linkers, Assemblers, Macro processors, Compilers, Debuggers. Machine Structure. Assemblers: General design procedure, Design of two pass assembler, Single pass assembler. Macro Processor: Macro instructions, Features of macro facility, Design of two-pass, single pass and nested macro processor.	08	CO1
Unit-II	**INTRODUCTION TO COMPILERS**	**No.of Hours**	**COs**
	Phases of Compiler, Lexical analysis: Token, patterns and Lexemes & Lexical Errors, regular definitions for the language constructs & strings, sequences. Syntax Analysis: Grammars, Top-down v/s bottom up parsing. Semantic Analysis: SDT and dependency trees. Intermediate code generation –Three address code Intermediate Code forms.	08	CO2
Unit-III	**INTRODUCTION TO OS AND PROCESS MANAGEMENT**	**No. of Hours**	**COs**
	Introduction: Types of OS, System Components, OS services, System structure- Layered Approach. Process Management: Process Concept- Process states, Process control block, Threads. Process Scheduling: Types of process schedulers. Types of scheduling: Pre-emptive, Non pre-emptive. Scheduling algorithms: FCFS, SJF, RR, and Priority.	08	CO3
Unit-IV	**PROCESS SYNCRONIZATION**	**No. of Hours**	**COs**
	Mutual Exclusion: Concurrency, Mutual Exclusion: Hardware Support, Semaphores and Mutex, Monitors. Producer and Consumer problem, Interprocess communication. Deadlocks: Methods of handling deadlocks, Deadlock prevention, avoidance and detection, Recovery from deadlocks.	08	CO4
Unit-V	**MEMORY MANAGEMENT**	**No. of Hours**	**COs**
	Storage allocation methods, Contiguous and non-contiguous, Swapping, Paging, Segmentation, Segmentation with Paging. Virtual Memory, Demand paging. Page replacement scheme- FIFO, LRU, Optimal, Thrashing.	08	CO5
Unit-VI	**I/O Management**	**No. of Hours**	**COs**
	I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Hardware organization, device scheduling policies, device drivers Disk Scheduling- Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN.	08	CO6

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Text Books:
1. William Stallings, "Operating System: Internals and Design Principles", Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition.
2. Silberscharz, A. and Galvin, P.B., "Operating System Concepts", 7th Edition, Addison-Wesley, ISBN 978-1-118-06333-0.
3. Dhamdhere D.M., "System Programming & Operating Systems", 2nd Edition, Tata McGraw-Hill, ISBN 0 - 07 - 463579 – 4.
4. Godbole, "Operating System", Tata-McGraw Hill.
Reference Books:
1. Beck, L.L., "System Software", 3rd Edition, Addison Wesley.
2. Bryant, R.E. and O' Hallaron, D.R., "Computer Systems: A Programmer's Perspective", Prentice-Hall of India.
3. Nutt, G., "Operating Systems", Addison-Wesley, 2004.
4. Joshi, R. C. and Tapaswi, S., "Operating Systems", Wiley Dreamtech.
5. Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India.
eLearning Resources
1. **Online Course:** Dr. S. Sasikala, "Operating Systems", Swayam, https://onlinecourses.swayam2.ac.in/cec21_cs20/preview
2. **eBook:** Operating System and Middleware: Supporting Controlled Interaction, https://gustavus.edu/mcs/max/os-book/osm-rev1.3.1.pdf

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IT303: Computer Network	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment:** **20 Marks**
	In-Sem Exam: **30 Marks**
	End-Sem Exam: **50 Marks**
Credits: 3	**Total:** **100 Marks**
Prerequisite Course: Digital Electronic & Computer Organization	

Course Objectives
1. To learn about computer network fundamentals.
2. To learn different techniques for error control and flow control.
3. To learn about channel allocations and multiple access protocols.
4. To understand various routing algorithm.
5. To learn transportation in network programming.
6. To learn different protocols of application layer.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	**Descriptor**
CO1 **Understand** computer network fundamentals.	2	Understand
CO2 **Detect** different techniques for error control and flow control.	2	Understand
CO3 **Understand** channel allocations and multiple access protocols.	2	Understand
CO4 **Understand** various routing algorithm.	2	Understand
CO5 **Apply** transportation in network programming.	3	Apply
CO6 **Analyze** different protocols of application layer.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	1	1	1	1	3	1	3	3	3	2
CO2	1	3	1	1	3	1	1	1	2	3	1	3	3	3	2
CO3	1	1	1	1	2	1	1	1	2	3	1	3	2	3	2
CO4	3	3	2	1	3	1	2	1	3	3	1	3	2	3	2
CO5	2	1	1	1	2	1	2	1	2	3	1	3	3	3	2
CO6	1	2	1	1	1	1	1	1	1	3	1	3	2	3	2

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Introduction of LAN; MAN; WAN; PAN, The OSI reference model, TCP/IP reference model, Data and transmission techniques, CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Hub, Bridge, Switch, Router, Reference Model: Multiplexing: FDM, WDM, TDM.	06	CO1
Unit-II	**PHYSICAL & DATALINK LAYER**	**No.of Hours**	**COs**
	Topologies: Star and Hierarchical, Transmission media: Guided media & Unguided Media, Layer design issues, services provided to network layers, Error Control: Parity Bits, Hamming Codes, CRC Data link control and protocols – Simplex protocol, Stop-and Wait Protocol, Piggybacking.	06	CO2
Unit-III	**MEDIUM ACCESS LAYER**	**No. of Hours**	**COs**
	Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access protocol: Reservation, Polling, Token Passing, IEEE 802.11 Project: Architecture, MAC Sublayer, Bluetooth: Architecture, Layers.	06	CO3
Unit-IV	**NETWORK LAYER**	**No. of Hours**	**COs**
	Network Layer design issues, IP: IPv4 & IPv6, NAT, Routing algorithms and protocols: Unicast Distance Vector Routing, Link State Routing, Unicast Routing Protocols: RIP, EIGRP, OSPF, BGP, Congestion Control Algorithms, N/W Layer Protocols: ARP Protocol, RARP, DHCP, ICMPv4.	06	CO4
Unit-V	**TRANSPORT LAYER**	**No. of Hours**	**COs**
	Transport services, Design issues, Transport Layer Protocols: UDP: Datagram, Services, Applications: Header, Services, Features, Segment, SCTP: Header, Services, Features, Packet Format, Socket: TCP and UDP Socket.	06	CO4
Unit-VI	**APPLICATION LAYER**	**No. of Hours**	**COs**
	Application layer protocol: HTTP, WWW, DNS, SMTP, FTP, TFTP, POP3, IMAP, MIME, SNMP.	06	CO6

Text Books:

1. Andrew S. Tanenbaum, David J. Wethrall, "Computer Network", Pearson Education, ISBN: 978-0-13-212695-3.
2. Behrouz A. Forouzan, "TCP/IP Protocol Suite", McGraw Hill Education, 4th Edition, ISBN: 978-0-07-070652-1.

Reference Books:

1. Behrouz A. Forouzan, "Data Communication and Networking", McGraw Hill Education, 5th Edition, ISBN: 978-1-25-906475-3.
2. Mayank Dave, "Computer Network", Cengage Learning, ISBN: 978-81-315-0986-9.
3. Kurose Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, ISBN: 978-81-7758-878-1.

IT304: Internet of Things

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Digital Electronic & Computer Organization		

Course Objectives

1. To understand fundamentals of Internet of Things (IoT).
2. To understand the fundamental of IoT Network Architecture and Design.
3. To develop comprehensive approach towards building Middleware for IoT and Security Challenges.
4. To learn about the Fundamental IoT Mechanism and Key Technologies.
5. To understand fundamentals of cloud of things in IoT,
6. To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1	**Explain** the given societal challenge using IoT.	2	Understand
CO2	**Demonstrate** IoT systems based on IoT design methodologies.	3	Apply
CO3	**Choose** between available platform for stated IoT challenge	2	Understand
CO4	**Implement** Fundamental IoT Mechanism and Key Technologies for IoT specified Environment.	3	Apply
CO5	**Design** and Implement Cloud based IoT implementations for real-world applications.	3	Apply
CO6	**Analyze** real world application scenarios of IoT along with its societal and economic impact using case studies.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO2	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO3	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO4	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO5	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO6	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-

Course Contents			
Unit-I	**INTRODUCTION TO IOT**	**No. of Hours**	**COs**
	IoT Definition, General Observations, Overview and Motivation, Examples of Application, Exemplary Devices: Raspberry Pi, Arduino, Beagle Bone Black, Types of Sensor, IPv6 Role, Areas Development and Standardization, Scope of the Present Investigation.	06	CO1
Unit-II	**NETWORKING**	**No. of Hours**	**COs**
	Comparing IoT Architectures, A simplified IoT Architecture, The Core of IoT functional Stack, IoT Data Management and Compute Stack, SMAC Stack, IoT Protocols.	06	CO2
Unit-III	**MIDDLEWARE FOR IoT**	**No. of Hours**	**COs**
	Platform middleware – Embedded IoT Devices - communication middleware – M2M – RFID – WSN - SCADA – software middleware – Frameworks – Data standards – 5G for IoT, IoT information Security, Privacy and Governance.	06	CO3
Unit-IV	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES**	**No. of Hours**	**COs**
	Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology.	06	CO4
Unit-V	**IoT PHYSICAL SERVERS AND CLOUD OFFERINGS**	**No. of Hours**	**COs**
	Introduction to Cloud Storage Models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform.	06	CO5
Unit-VI	**CASE STUDIES**	**No. of Hours**	**COs**
	Case Studies: Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards Tracking (Following and Monitoring Mobile Objects).	06	CO6

Text Books:

1. Honbo Zhou, "The Internet of Things in the Cloud A Middleware Perspective", CRC Press, 2013.
2. AdrainMcEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete,"IoT Fundamentals: Networking Technologies, Protocols, Use cases for the Internet of things", Cisco Press – Paperback- 16 August 2017 978-1-58714-456- 1 599.

Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publication- 2013 978-1-118-47347-4, 466.
2. Arshdeep Bahga, Vijay K. Madisetti, "Internet of Things A Hands-on Approach", VPT, 1st Edition, 2014.
3. Rolf H. Weber, Romana Weber, "Internet of Things Legal Perspectives", Springer 2010, ISBN

978-3-642-11709-1.

