Bhartiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

[Knowledge is Nectar]

Liberal, Pi-Model of Engineering Education @ SPIT
(Department of Information Technology)

Salient Features

- 160-Credit **Liberal** Engineering Education Model.
- A strong **program core of 12 courses** and **6 baskets of program electives** to ensure the breadth and depth in a chosen domain of studies. Program electives are arranged either to grow in a specified vertical or have diversified exposure.
- **Full semester industry internship to interested students.**
- Aggressive model of **"Learning-by-doing". (**Engagement in classroom and laboratory sessions is 50:50)
- Special tracks for **"Minor"** Certification for interested learners, ensuring significant awareness of additional discipline leading to multiple specializations
- **Unique, multi-track model of "Honors" Certification,** for well performers for enhanced depth in the domain of study.
- Special sequel of optional **industry floated "SCOPE"** courses (Skilled Certification for Outcome-based Professional Education) for interested learners, ensuring high technical skills, in the diversified cutting-edge technologies.
- **First-of-its-kind-in-education** blend to Engineering Curriculum. **"ABLL@LLC"®** (Activity Based Liberal Learning about **Life, Literature and Culture**) in **all EIGHT** semesters, ensuring **all dimensional holistic growth** of the learner. These eight activity based mini courses are offered as two sequels namely **"SEVA"®** (Social Empowerment through Various Activities", and **"SATVA"®** (Self accomplishment through various Activities).

This curriculum aims at development of an **all-rounded** personality. It follows **holistic** approach of education, ensures strong science, mathematics foundation and program core, develops expertise in domain vertical though sequel of electives, ensures significant exposure of additional discipline through "Minor" program, collaborates outside world for the imparting relevant skills through "SCOPE" courses, challenges good learners through "Honors" evaluation, and systematically develops soft skills, and social, physical, mental, spiritual personality through carefully articulated **Liberal Learning** and **Humanities** sequels. Thus, offers a unique, liberal **"Pi-Model"** of Engineering Education.

Program Core

At SPIT, every undergraduate program consists of **Twelve Core Courses** referred as **Program Core**. Several academic models from reputed institutions in the country and outside the country are studied in articulating this Program Core, to make curriculum Globally Competitive. All courses in this Core have laboratory component to augment the learning. Each program core course has additional optional component of "Contents beyond the curriculum" which is carefully designed to ensure additional 15-20 hours engagement of the learners. The learner thus is nurtured towards the "Self-Learning" and "lifelong learning" which are essential attributes of 21st Century learner.

Program Electives

At SPIT, every program has **Six baskets** of Program Electives, each basket having minimum 3 courses. This enables learner to grow in a **domain-specialization** or **domain-vertical**. For example, learner can graduate with B.Tech Electronics with vertical in "Embedded Systems" or "VLSI" or "Signal Processing". Or a learner can graduate with B.Tech Computer Engineering with specialization in "Security" or "ML & AI" or "Computer Networking" or "Data Science". At the same time, learner can increase her bandwidth opting for elective courses which are general in nature, not pointing out towards a specific vertical.

Open Electives

Every undergraduate program has three baskets of open electives. This is planned to give exposure to interdisciplinary and cross disciplinary domains. The courses in these baskets are planned both at department and institute level. Students can choose any combination of these courses (not floated by the parent department) to get familiar with other domains of learning. One of these open electives must be chosen from Basic science courses or Engineering Science courses. **This unique approach of offering additional basic science or engineering science elective at senior level aims at appreciating the importance of other domains of learning.**

Humanities and Social Science Electives

National Education policy 2019 has aptly spelled out the necessity of Humanities in the Professional Education. It quotes, "A holistic and liberal education as described so beautifully in India's past is indeed what is needed for the education of India in the future to truly lead the country into the 21st century and the fourth industrial revolution. Even engineering schools such as the IITs must move towards a more liberal education integrating arts and humanities". Every program at SPIT has three baskets of humanities. Learners are encouraged to take diversified courses in the field of languages, law, history, economics, management, finance etc.

SCOPE Certification

This unique sequel is designed to systematically develop skills required for an industrial sector. SPIT is partnering with various industries to offer the high-end skills required for a specific industrial sector. Well performing students can stretch the envelop and add new dimension to their Professional Personality by earning this certification. There are multiple tracks for SCOPE certification. Each track is offered with partnership with reputed institution or industry. These tracks are jointly designed by SPIT and partnering industry. Each track has four courses

(modules). Each module/course is of 2-3 credits including laboratory component for most of the tracks. These tracks are also open for outside learners, leading to Certificate Program in a chosen domain.