IT305: Theory of Computation

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Engineering Mathematics IV		

Course Objectives
1. To Learn Finite Automata and Finite State Machine.
2. To Study Regular Expression, Pumping Lemma and Properties of Regular Languages.
3. To Understand Context Free Grammar and Context Free Languages.
4. To Learn Pushdown Automata, Post Machines and its construction.
5. To Study Turing Machine and variants of Turing Machine.
6. To Learn Decidable Languages and Turing Reducibility.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Apply** the concepts offinite state machines to solve computing problems.	3	**Apply**
CO2	**Solve** the different regular expressions for the regular languages.	3	**Apply**
CO3	A**pply** well defined rules for verification and simplification of context free grammar.	3	**Apply**
CO4	**Apply** the basic concepts of Push Down Automata and Post Machine for construction of Machines for context free languages.	3	**Apply**
CO5	**Understand** the variants of Turing Machine for formal languages.	2	**Understand**
CO6	Express the **understanding** of the decidability and its problems.	2	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	1	-	1	-	-	2	2	1	-	-
CO2	2	2	2	2	-	1	1	2	-	-	1	2	-	-	-
CO3	3	2	2	2	-	1	-	1	-	1	1	2	2	-	-
CO4	3	2	2	2	-	1	-	1	-	-	-	2	-	-	-
CO5	3	2	3	2	-	1	-	1	-	-	-	2	1	-	-
CO6	2	3	3	2	-	1	-	1	-	-	2	1	1	-	-

Course Contents			
Unit-I	**FINITE STATE MACHINE**	No. of Hours	COs
	Basic Machine and Finite State Machine. FSM without output: Definition and Construction-DFA, NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA. FSM with output: Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.	06	CO1
Unit-II	**REGULAR EXPRESSIONS**	No.of Hours	COs
	Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Language from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.	06	CO2
Unit-III	**CONTEXT FREE LANGUAGES**	No. of Hours	COs
	Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languages, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular grammar, equivalence of RG(LRG and RLG) and FA.	06	CO3
Unit-IV	**PUSHDOWN AUTOMATA (PDAs)**	No. of Hours	COs
	Push Down Automata: Introduction and Definition of PDA, Construction (Pictorial/ Transition diagram) of PDA, Instantaneous Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondeterministic PDA, Closure properties of CFLs, Introduction Post Machine- Definition.	06	CO4
Unit-V	**TURING MACHINES (TMs)**	No. of Hours	COs
	Formal definition of a Turing machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing machines, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine, Nondeterministic Turing machines. Comparisons of all automata.	06	CO4
Unit-VI	**DECIDABILITY AND REDUCIBILITY**	No. of Hours	COs
	Decidability: Decidable problems concerning regular languages, Decidable problems concerning context-free languages, Un-decidability, Halting Problem of TM, A Turing-unrecognizable language. Reducibility: Un-decidable Problems from Language Theory, A Simple Un-decidable Problem PCP, Mapping Reducibility.	06	CO6

Text Books:

1. Michael Sipser, "Introduction to the Theory of Computation", CENGAGE Learning, 3rd Edition ISBBN-13:978-81-315-2529-6.
2. Vivek Kulkarni, "Theory of Computation", Oxford University Press, 3rd Edition, ISBN-13: 978-0-19-808458-7.

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Reference Books:
1. Hopcroft Ulman, "Introduction to Automata Theory, Languages and Computations", Pearson Education Asia, 2nd Edition, ISBN: 9788131720479.
2. Daniel I. A. Cohen, "Introduction to Computer Theory", Wiley-India, 2nd Edition, ISBN: 978-81-265-1334-5.
3. K.L.P Mishra, N. Chandrasekaran, "Theory of Computer Science (Automata, Languages and
4. Computation)", Prentice Hall India, 2nd Edition.
5. John C. Martin, "Introduction to Language and Theory of Computation", TMH, 3rd Edition, ISBN: 978-0-07-066048-9.
6. Kavi Mahesh, "Theory of Computation: A Problem Solving Approach", Wiley-India, 3rd Edition, ISBN:978-81-265-3311-4.
7. BasavarajS.Anami, Karibasappa K.G, "Formal Languages and Automata Theory", Wiley India, ISBN: 9788126520107.

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IT306A: Cloud Computing (Professional Elective-I)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment:** **20 Marks**
	In-Sem Exam: **30 Marks**
	End-Sem Exam: **50 Marks**
Credits: 3	**Total:** **100 Marks**
Prerequisite Course: Digital Electronics & Computer Organization	

Course Objectives
1. To understand the fundamental of Cloud Computing.
2. To gain the knowledge of Cloud IaaS Service.
3. To gain the knowledge of Cloud PaaS Service.
4. To gain the knowledge of Cloud SLA Management.
5. To gain the knowledge of Cloud Security
6. To introduce the challenges of Cloud which motivates the students towards research.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the need of cloud computing	**2**	**Understand**
CO2	**Understand** the importance of IaaS service of Cloud computing	**2**	**Understand**
CO3	**Understand** PaaS service of Cloud computing	**2**	**Understand**
CO4	**Understand** the role of SLA in cloud computing	**2**	**Understand**
CO5	**Understand** Cloud Security	**2**	**Understand**
CO6	**Understand** the issues and challenges of cloud computing which will lead students towards research platform.	**2**	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO2	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO3	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO4	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO5	3	2	3	1	2	-	1	3	2	--	1	1	3	2	1
CO6	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1

Course Contents			
Unit-I	**INTRODUCTION TO CLOUD COMPUTING**	**No. of Hours**	**COs**
	Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks.	06	CO1
Unit-II	**INFRASTRUCTURE AS A SERVICE (IAAS)**	**No. of Hours**	**COs**
	Introduction and Inspiration, Background and Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine (VM) Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context, Future Research Directions.	06	CO2
Unit-III	**PLATFORM AS A SERVICE (PAAS)**	**No. of Hours**	**COs**
	Introduction, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, Aneka Resource Provisioning Service, Hybrid Cloud Implementation, Visionary thoughts for Practitioners.	06	CO3
Unit-IV	**SLA MANAGEMENT IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.	06	CO4
Unit-V	**SECURITY IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Introduction Cloud in Information Technology, Cloud General Challenges Security Aspects, Data Security, Data Center Security, Access Control, Encryption and Decryption Virtualization Security, Network Security- Platform-Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues Audit and Compliance, Disaster Recovery, Privacy and Integrity	06	CO5
Unit-VI	**CHALLENGES AND ISSUES IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Cloud Computing Challenges: Security Policy Implementation, Virtualization Security Management, Virtual Threats, VM Security Recommendations, VM-Specific Security Techniques, Cloud Computing Scheduling Challenges, Cloud Computing SLA Challenges, Cloud Computing power management challenges.	06	CO6

Text Books:
1. Prof. K. Chandrashekharan, "Essentials of Cloud Computing", CRC Press, Taylor & Francis Group.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley India, ISBN: 9788126541256.
3. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things", Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
4. Thomas Erl, ZaighamMahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology & Architecture", Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition.

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Reference Books:
1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing: Foundations and Applications Programming", McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley, ISBN: 978 8126529803.
3. Gautham Shroff, "Enterprise Cloud Computing", Cambridge, ISBN: 9781107648890.
4. Ronald L. Krutz and Russell D. Vines, "Cloud Security: A Comprehensive guide to Secure Cloud Computing", Wiley, ISBN: 9788126528097.
5. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, "OpenStack: Cloud Application Development", Wrox, ISBN :9781119194316.
6. KailashJayaswal, JagannathKallakurchi, Donald J. Houde, "Cloud Computing Black Book",Wiley Dreamtech,ISBN:9789351194187.

IT306B: Foundation of Data Science (Professional Elective-I)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Engineering Mathematics, Database Management Systems		

Course Objectives

1. To introduce the data mining basics.
2. To introduce the origins of big data.
3. To introduce the fundamentals of big data.
4. To introduce the classification techniques of data.
5. To introduce the clustering techniques of data.
6. To introduce the data analytics with case study.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** concept of data mining.	2	Understand
CO2	**Understand** the sources of big data.	2	Understand
CO3	**Analyze** the fundamentals of big data.	4	Analyze
CO4	**Analyze** various classifications techniques of data.	4	Analyze
CO5	**Apply** various clustering techniques of data.	3	Apply
CO6	**Apply** the data analytics case study.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	-	1	3	2	-	1	1	2	3	1
CO2	3	2	3	1	2	-	1	3	2	-	1	1	2	3	1
CO3	3	2	3	1	2	-	1	3	2	-	1	1	2	3	1
CO4	3	2	3	1	2	-	1	3	2	-	1	1	2	3	1
CO5	3	2	3	1	2	-	1	3	2	--	1	1	2	3	1
CO6	3	2	3	1	2	-	1	3	2	-	1	1	2	3	1

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Course Contents			
Unit-I	**INTRODUCTION TO DATA MINING**	**No. of Hours**	**COs**
	Need of Data Mining, procedure of Data Mining, various kinds of data for mining- Database Data, Data Warehouses, Transactional Data, Other Kinds of Data, Limitations of Data mining - Mining Methodology, User Interaction, Efficiency and Scalability, Diversity of Database Types, Data Mining and Society.	06	CO1
Unit-II	**ORIGINS TO GENERATE BIG DATA**	**No.of Hours**	**COs**
	Sensors/meters and activity records from electronic devices- case study, Social interactions- case study, Business transactions- case study, Electronic Files- case study, Broadcastings- case study.	06	CO2
Unit-III	**FUNDAMENTALS OF BIG DATA**	**No. of Hours**	**COs**
	Aspects of Big data – structured data, Unstructured data, Natural Language, Machine generated data, graph-based data, big data architecture, audio, image and video data, streaming data, Data science process- necessity to prepare data, retrieving data, preparation of data, data explosion, data modeling and model building, presentation and automation.	06	CO3
Unit-IV	**BASICS OF DATA CLASSIFICATION**	**No. of Hours**	**COs**
	Concept of Data classification, Introduction of Decision tree, Bayes Classification, Rule based classification, Model Evaluation and Selection, Bayesian Belief Networks, Support Vector Machines, Genetic Algorithms, Rough Set Approach, Fuzzy Set Approaches, Classification accuracy improvement techniques.	06	CO4
Unit-V	**BASICS OF CLUSTERING**	**No. of Hours**	**COs**
	Introduction of Clustering, need to use Clustering, K-means Preliminaries, The K-means Algorithm, How to Evaluate Clustering, Beyond K-means: What Really Makes a Cluster, Beyond K-means: Other Notions of Distance, Beyond K-means: Grouping Data by Similarity, Data and Pre-Processing, Big Data and Nonparametric Bayes.	06	CO5
Unit-VI	**DATA ANALYTICS LIFECYCLES**	**No. of Hours**	**COs**
	Data Analytics Lifecycles overview, Discovery, data preparation, Model planning, Model building, Communication results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA).	06	CO6

Text Books:
1. Jiawei Han, MichelineKamber, Jian Pei,"Data Mining- Concepts and Techniques", 3rd Edition, ISBN 978-0-12-381479-1.
2. DT Editorial Services, "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Dreamtech Publication, ISBN- 9789351199311.
3. Li Chen, Zhixun Su, Bo Jiang, "Mathematical Problems in Data Science", Springer, ISBN :978-3-319- 25127-1.

Reference Books:
1. Michael Minelli, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic

Trends for Today's Business", Wiley CIO Series.
3. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", IBM Corporation, ISBN:978-1-58347-380-1.
4. EMC Education Services, "Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data", Wiley, 1st Edition, ISBN-13978-1118876138.

IT306C: Data Mining Techniques (Professional Elective-I)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment:** **20 Marks**
	In-Sem Exam: **30 Marks**
	End-Sem Exam: **50 Marks**
Credits: 3	**Total:** **100 Marks**
Prerequisite Course: Engineering Mathematics, Database Management Systems	

Course Objectives
1. To understand the fundamentals of Data Mining.
2. To identify the appropriateness and need of mining the data.
3. To learn the pre-processing, mining and post processing of the data.
4. To understand various methods, techniques and algorithms in data mining.
5. To study concepts of pattern based data mining for decision making.
6. To understand Data Mining needs and Application.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	**Descriptor**
CO1 **Apply** basic, intermediate and advanced techniques to mine the data.	3	**Apply**
CO2 **Analyze** the output generated by the pre-processing of data.	4	**Analyze**
CO3 **Explore** the hidden patterns in the data	4	**Analyze**
CO4 **Demonstrate** the algorithms used for text mining	3	**Apply**
CO5 **Implement** mining techniques for realistic data.	3	**Apply**
CO6 **Understand** the various kinds of tools.	2	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	-	-	-	-	-	2	-	-	3	-	-
CO2	3	1	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	1	2	3	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO5	3	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO6	2	1	2	3	-	3	2	-	-	-	-	-	2	-	-

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Course Contents		
Unit-I **INTRODUCTION**	**No. of Hours**	**COs**
Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute; Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Pre-processing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal; scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data, Discretization: Binning, Histogram Analysis.	06	CO1
Unit-II **ASSOCIATION RULES MINING**	**No. of Hours**	**COs**
Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.	06	CO2
Unit-III **CLASSIFICATION**	**No. of Hours**	**COs**
Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbour Classifiers, Case-Based Reasoning.	06	CO3
Unit-IV **CLUSTERING**	**No. of Hours**	**COs**
Cluster analysis, distance measures, partitioning methods – k-means, k-medoids, hierarchical methods – single-link, complete-link, centroid, average link, Agglomerative method.	06	CO4
Unit-V **TEXT AND WEB MINING**	**No. of Hours**	**COs**
Text mining: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Feature vector, Bag of words, Tf-idf, Text Mining Approaches. Web mining: Introduction, web content mining, web usage mining, web structure mining, web crawlers.	06	CO5
Unit-VI **REINFORCEMENT LEARNING AND BIG DATA MINING**	**No. of Hours**	**COs**
Reinforcement learning- Introduction to reinforcement and holistic learning, Multi-perspective decision making for Big data and multi-perspective learning for big data, Advanced techniques for big data mining.	06	CO6
Text Books:		
1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN: 9780123814791, 9780123814807. 2. Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making",		

Wiley-IEEE Press, ISBN: 978-0-470-91999-6.

Reference Books:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More", Shroff Publishers, 2nd Edition, ISBN: 9780596006068.
2. Saumen Charkrobarti, "Mining the Web Discovering Knowledge from Hypertext Data", Morgan Kaufmann, ISBN-13978-1558607545.
3. M. Dunham, "Data mining: Introductory and Advanced topics", Pearson Education, 2003.

IT306D: Compiler Design (Professional Elective-I)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Theory of Computations		

Course Objectives
1. To understand the theory and practice of compiler implementation.
2. To study finite state machines and lexical scanning
3. To learn context free grammars, compiler parsing techniques.
4. To learn construction of abstract syntax trees and symbol tables.
5. To understand Intermediate machine representations.
6. To learn actual code generation and code optimization.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** the different phases of compiler and compiler construction tools.	2	Understand
CO2	Design and **Implement** lexical analyzer and syntax analyzer.	3	Apply
CO3	**Apply** the concepts of grammars and compiler parsing techniques.	3	Apply
CO4	**Implement** abstract syntax trees and symbol tables using syntax directed translation.	3	Apply
CO5	**Understand** the intermediate code generation phase.	2	Understand
CO6	**Understand** code generation and to identify the sources of optimization.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	1	-	1	-	-	2	2	1	-	-
CO2	3	2	3	2	-	1	1	2	-	-	1	2	-	-	-
CO3	2	2	3	1	-	1	-	1	-	1	1	2	2	-	-
CO4	3	1	2	2	-	1	-	1	-	-	-	2	-	-	-
CO5	3	2	2	2	-	1	-	1	-	-	-	2	1	-	-
CO6	2	2	2	1	-	1	-	1	-	-	2	1	1	-	-

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		No. of Hours	COs
	Course Contents		
Unit-I	**INTRODUCTION**	No. of Hours	COs
	Introduction: Compilers Analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases, Bootstrapping and Compiler construction tools, Symbol Table. Introduction to Finite Automata and Regular Expression. Introduction to Grammar.	06	CO1
Unit-II	**LEXICAL ANALYSIS**	No. of Hours	COs
	Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, From Regular expression to Automata and Design of Lexical Analysis generator.	06	CO2
Unit-III	**SYNTAX ANALYSIS**	No. of Hours	COs
	Role of the parse, Writing Grammars, Context-Free Grammars, Ambiguous Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, SLR Parser, Canonical LR Parser, LALR Parser.	06	CO3
Unit-IV	**SYNTAX DIRECTED TRANSLATION**	No. of Hours	COs
	Syntax Directed Translation: Syntax Directed Definitions, Application of SDT (Syntax Directed Translation) and SDT schemes.	06	CO4
Unit-V	**INTERMEDIATE CODE GENERATION**	No. of Hours	COs
	Intermediate Code Generation: Directed acyclic graphs, three-address code Intermediate languages - Declarations, Assignment Statements, Boolean Expressions, Array references, Back patching.	06	CO5
Unit-VI	**CODE GENERATION AND OPTIMIZATION**	No. of Hours	COs
	Code generation and Optimization: Issues, Basic Blocks and Flow Graphs, DAG representation of Basic Blocks, Optimization of basic Blocks, Peephole Optimization, Principal Sources of Optimization, Loop Optimization, Global Data Flow Analysis.	06	CO6

Text Books:

1. V Aho, R Sethi, J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson 2nd Edition, ISBN 81-7758-590-8.
2. Dick Grune, Bal, Jacobs, Langendoen, "Modern Compiler Design", Wiley, 2nd Edition, ISBN 81-265- 0418-8.

Reference Books:

1. Anthony J. Dos Reis, "Compiler Construction Using Java", JavaCC and Yacc Wiley, 1st Edition, ISBN 978-0-470-94959-7.
2. K Muneeswaran, "Compiler Design", Oxford University Press, 1st Edition, ISBN 0-19-806664-3.
3. J R Levin, T Mason, D Brown, "Lex and Yacc", O'Reilly, 2000, 2nd Edition, ISBN 81-7366-061-X.

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

IT307 : System Programming and Operating system Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	50 Marks
Credits: 1	Total:	50 Marks

Prerequisite Course: Computer Fundamentals& Programming, Data Structures.

Course Objectives

1. To implement basic language translator by using various needed data structures.
2. To make use of system calls and process scheduling algorithms.
3. To understand process synchronization.
4. To learn and understand I/O and memory management.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Apply** the programming construct to Implement Assembler and lexical analyzer.	3	Apply
CO2 **Use** system calls and process scheduling algorithms.	3	Apply
CO3 **Apply** process synchronization techniques.	3	Apply
CO4 **Apply** the Memory management algorithms and Disk scheduling	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	-	1	-	-	-	2	2	-	-	-	2	-
CO2	1	-	2	-	1	-	-	-	2	2	-	-	-	2	-
CO3	1	-	2	-	1	-	-	-	2	2	-	-	-	2	-
CO4	1	-	2	-	-	-	-	-	2	1	-	2	1	-	-

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

Guidelines: This System Programming and Operating System Laboratory course has System Programming and Operating System as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in C or C++ or Java Language.

Sr. No.	Assignment	No. of Hours	COs
	Suggested List of Assignments		
1.	Assignment Based on Implementation of Two Pass Assembler.	2 Hrs.	CO1
2.	Assignment Based on lexical analyzer.	2 Hrs.	CO1
3.	Assignment based on use of system calls.	2 Hrs.	CO2
4.	Assignment based on process scheduling algorithms.	2 Hrs.	CO2
5.	Assignment Based on Process Synchronization.	2 Hrs.	CO3
6.	Assignment based on deadlock handling algorithms.	2 Hrs.	CO3
7.	Assignment Based on Page Replacement Algorithm.	2 Hrs.	CO4
8.	Assignment Based on Disk Scheduling.	2 Hrs.	CO4

Text Books:

1. Paul Gries, Jennifer Campbll, Jason Montojo, "Practical Programming Second Edition", SPD, ISBN: 978-93-5110-469-8.
2. Silberscharz, A. and Galvin, P.B., "Operating System Concepts", 7th Edition, Addison-Wesley, ISBN 978-1-118-06333-0.