Minor Certification

This additional and optional certification provides an opportunity to learner to develop the leaners in the additional domain of interests. It broadens the education and ensures the multi-disciplinary development which is essential attribute of 21st century engineer. However, this is optional. Well performing students can stretch the envelop and add new dimension to their Professional Personality. Each track for this minor certification is offered either by SPIT or with partnership with other reputed institutions. Each track has four courses (modules). Each course is of 3 credits and laboratory component if any. These tracks are also open for outside learners, leading to Certificate Program of 12 credits in a chosen domain.

Honors Certification

While the Minor and SCOPE certifications aim at adding additional professional dimension to the professional personality of the learners, the Honors certification gives opportunity to well performing learners to drive deep in the chosen field of study. Multiple plans/ways are planned to encourage learners to earn this certification which essentially excite the learners to push an envelope and go extra/deep in the chosen area of the study. Students earn additional stars (*) as shown in Table 1 during their program. If at the time of graduation student earns total **TWELVE** stars, she is conferred with “Honors” certification.

Table 1: Additional "STAR" Earning leading to "Honors" certification

<table>
<tr><th>Activity</th><th>Definition of "STAR"</th><th>Maximum Limit</th></tr>
<tr><td>Earning top grade in any of the 12 courses which constitute the program core.</td><td>Top Grade: Full STAR
Next GRADE: Half STAR</td><td>8 STARs</td></tr>
<tr><td>Enrolling additional "Honors" Course at fourth year.</td><td>Top Grade: 3 STARs
Next GRADE: 2 STARs
Next GRADE: 1 STAR</td><td>6 STARs</td></tr>
<tr><td>Success in the GATE examination</td><td><table><tr><th>Percentile Score</th><th>STARs Earned</th></tr><tr><td>Above 99</td><td>6</td></tr><tr><td>Above 98</td><td>5</td></tr><tr><td>Above 95</td><td>4</td></tr><tr><td>Above 90</td><td>4</td></tr><tr><td>Valid score</td><td>2</td></tr></table></td><td>8 STARs</td></tr>
<tr><td>Research Publication</td><td>Journal* :2- 6 STARs
SPIT supported Patent : 3 STARs</td><td>8 STARs</td></tr>
<tr><td>Completion of PG level on line course from IITs available on NPTEL</td><td><table><tr><th>Percentile Score</th><th>STARs Earned</th></tr><tr><td>Above 95</td><td>3</td></tr><tr><td>Above 90</td><td>2</td></tr><tr><td>Above 80</td><td>1</td></tr></table></td><td>6 STARs</td></tr>
<tr><td>#Winning prestigious technical competitions at National level</td><td><table><tr><th>Rank</th><th>STARs Earned</th></tr><tr><td>1</td><td>4</td></tr><tr><td>2</td><td>3</td></tr><tr><td>3</td><td>2</td></tr></table></td><td>6 STARTs</td></tr>
<tr><td>**Enrolling for optional "Special Honors Paper" in Semester 3, 4, and 5.</td><td>Above 70% : 3 STARs
Above 60%: 2 STARs
Above 50%: 1 STAR</td><td>8 STARs</td></tr>
</table>

*In identified journals only. No of STARs to be decided by Institute Committee.

#In identified events by the institute

**This special paper will cover all core courses in the semester and its difficulty level will be higher than the normal end semester examination paper. The question paper will be of GATE standard.

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC)

"Education will fail ignominiously in its objective if it manufactures only a robot and called him an economic man stressing the adjective economic and forgetting the substantive man. A university cannot afford to ignore the cultural aspects of education whatever studies it specializes in. Science is a means, not an end. Whereas culture is an end in itself. Even though you may ultimately become a scientist, a doctor, or an engineer, you must, while in college, absorb fundamental values which will make you a man of culture.."

Kulpati Dr. K. M. Munshi

How aptly our visionary founder has given direction to the education. His wisdom towards education inspires, encourages us to experiment in the field of education, to make it as relevant and helpful to the society as possible. Mahatma Gandhi once quoted, *"By education I mean an all-round drawing out of the best in man; body, mind and spirit."*

Recently announced National Policy on Education-2019, reconfirms this and profoundly stresses the need of liberalizing the higher education including professional education. It quotes, *"Higher education must develop good, well-rounded and creative individuals, with intellectual curiosity, spirit of service and a strong ethical compass".* Moving towards a more liberal undergraduate education is one of the most important features of this policy. It narrates, *"The needs of the 21st century require that liberal broad-based multidisciplinary education become the basis for all higher education. This will help develop well-rounded individuals that possess critical 21st century capacities in fields across arts, humanities, sciences, social sciences, and professional, technical, and vocational crafts, an ethic of social engagement, and rigorous specialization in a chosen field or fields. Such a liberal education would be, in the long run, the approach across all undergraduate programs, including those in professional, technical, and vocational disciplines. Imaginative and flexible curricular structures will enable creative combinations of disciplines for students to study, thus demolishing currently prevalent rigid boundaries and creating new possibilities for lifelong learning. The notion of 'knowledge of many arts'- i.e. what is called 'liberal arts' in modern times – must be brought back to Indian education, as it is exactly the kind of education that will be required for the 21st century."*