Reference Books:

1. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++",Prentice Hall of India.
2. Herbert Schildt, "Java2:The Complete Reference", Tata-McGraw Hill, 5th Edition, ISBN:9780070495432, 0070495432.

IT308 : Computer Network Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Term Work:	NA
	Oral :	50 Marks
	Practical:	NA
Credits: 1	Total:	50 Marks

Prerequisite Course: Digital Electronic & Computer Organization

Course Objectives

1. To design small size network and simulation using network simulator.
2. To implement routing algorithms.
3. To implement Network Address Translation.
4. To understand transport and application level protocols.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Design** small size network and simulation using network simulator.	3	Apply
CO2 **Implementation** of routing algorithms.	3	Apply
CO3 **Implementation of** Network Address Translation.	3	Apply
CO4 **Demonstrate** transport and application level protocols.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	1	1	1	1	3	1	3	3	3	2
CO2	1	3	1	1	3	1	1	1	2	3	1	3	3	3	2
CO3	1	1	1	1	2	1	1	1	2	3	1	3	2	3	2
CO4	3	3	2	1	3	1	2	1	3	3	1	3	2	3	2

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

Guidelines: This Computer Network Laboratory course has Computer Network as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in C or C++ or Java Language.

<table>
<tr><th colspan="4">Suggested List of Assignments</th></tr>
<tr><th>Sr. No.</th><th>Assignment</th><th>No. of Hours</th><th>COs</th></tr>
<tr><td>1.</td><td>Assignment on setting up a small IP network</td><td>2 Hrs.</td><td>CO1</td></tr>
<tr><td>2.</td><td>Assignment on network simulator.</td><td>2 Hrs.</td><td>CO1</td></tr>
<tr><td>3.</td><td>Assignment of implementation of various routing algorithms like Static and RIP.</td><td>2 Hrs.</td><td>CO2</td></tr>
<tr><td>4.</td><td>Assignment of implementation of various routing algorithms like EIGRP and OSPF.</td><td>2 Hrs.</td><td>CO2</td></tr>
<tr><td>5.</td><td>Assignment on configuration of Network Address Translation Static and Dynamic using suitable network simulator.</td><td>2 Hrs.</td><td>CO3</td></tr>
<tr><td>6.</td><td>Assignment on configuration of Network Address Translation-Port Address Translation using suitable network simulator.</td><td>2 Hrs.</td><td>CO3</td></tr>
<tr><td>7.</td><td>Assignment on socket programming on Linux – TCP and UDP server.</td><td>2 Hrs.</td><td>CO4</td></tr>
<tr><td>8.</td><td>Assignment on application protocol such as HTTP, FTP, SMTP, DNS.</td><td>2 Hrs.</td><td>CO4</td></tr>
</table>

Text Books:

1. Andrew S. Tanenbaum, David J. Wethrall, "Computer Network", Pearson Education, ISBN: 978-0-13-212695-3.
2. Behrouz A. Forouzan, "TCP/IP Protocol Suite", McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
3. William Stallings, Computer Security: Principles and Practices, Pearson 6th Edition, ISBN: 978-0-13-335469-0.
4. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd, ISBN- 978-81-265-2179-1.
5. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, ISBN-978-81-315-1349-1.

Reference Books:

1. Behrouz A. Forouzan, "Data Communication and Networking", McGraw Hill Education, 5th Edition, ISBN: 978-1-25-906475-3.
2. Mayank Dave, "Computer Network", Cengage Learning, ISBN: 978-81-315-0986-9.
3. Berouz Forouzan, "Cryptography and Network Security", TMH, 2nd Edition, ISBN -978-00-707-0208-0.
4. Kurose Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, ISBN: 978-81-7758-878-1.
5. Bruice Schneier, "Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms", Wiley India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.
6. Nina Godbole, "Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
7. CK Shyamala et al., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN-978-81-265-

2285-9.
8. Dr. V. K. Pachghare, "Cryptography and Information Security", PHI, 2nd Edition, ISBN- 978-81-203-5082-3.

IT309 : Internet of Things Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Term Work:	50 Marks
	Oral :	NA
	Practical:	NA
Credits: 1	Total:	50 Marks

Prerequisite Course: Computer Network Technology

Course Objectives

1. To learn IoT platforms and operating system such as Raspberry -Pi/Beagle Board/ Arduino.
2. To learn web interface for IoT.
3. To learn the knowledge for communication objects.
4. To learn cloud environment for IoT.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 — **Understand** IoT platforms and operating system such as Raspberry-Pi/Beagle Board/Arduino.	2	Understand
CO2 — **Implement** the web interface for IoT and solve Real World Problems	3	Apply
CO3 — **Demonstrate** communication within the objects using IoT platforms such as Raspberry-Pi/Beagle Board/Arduino.	3	Apply
CO4 — **Implement** cloud environment for IoT applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	2	3	-	-	-	-	-	-	-	-	2	-
CO2	-	-	3	3	-	2	-	-	-	-	-	-	-	2	-
CO3	-	-	3	3	-	2	-	1	2	-	-	-	-	2	-
CO4	-	-	3	3	-	2	-	-	3	-	-	-	-	2	-

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Guidelines: This Internet of Things Laboratory course has Internet of Things as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C or C++ or Java Language.

	Suggested List of Assignments		
Sr. No.	**Assignment**	**No. of Hours**	**COs**
1.	Assignment based on Study of Raspberry-Pi/Beagle Board/Arduino	2 Hrs.	CO1
2.	Assignment based on Study of different operating systems for Raspberry-Pi/Beagle board/Arduino. Understanding the process of OS installation on Raspberry-Pi/Beagle board/Arduino.	2 Hrs.	CO1
3.	Assignment based on Open source prototype platform- Raspberry-Pi/Beagle board/Arduino. Simple program digital read/write using LED.	2 Hrs.	CO2
4.	Assignment based on Designing a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.	2 Hrs.	CO2
5.	Write an application to detect obstacle using Proximity sensor and notify the user using LED or Buzzer.	2 Hrs.	CO3
6.	Assignment based on RFID/NFC using Arduino.	2 Hrs.	CO3
7.	Assignment based on Cloud Server.	2 Hrs.	CO4
8.	Assignment based on Mini Project.	2 Hrs.	CO4

Text Books:

1. Vijay Madisetti, "Internet of Things: A Hands-On Approach Arshdeep Bahga", VPT – Paperback2015 978- 0996025515 628/- 2.
2. David Hanes, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications - 2013 978-1-118- 47347-4, 466.

Reference Books:

1. Olivier Hersent, "The Internet of Things Key applications and protocols", Willy Publications 2nd Edition 978-1-119- 99435-0.
2. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web", Willy Publications, 978-1-84821- 140-7.
3. Agus Kurniawan, "The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects", PACKT.
4. Cuno Pfister, "Getting Started with the Internet of Things", SPD O'REILL Y IOT.
5. Dr. V.K. Pachghare, "Cryptography and Information security", PHI, 2nd Edition, ISBN- 978-81-203-5082-3.

IT310 : Skill Based Credit Course

Teaching Scheme	Examination Scheme	
Lectures: 1 Hrs./Week	Continuous Assessment	50 Marks
	In-SemExam	NA
	End-Sem Exam	NA
Credits: 1	Total:	50 Marks

Prerequisite Course: Computer Network Technology

Course Objectives

1. To understand and recall Software Product development experience using industry standard.
2. To understand how teams are organized to deliver on software projects.
3. To analyze problem to be solved.
4. To create design document, white-boarding component diagram

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Demonstrate** knowledge of multithreading in java language.	2	Understand
CO2 **Use** Exception handling in Java programming	3	Apply
CO3 **Demonstrate** knowledge of AWT and Swings components	2	Understand
CO4 **Apply** knowledge of database in Java Language	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	2	3	1	2	1	2	3	2	1	3	2	2
CO2	2	1	-	2	3	1	2	1	2	3	2	2	3	2	2
CO3	-	-	1	1	3	1	2	1	1	3	2	1	3	2	2
CO4	-	-	-	-	1	-	2	1	2	2	1	1	3	2	2

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Guidelines: This System Programming and Operating System Laboratory course has System Programming and Operating System as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.
Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C or C++ or Java Language.

	Suggested List of Assignments		
Sr. No.	**Assignment**	**No. of Hours**	**COs**
1.	Introduction (software development process, mvpetc), handing out projects, squad formations, roles & responsibilities, how to make design document, plan for app development, Jira introduction, Q&A, highlight what students can adopt, define future course of action.	4 Hrs.	CO1
2.	Presentations on design documents by groups, development process best practices (by instructor), (Agile, Jira continuation, git, unit testing, automation test tools, coding best practices) (Local development, sprint planning for 1 group)	5 Hrs.	CO2
3.	Sprint demo local deployment by groups, sprint planning & sprint retrospective any 1 group at random, building a pipeline 30 mins, (by instructor)	4 Hrs.	CO3
4.	Sprint demo cloud deployment by groups, sprint planning & sprint retrospective any 1 group at random, how do you iterate, change management	4 Hrs.	CO4
5.	Final sprint demo cloud deployment by groups, sprint retrospective any 1 group at random, closing comments by instructor	4 Hrs.	CO5

Text Books:

1. Docker containers:-
   https://docs.docker.com/engine/install/
   https://learning.oreilly.com/videos/docker-for-the/9781788991315/
2. Gitlab:- https://docs.gitlab.com/ee/gitlab-basics/
3. Jira for Agile team management https://www.youtube.com/watch?v=TsG3OWTDAFY
4. Selenium- https://www.youtube.com/watch?v=oo8hakhidQM (Selenium installation on your machine and basic test automation)
   https://www.youtube.com/watch?v=_lBaedX4UAE (Selenium docker setup)
   https://www.youtube.com/watch?v=esb1v_d5-™   (Selenium running tests via containers)
5. AWS ECS deployment
   https://docs.aws.amazon.com/AmazonECS/latest/userguide/ECS_CLI_installation.html
   (installation)
   https://docs.aws.amazon.com/AmazonECS/latest/userguide/ecs-cli-tutorial-fargate.html
   https://reflectoring.io/aws-deploy-docker-image-via-web-console/

Reference Books:

MC 311 : Behavioural and Interpersonal skills
(non-verbal skills / behaviours, nonaggression)(Mandatory Course – V)

Teaching Scheme	Examination Scheme	
Lectures: 1 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	NA
Credits: Non Credit	Total:	NA

Course Contents

Each individual has behaviour patterns that are shaped by the context of his or her past. Most often, adapting the behaviour to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression. The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn thegoal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team. The specific objectives, however, are as following.

- To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
- To train the students for communicating effectively in both formal as well as in informal settings.
- To help the students to understand the importance of non-verbal aspects of effective communication.
- To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work
- To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.
- To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making.

The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

T.Y. B. Tech Information Technology Semester VI

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

IT312: Cryptography and Cyber Security

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Basic of Mathematics, Computer Fundamentals& Programming,		

Course Objectives

1. Understand security attack, security services and security mechanism
2. Use the different cryptographic algorithms for implementing security.
3. Use the different Message digest algorithms to secure a message over insecure channel.
4. Understand various protocols for network security to protect against the threats in the networks.
5. Apply and exhibit knowledge to secure personal data, and secure computer networks in an organization.
6. Design and implement security solutions in an organization.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Understand** security attack, security services and security mechanism.	2	**Understand**
CO2 **Use** different cryptographic algorithms for implementing security.	3	**Apply**
CO3 **Use** the different Message digest algorithms to secure a message over insecure channel.	3	**Apply**
CO4 **Understand** various protocols for network security to protect against the threats in the networks.	2	**Understand**
CO5 **Apply** and exhibit knowledge to secure personal data, and secure computer networks in an organization	3	**Apply**
CO6 **Design** and implement security solutions in an organization.	3	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

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	Course Contents		
Unit-I	**SECURITY FUNDAMENTALS**	**No. of Hours**	**COs**
	Introduction, Threats and Attacks, Security Services, Security Mechanisms, Cipher Techniques: Substitution and Transposition, One Time Pad, Block Ciphers, Stream Ciphers.	06	CO1
Unit-II	**CRYPTOGRAPHY**	**No. of Hours**	**COs**
	Symmetric Key Algorithms: Data Encryption standards, Advanced Encryption Standard, Linear Cryptanalysis and Differential Cryptanalysis, Public Key Algorithms: RSA, Key Generation and Usage, Diffie-Hellman Key Exchange Algorithm.	06	CO2
Unit-III	**MESSAGE DIGEST AND KEY MANAGEMENT**	**No. of Hours**	**COs**
	Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, Kerberos 5.0.	06	CO3
Unit-IV	**NETWORK SECURITY**	**No. of Hours**	**COs**
	IPSEC- Introduction, AH and ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol.	06	CO4
Unit-V	**INTRODUCTION TO CYBER SECURITY**	**No. of Hours**	**COs**
	Introduction, Definition and origin, Cybercrime and Information Security, Classification of Cybercrimes, The legal Perspectives- Indian Perspective, Global Perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyberstalking.	06	CO5
Unit-VI	**TOOLS AND METHODS USED IN CYBERCRIME**	**No. of Hours**	**COs**
	Introduction, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS ,SQL injection, Cyber laws-Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures.	06	CO6

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education/PHI, 2006.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
3. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiely India Pvt. Ltd, ISBN- 978-81-265-2179-1.

Reference Books:

1. Nina Godbole, "Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
2. Willaim Stallings, "Computer Security : Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6.
3. Mark Merkow, "Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7.
4. CK Shyamala, et al., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
5. Berouz Forouzan, "Cryptography and Network Security", 2nd Edition, TMH, ISBN :9780070702080.

IT313: Artificial Intelligence	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment:** **20 Marks**
	In-Sem Exam: **30 Marks**
	End-Sem Exam: **50 Marks**
Credits: 3	**Total:** **100 Marks**
Prerequisite Course: Data Structures and Files	

Course Objectives

1. To understand the basic principles of Artificial Intelligence
2. To provide an understanding of uninformed search strategies.
3. To provide an understanding of informed search strategies.
4. To study the concepts of Knowledge based system.
5. To learn and understand use of fuzzy logic and neural networks.
6. To learn and understand various application domain of Artificial Intelligence.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.	**2**	**Understand**
CO2	**Analyze** of different uninformed search algorithms on well formulates problems along with stating valid conclusions that the evaluation supports.	**4**	**Analyze**
CO3	**Design and Analysis** of informed search algorithms on well formulated problems.	**4**	**Analyze**
CO4	**Formulate and solve** given problem using Propositional and First order logic.	**3**	**Apply**
CO5	**Apply** planning and neural network learning for solving AI problems	**3**	**Apply**
CO6	**Apply** reasoning for non-monotonic AI problems.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	1	1	2	1	1	1	1	3	2	1
CO2	2	2	3	2	2	1	1	2	1	1	1	1	3	2	1
CO3	2	2	3	2	2	1	1	2	1	1	1	1	3	2	1
CO4	2	2	3	2	2	1	1	2	1	1	1	3	3	2	1
CO5	2	2	3	2	2	1	1	2	1	1	1	3	3	2	1
CO6	2	2	3	2	2	1	1	2	1	1	1	3	3	2	1

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Course Contents			
Unit-I	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**	**No. of Hours**	**COs**
	Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation	06	CO1
Unit-II	**UNINFORMED SEARCH STRATEGIES**	**No. of Hours**	**COs**
	Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensor-less problems, Contingency problems.	06	CO2
Unit-III	**INFORMED SEARCH STRATEGIES**	**No. of Hours**	**COs**
	Generate& test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence.	06	CO3
Unit-IV	**KNOWLEDGE REPRESENTATION**	**No. of Hours**	**COs**
	Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forwardand Backward Chaining. Basics of PROLOG: Representation, Structure, Backtracking. Expert System: Case study of Expert System in PROLOG	06	CO4
Unit-V	**INTRODUCTION TO PLANNING AND ANN**	**No. of Hours**	**COs**
	Blocks world, STRIPS, Implementation using goal stack, Introduction to Neural networks:- basic, comparison of human brain and machine, biological neuron, general neuron model, activation functions, Perceptron learning rule, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks.	06	CO5
Unit-VI	**UNCERTAINTY**	**No. of Hours**	**COs**
	Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Justification based Truth Maintenance Systems, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy set for a given application. Probability and Bayes' theorem, Bayesian Networks.	06	CO6
Text Books:			
1. Elaine Rich and Kevin Knight, "Artificial Intelligence" Tata McGraw Hill. 2. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.			

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Reference Books:
1. Ivan Bratko, "Prolog Programming For Artificial Intelligence", 2nd Edition, Addison Wesley, 1440.   2. Eugene, Charniak, Drew Mcdermott, "Introduction to Artificial Intelligence", Addison Wesley.   3. Patterson, "Introduction to AI and Expert Systems", PHI.   4. Nilsson, "Principles of Artificial Intelligence", Morgan Kaufmann.   5. Carl Townsend, "Introduction to turbo Prolog", Paperback, 1483.   6. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication.
eLearning Resources
Online Courses: 1. An Introduction to Artificial Intelligence by Prof. Mausam, IIT Delhi, NPTEL Course.   2. AI for Everyone by Andrew Ng, Coursera Course.   **eResources:**   1. http://www.eecs.qmul.ac.uk/~mmh/AINotes/AINotes4.pdf   2. https://www.slideshare.net/JismyKJose/conceptual-dependency-70129647   3. https://web.archive.org/web/20150813153834/http://www.cs.berkeley.edu/~zadeh/papers/Fuzzy%20Sets-Information%20and%20Control-1965.pdf   4. https://www.youtube.com/watch?v=aircAruvnKk   5. https://www.youtube.com/watch?v=IHZwWFHWa-w

IT314A : Software Testing and Quality Assurance (Professional Elective-II)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment:** **20 Marks**
	In-Sem Exam: **30 Marks**
	End-Sem Exam: **50 Marks**
Credits: 3	**Total:** **100 Marks**
Prerequisite Course: Seminar and Mini-project	

Course Objectives
1. To comprehend the software process models.
2. To understand the types of software requirements and SRS document.
3. To describe the testing strategies and methodologies in projects.
4. To understand different types of testing for web applications.
5. To understand the concepts of STLC to achieve quality.
6. To understand automation tools used in quality management.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Apply** basic concepts of Software Engineering and Process Models	3	**Apply**
CO2	**Understand** the Software Requirements and SRS Documents	2	**Understand**
CO3	**Describe** the testing concepts and Quality Assurance	2	**Understand**
CO4	**Analyze** different test methodologies and approaches for web applications.	4	**Analyze**
CO5	**Apply** Software Testing Life Cycle for testing an application	3	**Apply**
CO6	**Select** proper tool to perform Software Testing.	5	**Evaluate**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	-	-	-	-	-	2	-	-	3	-	-
CO2	3	1	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	1	2	3	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO5	3	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO6	2	1	2	3	-	3	2	-	-	-	-	-	2	-	-

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Course Contents			
Unit-I	**INTRODUCTION TO SOFTWARE ENGINEERING**	**No. of Hours**	**COs**
	Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. **A Generic view of process:** Software engineering- A layered technology, a process framework, Process patterns, process assessment. **Process models:** The waterfall model, Incremental process models, Evolutionary process models.	06	CO1
Unit-II	**REQUIREMENT ANALYSIS & SOFTWARE DEVELOPMENT LIFE CYCLE**	**No. of Hours**	**COs**
	Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. **SDLC Phases:** Requirements Phase, Analysis Phase, Design phase, Coding Phase, Testing phase, Delivery and Maintenance Phase, **SDLC Models:** Waterfall Model, V Model, Agile Model, Prototype Model, Spiral Model	06	CO2
Unit-III	**SOFTWARE TESTING**	**No. of Hours**	**COs**
	Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Differences between Manual and Automation. Quality Assurance, Quality Control, Differences between QA & QC & Testing	06	CO3
Unit-IV	**SOFTWARE TESTING METHODOLOGIES AND TEST APPROACHES**	**No. of Hours**	**COs**
	White Box Testing, Black Box Testing, Grey Box Testing. **Static Techniques:** Informal Reviews, Walkthroughs, Technical Reviews, Inspection **Dynamic Techniques: Functional Testing -** Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. **Non Functional Testing -** Performance Testing. Scalability Testing, Compatibility Testing, Security Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing.	06	CO4
Unit-V	**SOFTWARE TESTING LIFE CYCLE**	**No. of Hours**	**COs**
	Requirements Analysis/Design, Test Planning, Test Cases Design, Test Environment setup, Test Execution and Test Closure	06	CO5
Unit-VI	**SOFTWARE TEST AUTOMATION**	**No. of Hours**	**COs**
	What is Test Automation, Terms used in automation, Skills needed for automation, What to automate, scope of automation, Introducing Selenium, Selenium Tool Suite, Selenium-IDE, Selenium RC, Selenium Webdriver, Selenium Grid.	06	CO6

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Text Books:
1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices" Pearson.   2. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison Wesley.   3. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903.
Reference Books:
1. Roger S. Pressman, "Software Engineering", Mc Graw Hill.   2. Aditya P. Mathur, "Foundations of Software Testing", Pearson.   3. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press.   4. Stephen Kan, "Metrics and Models in Software Quality", Addison Wesley, 2nd Edition.
eLearning Resources
1. https://nptel.ac.in/courses/106/105/106105150/   2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview

IT314B: Big Data Analytics (Professional Elective-II)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course: Engineering mathematics, Database Management Systems, Foundation of data science		

Course Objectives

1. To introduce big data process in detail.
2. To introduce association rules for big data.
3. To introduce regression for big data.
4. To introduce classification for big data.
5. To introduce time series analysis for big data.
6. To introduce big data analytic tools for analytics.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Understand** the process of big data.	2	Understand
CO2 **Understand** an association rules in big data.	2	Evaluate
CO3 **Apply** regression in big data.	3	Apply
CO4 **Apply** classification in big data.	3	Apply
CO5 **Understand** time series analysis in big data.	2	Understand
CO6 **Understand** various analytic tools and apply them for big data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	1	1	1	1	3	1	3	3	3	2
CO2	1	3	1	1	3	1	1	1	2	3	1	3	3	3	2
CO3	1	1	1	1	2	1	1	1	2	3	1	3	2	3	2
CO4	3	3	2	1	3	1	2	1	3	3	1	3	2	3	2
CO5	2	1	1	1	2	1	2	1	2	3	1	3	3	3	2
CO6	1	2	1	1	1	1	1	1	1	3	1	3	2	3	2

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Course Contents			
Unit-I	**THE BIG DATA SCIENCE PROCESS**	**No. of Hours**	**COs**
	Overview of data science process, defining research goal, retrieving data, cleaning, integrating, and transforming data, exploratory data analysis, Build the model, presentation of data.	06	CO1
Unit-II	**ADVANCED ANALYTICAL THEORY AND METHODS: ASSOCIATION RULES**	**No. of Hours**	**COs**
	Overview, A priori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules an Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent item set Generation, Rule Generation and Visualization Validation and Testing Diagnostics.	06	CO2
Unit-III	**ADVANCED ANALYTICAL THEORY AND METHODS: REGRESSION**	**No. of Hours**	**COs**
	Linear Regression, Use Cases, Model Description, Diagnostics, Logistic Regression, Use Cases, Model Description Diagnostics, Reasons to Choose and Cautions, Additional Regression Models.	06	CO3
Unit-IV	**ADVANCED ANALYTICAL THEORY AND METHODS: CLASSIFICATION**	**No. of Hours**	**COs**
	Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree Decision Trees, Naive Bayes, Bayes' Theorem, Naive Bayes Classifier Smoothing Diagnostics Naive Bayes Diagnostics of Classifiers Additional Classification Methods.	06	CO4
Unit-V	**ADVANCED ANALYTICAL THEORY AND METHODS: TIME SERIES ANALYSIS**	**No. of Hours**	**COs**
	Overview of Time Series Analysis, Box-Jenkins Methodology, ARIMA Model, Autocorrelation Function (ACF), Autoregressive Model, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions.	06	CO5
Unit-VI	**ADVANCED ANALYTICS-TECHNOLOGY AND TOOLS**	**No. of Hours**	**COs**
	Analytics for Unstructured Data, Use Case- MapReduce, Apache Hadoop, R- Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation.	06	CO6

Text Books:

1. Davy Cielen, Mohammad Ali, "Introducing Data Science", Manning Publications.
2. "Data Science & Big Data Analytics - Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services", Wiley Publication

Reference Books:

1. J. Hurwitz, et al., "Big Data for Dummies", Wiley, 2013.
2. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill, 2012.
3. James Manyika, Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, Angela Hung Byers, "Big data: The next frontier for innovation, competition, and productivity", McKinsey Global Institute May 2011.

IT314C: Natural Language Processing (Professional Elective-II)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks

Prerequisite Course: Basic understanding of probability theory, Basic knowledge of finite automata.

Course Objectives

1. To understand the core concepts of Natural language processing and levels of language analysis.
2. To understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
3. Learning state of art NLP research areas such as parsing algorithms, ambiguity resolution and machine translation.
4. To study algorithmic examples in distributed, concurrent and parallel environments
5. To apply algorithmic strategies while solving problems
6. To develop time and space efficient algorithms

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Understand** automatic processing of human languages using computers.	2	Understand
CO2 **Understand** various applications of natural language processing. Automatic processing and information extraction of human language using computer.	2	Understand
CO3 **Analyze** Automatic processing and information extraction of human language using computer.	4	Analyze
CO4 **Understand** applications of Natural Language Processing such as Information extraction, semantic web search, machine translation, text summarization, spam detection	2	Understand
CO5 **Create** presentation for applying NLP for multi-core or distributed, concurrent/Parallel environments.	6	Create
CO6 **Implement** programs using NLP open source tools.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	1	1	1	1	3	1	3	3	3	2
CO2	1	3	1	1	3	1	1	1	2	3	1	3	3	3	2
CO3	1	1	1	1	2	1	1	1	2	3	1	3	2	3	2
CO4	3	3	2	1	3	1	2	1	3	3	1	3	2	3	2
CO5	2	1	1	1	2	1	2	1	2	3	1	3	3	3	2
CO6	1	2	1	1	1	1	1	1	1	3	1	3	2	3	2

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Course Contents			
Unit-I	**INTRODUCTION**	No. of Hours	COs
	Applications of Natural Language Understanding, Evaluating Language Understanding Systems, The Elements of Simple Noun Phrases, Verb Phrases and Simple Sentences, Noun Phrases, Adjective Phrases, Adverbial Phrases.	06	CO1
Unit-II	**GRAMMARS**	No. of Hours	COs
	Grammars and Sentence Structure, Top-Down Parser, Bottom-Up Chart Parser, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features.	06	CO2
Unit-III	**PARSING**	No. of Hours	COs
	Auxiliary Verbs and Verb Phrases, Noun Phrases and Relative Clauses, Human Preferences in Parsing, Encoding Uncertainty: Shift-Reduce Parsers, A Deterministic Parser, Techniques for Efficient Encoding of Ambiguity, Partial Parsing.	06	CO3
Unit-IV	**AMBIGUITY RESOLUTION**	No. of Hours	COs
	Part-of-Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best-First Parsing, Semantics and Logical Form, Word Senses and Ambiguity, Encoding Ambiguity in Logical Form, Verbs and States in Logical Form.	06	CO4
Unit-V	**LINKING SYNTAX AND SEMANTICS**	No. of Hours	COs
	Semantic Interpretation and Compositionality, Prepositional Phrases and Verb Phrases, Lexicalized Semantic Interpretation and Semantic Roles, Handling Simple Questions, Semantic Interpretation Using Feature Unification, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation	06	CO5
Unit-VI	**KNOWLEDGE REPRESENTATION AND RECENT TRENDS IN NLP**	No. of Hours	COs
	Handling Natural Language Quantification, Time and Aspectual Classes of Verbs, Automating Deduction in Logic-Based Representations, Procedural Semantics and Question Answering Machine Translation. MT evaluation tools such as Bleu,(word error rate) WER etc. Automatic text summarization, Sentiment Speech Recognition, Semantic web search, Automatic text Clustering.	06	CO6
Text Books:			
	1. Allen James, Natural Language Understanding, Pearson India, 2nd Edition, ISBN: 9788131708958, 8131708950. 2. James H. Martin, Daniel Jurafsky, "Speech and Language Processing", Pearson, 1st Edition, ISBN: 9789332518414, 8131716724.		

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Reference Books:

1. M. Christopher, H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1st Edition, ISBN: 9780262133609.
2. C. Eugene, "Statistical Language Learning", MIT Press, 1st Edition, ISBN: 9780262032162.
3. S. Bird, E. Klein & E. Loper, "Natural Language Processing with Python", O' Reilly (Shroff Publishers), 1st Edition, ISBN:9788184047486.

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IT314D: Optimization Techniques (Professional Elective-II)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks

Prerequisite Course: Mathematical preliminaries like Linear algebra, matrices, Elements of probability theory & Elementary multivariable calculus. Design and Analysis of Algorithms, Genetic Algorithms.

Course Objectives
1. To enable the student to learn and acquire mathematical methods in engineering disciplines.
2. To introduce the methods of optimization to solve a linear programming problem by various methods.
3. To introduce few advanced optimization techniques.
4. To understand the need and origin of the optimization methods.
5. To get a broad picture of the various applications of optimization methods used in engineering.
6. To define optimization problem and its various components.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Implement** various optimization techniques.	3	Apply
CO2 **Learn** model real-world problems in optimization framework.	2	Understand
CO3 **Apply** various optimization models to solve optimization problems in computer-science & IT Engineering.	3	Apply
CO4 **Understand** the need of optimization techniques	2	Understand
CO5 **Solve** the engineering optimization problems	3	Apply
CO6 **Tackle** problems of interdisciplinary nature	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	-	-	-	-	-	2	-	-	3	-	-
CO2	3	1	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	1	2	3	1	-	-	-	-	-	-	-	-	-	3	-
CO4	2	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO5	3	1	2	3	-	-	-	-	-	-	-	-	3	2	-
CO6	2	1	2	3	-	3	2	-	-	-	-	-	2	-	-

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	Course Contents		
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Overview, Operation Research Modeling Approach and Various Real Life Situations, Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation, Solving Linear Programming Problems: Using Simultaneous Equations and Graphical Method; Simplex Method; Duality Theory; Charnes' Big – M Method. Transportation Problems and Assignment Problems, 0/1 knapsack problem using brute force and dynamic approach.	06	CO1
Unit-II	**NETWORK ANALYSIS**	**No. of Hours**	**COs**
	Shortest Path: Dijkstra Algorithm; Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM, network design algorithms.	06	CO2
Unit-III	**INVENTORY CONTROL**	**No. of Hours**	**COs**
	Introduction; Economic Order Quantity (EOQ) models, Deterministic and probabilistic Models, Safety Stock, Buffer Stock, Inventory Model of Central Warehouse.	06	CO3
Unit-IV	**GAME THEORY**	**No. of Hours**	**COs**
	Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems, Games without saddle point ; Graphical Method ; Principle of Dominance.	06	CO4
Unit-V	**QUEUING THEORY**	**No. of Hours**	**COs**
	Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models: M/M/1: ∞/FIFO and M/M/1:N/ FIFO.	06	CO4
Unit-VI	**ADVANCED OPTIMIZATION TECHNIQUES**	**No. of Hours**	**COs**
	Direct and indirect search methods, Evolutionary algorithms for optimization and search, Concepts of multi-objective optimization, genetic algorithms and simulated annealing, optimization of machine learning algorithms, ant colony optimization, Applications of IT Engineering: Search Engine Optimization, Smart Grid Optimization.	06	CO6

Text Books:

1. H.A. Taha, "Operations Research", 5th Edition Macmillan Publishing Company, 1992.
2. K. Deb, "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
3. Hadley G., "Linear Programming", Narosa Publishers, 1987.
4. Mital, "Optimization Methods", New Age International.
5. Kalyanmoy Deb, "Mulitobjective Optimization –An evolutionary Algorithmic Approach", John Wiley & Sons, New York.

Reference Books:

1. J.C.Pant, "Introduction to Optimization", Jain Brothers, New Delhi, 1983.
2. Rao, "Engineering Optimization", New Age International.
3. Edwin K P Chong, Stainslaw H Zak, "Introduction to Optimization"

IT315: Object Oriented Programming with C++/Java (Open Elective – I)

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 4	Total:	100 Marks

Prerequisite Course: Computer Fundamentals & Programming

Course Objectives
1. To understand the basics of object oriented programming paradigm and principles.
2. To understand classes and objects.
3. To understand inheritance and polymorphism.
4. To understand exception handling mechanism.
5. To understand multithreading.
6. To understand library.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** the basics of object oriented programming paradigm and principles..	2	Understand
CO2	**Use** classes and objects to write object oriented programs.	3	Apply
CO3	**Use** inheritance and polymorphism.	3	Apply
CO4	**Use** exception handling mechanism.	3	Apply
CO5	**Use** multithreaded programming.	3	Apply
CO6	**Use** inbuilt library functions.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	1	2	2	-	-	3	-	-
CO2	2	2	3	-	1	-	-	1	2	2	-	-	3	-	-
CO3	2	2	3	2	1	-	-	1	2	2	1	-	3	-	2
CO4	2	-	3	-	1	-	-	1	2	2	1	-	3	-	2
CO5	2	-	2	2	1	-	1	1	2	2	1	-	3	-	2
CO6	2	-	2	2	1	1	-	1	2	2	1	3	3	-	2

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	Course Contents		
Unit-I	**Object Oriented Programming Paradigm and Principles**	**No. of Hours**	**COs**
	Procedure and object oriented paradigm, Basic Principles of Object Oriented Programming: Data abstraction and encapsulation, Inheritance, Polymorphism.	08	CO1
Unit-II	**CLASSES AND OBJECTS**	**No. of Hours**	**COs**
	Defining classes and objects, visibility, constructors, instance and static members, array of object.	08	CO2
Unit-III	**INHERITANCE AND POLYMORPHISM**	**No. of Hours**	**COs**
	Inheritance types, single inheritance, multiple inheritance, syntax, abstract class. Overloading and overriding functions/methods, dynamic polymorphism.	08	CO3
Unit-IV	**EXCEPTION HANDLING**	**No. of Hours**	**COs**
	Try-catch block, multiple catch, nested try catch, finally.	08	CO4
Unit-V	**MULTITHREADING**	**No. of Hours**	**COs**
	Introduction, main thread, creating child thread, inter-thread communication, synchronization.	08	CO5
Unit-VI	**LIBRARY**	**No. of Hours**	**COs**
	String, Stream, Standard Template Library/Networking, Date and Time.	08	CO6

Text Books:
1. E. Balagurusamy, "Object Oriented Programming with C++ and Java", 8th Edition, McGraw Hill.
2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill, 2017.
3. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill, 2003.

Reference Books:
1. Bjarne Stroustrup, "C++ Programming Language", 4th Edition, Addison Wesley.
2. Somashekara M.T., "Object Oriented Programming with Java", PHI.
3. Vasapannarava, et al, "Object Oriented Programming Using C++ and Java" Pearson.

eLearning Resources
1. **NPTEL Course: Programming in Java,**
   https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. **NPTEL Course: An Introduction to Programming Through C++,**
   https://onlinecourses.nptel.ac.in/noc22_cs42/preview
3. **Tutorials: Java T Point, https://www.javatpoint.com/java-tutorial ,**
   https://www.javatpoint.com/cpp-tutorial

Equivalent courses for IT315:
1. NPTEL Course: "Object Oriented Programming with C++".
2. NPTEL Course: "The Joy of Computing using Python".
3. NPTEL Course: "Programming in Java".
4. NPTEL Course: "Blockchain and it's Applications".

Department of Information Technology, Sanjivani College of Engineering, Kopargaon

PR316: Intellectual Property Rights and Entrepreneurship Development

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Continuous Assessment:	10 Marks
	In-Sem Exam:	15 Marks
	End-Sem Exam:	25 Marks
Credits: 1	Total:	50 Marks
Prerequisite Course: Nil.		

Course Objectives
1. To introduce student with IPR.
2. To explain IPR procedure in India such as Patents, Designs and Trademarks.
3. To make aware economic importance of IPRs.
4. To develop ability to search and analyse the IPRs.
5. To instill a spirit of entrepreneurship among the student participants.
6. To give insights into the Management of Small Family Business.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** patenting system.	2	Understand
CO2	**Understand** the procedure to file patent in India.	2	Understand
CO3	**Understand** financial importance of IPR.	2	Understand
CO4	**Search and analyze** the patents, designs and Trademarks.	4	Analyze
CO5	**Identify** the Skill sets required to be an entrepreneur.	4	Analyze
CO6	**Understand** the role of supporting agencies and Governmental initiatives to promote entrepreneurship.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO2	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO3	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO4	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO5	-	-	-	-	-	2	2	2	-	-	3	-	-	-	-
CO6	-	-	-	-	-	2	2	2	-	-	3	-	-	-	-

	Course Contents		
Unit-I	**INTRODUCTION TO IPR**	**No. of Hours**	**COs**
	Concepts of IPR, The history behind development of IPR, Necessity of IPR and steps to create awareness of IPR, Concept of IP Management, Intellectual Property and Marketing, IP asset valuation. **Introduction to the leading International Instruments concerning Intellectual Property Rights:** the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO.	04	CO1
Unit-II	**PATENTS**	**No. of Hours**	**COs**
	Introduction to Patents, Procedure for obtaining a Patent. Licensing and Assignment of Patents: Software Licensing, General public Licensing, Compulsory Licensing. Infringement of Patents, Software patent and Indian scenario.	04	CO2
Unit-III	**DESIGNS**	**No. of Hours**	**COs**
	Registrable and non-Registrable Designs, Novelty & Originality, Procedure for Registration of Design. Copyright under Design: Assignment, Transmission, License. Procedure for Cancellation of Design, Infringement, Remedies.	04	CO3
Unit-IV	**TRADEMARKS AND COPY RIGHTS**	**No. of Hours**	**COs**
	Trademarks: Concept of trademarks, Importance of brands and the generation of "goodwill", Trademark registration procedure, Infringement of trademarks and Remedies available, Assignment and Licensing of Trademarks. **Copyright Right:** Concept of Copyright Right, Assignment of Copyrights, Registration procedure of Copyrights, Infringement (piracy) of Copyrights and Remedies, Copyrights over software and hardware.	04	CO4
Unit-V	**ENTREPRENEURSHIP: INTRODUCTION**	**No. of Hours**	**COs**
	Concept and Definitions: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision, making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. **Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **Steps in Entrepreneurial Process:** Deciding Developing, Moving, Managing, Recognizing.	04	CO5
Unit-VI	**RESOURCES FOR ENTREPRENEURSHIP**	**No. of Hours**	**COs**
	Project Report Preparation: Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market, Preparation projected financial	04	CO6

statement. **Role of Support Institutions and Management of Small Business:** Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, StateFinancial Corporation (SFC), EPC, ECGC. **Various Governmental Initiatives:** Make in India, Start Up India, Stand Up India, Digital India, Skill India **Case Studies of Successful Entrepreneurs.**	

Text Books:

1. Neeraj Pandey and Khushdeep Dharni, "Intellectual Property Rights", PHI, New Delhi.
2. The Indian Patent act 1970.
3. The copy right act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. R. Anita Rao & Bhanoji Rao, "Intellectual Property Rights- A Primer", Eastern Book Co.
9. Desai, Vasant, "The Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House, Delhi.
10. Longenecker, Moore, Petty and Palich, "Managing Small Business", Cengage Learning, India Edition.
11. Morse and Mitchell, "Cases in Entrepreneurship", Sage South Asia Edition.
12. K Ramchandran, "Entrepreneurship – Indian Cases on Change Agents", Tata McGraw Hill.

Reference Books:

1. Handbook of Indian Patent Law and Practice.
2. David H. Holt, "Entrepreneurship: New Venture Creation".
3. Satish Taneja, S. L. Gupta, "Entrepreneurship Development New Venture Creation".
4. K. Nagarajan, "Project Management".

PR317: Intellectual Property Rights and Entrepreneurship Development Lab

Teaching Scheme	Examination Scheme	
Practical: 2 Hrs./Week	Term Work:	50 Marks
	Oral:	NA
	Practical:	NA
Credits: 1	Total:	50 Marks
Prerequisite Course: Nil.		

Course Objectives
1. To introduce student with IPR.
2. To explain IPR procedure in India such as Patents, Designs and Trademarks.
3. To make aware economic importance of IPRs.
4. To develop ability to search and analyse the IPRs.
5. To instill a spirit of entrepreneurship among the student participants.
6. To give insights into the Management of Small Family Business.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** patenting system.	2	Understand
CO2	**Understand** the procedure to file patent in India.	2	Understand
CO3	**Understand** financial importance of IPR.	2	Understand
CO4	**Search and analyze** the patents, designs and Trademarks.	4	Analyze
CO5	**Identify** the Skill sets required to be an entrepreneur.	4	Analyze
CO6	**Understand** the role of supporting agencies and Governmental initiatives to promote entrepreneurship.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO2	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO3	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO4	-	-	-	-	-	2	-	-	2	-	-	3	-	-	-
CO5	-	-	-	-	-	2	2	2	-	-	3	-	-	-	-
CO6	-	-	-	-	-	2	2	2	-	-	3	-	-	-	-

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List of experiments:

The term work shall consist following experiments/reports to be completed within the semester.
1. Searching of patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention.
3. Design draft preparation for a sample design.
4. Trademark draft preparation for a sample Trademark/Device.
5. Copy right draft preparation for a sample documents/audio/video.
6. Report preparation of patent Infringement.
7. Preparation of Detailed project report for new business/industry/startup.
8. Visit to industry to understand entrepreneurship and its report preparation.

Text Books:
1. Neeraj Pandey and Khushdeep Dharni, "Intellectual Property Rights", PHI, New Delhi.
2. The Indian Patent act 1970.
3. The copy right act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. R. Anita Rao & Bhanoji Rao, "Intellectual Property Rights- A Primer", Eastern Book Co.
9. Desai, Vasant, "The Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House, Delhi.
10. Longenecker, Moore, Petty and Palich, "Managing Small Business", Cengage Learning, India Edition.
11. Morse and Mitchell, "Cases in Entrepreneurship", Sage South Asia Edition.
12. K Ramchandran, "Entrepreneurship – Indian Cases on Change Agents", Tata McGraw Hill.

Reference Books:
1. Handbook of Indian Patent Law and Practice.
2. David H. Holt, "Entrepreneurship: New Venture Creation".
3. Satish Taneja, S. L. Gupta, "Entrepreneurship Development New Venture Creation".
4. K. Nagarajan, "Project Management".

<table>
<tr><td colspan="4" align="center">HS318: Corporate Readiness</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="2">Teaching Scheme</td><td colspan="2">Examination Scheme</td></tr>
<tr><td colspan="2">Lectures: 1 Hrs./Week</td><td>Term Work</td><td>50 Marks</td></tr>
<tr><td colspan="2" rowspan="2">Practical: 2 Hrs/Week</td><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Credits: 2</td><td>Total:</td><td>50 Marks</td></tr>
<tr><td colspan="4">Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)</td></tr>
</table>

Course Objectives
1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To develop required aptitude skills.
3. To design the functional and chronological resume.
4. To demonstrate the importance of critical thinking ability and expression in group discussions.
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Remember** placement processes of various organizations and modern job search approach.	1	**Remember**
CO2	**Understand** Industry Specific skill set with a view to design an Ideal Resume.	2	**Understand**
CO3	**Apply** the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	3	**Understand**
CO4	**Analyze and apply** the critical thinking ability as required during Aptitude/Technical Tests.	4	**Analyze**
CO5	**Evaluate** Technical/General Dataset to interpret insights in it.	5	**Evaluate**
CO6	**Create** an ideal personality that fits Industry requirement.	6	**Create**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

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Course Contents			
Unit-I	**PLACEMENT AWARENESS**	**No. of Hours**	**COs**
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06	CO1
Unit-II	**RESUME WRITING**	**No. of Hours**	**COs**
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05	CO2
Unit-III	**GROUP DISCUSSION AND PRESENTATION SKILLS**	**No. of Hours**	**COs**
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	05	CO3
Unit-IV	**LOGICAL REASONING I**	**No. of Hours**	**COs**
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05	CO4
Unit-V	**LOGICAL REASONING II**	**No. of Hours**	**COs**
	Data Interpretation, Data Sufficiency.	04	CO5
Unit-VI	**LOGICAL REASONING III**	**No. of Hours**	**COs**
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05	CO6

Text Books:
1. R.S. Agarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning".
2. B. S. Sijwali, "Reasoning verbal and non verbal".

Reference Books:
1. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
2. M. K. Panday, "Analytical Reasoning".
3. K. Gupta, "Logical and Analytical Reasoning".
4. Mishra & Kumar Dr. Lal, "Multi Dimensional Reasoning".

eLearning Resources:

EBooks:
1. https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
2. https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links:
1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

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IT319 : Cyber Security Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	50 Marks
Credits: 1	Total:	50 Marks

Prerequisite Course: Basic of Mathematics, Computer Fundamentals & Programming.

Course Objectives

1. Use the different cryptographic algorithms for implementing security.
2. Use the different Message digest algorithms to secure a message over insecure channel.
3. Design and implement security solutions in an organization.

Course Outcomes (COs):

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
CO1 **Use** the different cryptographic algorithms for implementing security.	3	Apply
CO2 **Use** the different Message digest algorithms to secure a message over insecure channel.	3	Apply
CO3 **Design** and implement security solutions in an organization.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

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Guidelines: This Cyber Security Laboratory course has Cryptography and Cyber Security as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have two hours to complete that. The practical examination will comprise of implementation of assignments and related theory. All assignments are to be performed in C, C++, Java or Python. Use of open-source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition; code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in C or C++ or Java or Python Language.

	Suggested List of Assignments		
Sr. No.	**Assignment**	**No. of Hours**	**COs**
1.	Write a program in C++ or JAVA or Python to implement RSA algorithm for key generation and cipher verification.	2 Hrs.	CO1
2.	Write a program in C++ or JAVA or Python to implement Diffie Hellman Key Exchange algorithm.	2 Hrs.	CO1
3.	Write a program in C++ or JAVA or Python to implement MD5 and SHA-1 algorithm using Libraries (API).	2 Hrs.	CO2
4.	Write a program in C++ or JAVA or Python to implement DES algorithm using Libraries (API).	2 Hrs.	CO2
5.	Write a program in C++ or JAVA or Python to implement AES algorithm using Libraries (API).	2 Hrs	CO2
6.	Configure and demonstrate use of IDS tool such as SNORT.	2 Hrs.	CO3
7.	Configure and demonstrate use of vulnerability assessment tool such as NESSUS.	2 Hrs.	CO3
8.	Implement web security with Open SSL tool kit.	2 Hrs.	CO3

Text Books:
1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education/PHI, 2006.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
3. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiely India Pvt. Ltd., ISBN- 978-81-265-2179-1.

Reference Books:
1. Nina Godbole, " Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
2. Willaim Stallings, "Computer Security : Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6.
3. Mark Merkow, " Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288-7.
4. CK Shyamala et el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
5. Berouz Forouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN :978007070208.

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IT320 : Artificial Intelligence Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	50 Marks
Credits: 1	Total:	50 Marks

Prerequisite Course: Data Structures and Files Laboratory.

Course Objectives

1. To implement Artificial Intelligence and Non Artificial Intelligence Techniques.
2. To implement uninformed and informed search strategies.
3. To understand and implement Artificial Neural Network.
4. To learn and understand Uncertainty in AI with example.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Apply** and implement Artificial and Non Artificial Intelligence techniques.	3	**Apply**
CO2	**Use** uninformed and informed search strategies for implementation of search algorithms.	3	**Apply**
CO3	**Apply** Artificial Neural Network for various learning algorithms.	3	**Apply**
CO4	**Apply** Fuzzy logic for the implementation of real life problems.	3	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	1	-	1	2	2	2	1	2	2	-
CO2	2	1	3	1	1	1	-	1	2	2	2	1	1	2	-
CO3	2	2	3	1	2	1	-	1	2	2	2	2	1	2	-
CO4	2	1	3	1	1	1	-	1	2	1	1	2	1	1	-

Guidelines: This Artificial Intelligence Laboratory course has Artificial Intelligence as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C/C++ or Python Language. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C/C++ or Python Language.

	Suggested List of Assignments		
Sr. No.	**Assignment**	**No. of Hours**	**COs**
1.	Assignment Based on direct heuristic search techniques.	2 Hrs.	CO1
2.	Implement any one technique from the following a) Best First Search and A* Algorithm b) AO* Algorithm c) Hill Climbing	2 Hrs.	CO1
3.	Implement Perceptron Learning Algorithm.	2 Hrs.	CO2
4.	Implement a real life application in AI libraries Python.	2 Hrs.	CO2
5.	Implement an expert system in Python.	2 Hrs.	CO3
6.	Implement any two player game using min-max search algorithm.	2 Hrs.	CO3
7.	Design a fuzzy set for shape matching of handwritten character.	2 Hrs.	CO4

Text Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill.
2. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.

Reference Books:

1. Ivan Bratko, "Prolog Programming For Artificial Intelligence", 2nd Edition, Addison Wesley.
2. Eugene, Charniak, Drew Mcdermott, "Introduction to Artificial Intelligence", Addison Wesley.

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MC321 : Suitable Technical / Non-Technical Activities finalized by Department (Mandatory Course – VI)

Teaching Scheme	Examination Scheme	
Lectures: 1 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	NA
Credits: Non Credit	Total:	NA

Course Contents

Faculty in-charge will facilitate students to organize and conduct following extra-curricular activities:
   1. Quizzes
   2. Expert Lecture
   3. Programming Event
   4. Poster Presentation
   5. Aptitude
   6. Blind Coding
   7. Surf & Presentation
   8. Group Discussion
   9. Bug Finding