We at Bhavan's SPIT, make sincere attempt to blend engineering education appropriately with arts, humanities, crafts, ethic of personal and social engagement to ensure holistic development of the learner. We have carefully designed liberal learning courses covering Life, Literature, and Culture (LLC @ LLC) for all the semesters of the program. Learner concurrently studies these courses. These courses broadly fall under two groups, namely "SEVA (Social Empowerment through Various Activities)" and "SATVA (Self Accomplishment through Various Activities)". Each of these groups, has four modules as indicated in Table 2 and Table 3. Further each module has multiple courses of 1 or 2 credits (An engagement of 35-40 hours is expected to earn one credit). Every learner at SPIT is expected to take 1 such course on LLC every semester. We strongly believe that these EIGHT liberal learning modules will help us to appropriately blend the professional education as envisaged by the National Policy Makers.

SUGGESTED LIST OF COURSES (INDICATIVE ONLY)

Open Electives I and II

OEXXX	IoT and I^2Ot
OEXXX	Cloud Computing
OEXXX	Augmented and Virtual Reality
OEXXX	3D Printing
OEXXX	Industrial Automation
OEXXX	Artificial Intelligence and Machine learning
OEXXX	Cyber Security & Digital Forensics
OEXXX	Block Chain Technology
OEXXX	E-Mobility
OEXXX	Smart Grid
	courses floated as **Open elective** by the **Departments**
OEXXX	Consumer Electronics
OEXXX	Robotic & Machine Vision
OEXXX	Data Structures and Algorithms
OEXXX	Information and Network Security
OEXXX	Human Machine Interaction
OEXXX	Software Engineering
OEXXX	Database Management Systems
OEXXX	Internet Technology
OEXXX	Data Analytics
	Any other 12 weeks Course approved by the Dean Academics and Principal

Open Elective III-Basic Science Electives

OEMA1	Advanced Statistics

OEAS1	Biology for Engineers-Part II
OEAS2	Climate and Earth Science
OEMA 2	Engineering Optimization
OEAS3	Environment and Sustainability
OEAS4	Semiconductor Optoelectronics
OEMA 3	Numerical Methods for Engineers
OEXX X	Any other Course approved by the Dean Academics and Principal

Open Elective III-Engineering Science Electives

OEXX X	Thermal & Fluid Engineering
OEXX X	Manufacturing Processes
OEXX X	Electric Drives
OEXX X	Engineering Materials
OEXX X	Data Structures
OEXX X	Algorithms
OEXX X	Sensors and Actuators
OEXX X	Communication Engineering
OEXX X	Any other Course approved by the Dean Academics and Principal

Open Elective IV: Humanities and Management Related

OEHX X	Management Principles
OEHX X	Research Methodology
OEHX X	IPR and Patents
OEHX X	Law for Engineers
OEHX X	Organizational Behavior
OEHX X	Leadership, Innovation and Entrepreneurship
OEHX X	Project Management

OEHXX	Finance for Engineers
OEHXX	Any course approved by Dean Academics and Principal

Humanities and Social Sciences Electives

Special Tracks

	HSSE-I		HSSE-II		HSSE-III
HSE11	Law for Engineers-I	HSE12	Law for Engineers-II	HSE13	Law for Engineers-III
HSE21	Finance for Engineers-I	HSE22	Finance for Engineers-II	HSE23	Finance for Engineers-III
HSE31	Psychology-I	HSE32	Psychology-II	HSE33	Psychology-III
HSE41	Economics-I	HSE42	Economics-II	HSE43	Economics-III
HSE51	Ancient India	HSE52	Medieval India	HSE53	Modern India
HSE6X1	Language X-I	HSE6X2	Language X-II	HSE6X3	Language X-III

Common Pool for HSSE-I, II and III (May be studied on MOOC's)

HSEC01	Film Appreciation	HSEC02	Universal Values
HSEC03	Game Theory	HSEC04	Human Behavior
HSEC05	Ecology and Society	HSEC06	Energy Economics and Policies
HSEC07	Drama Appreciation	HSEC08	Political Ideologies
HSEC09	Justice	HSECXX	Any other Approved Course
HSEXX	Any course from HSSE-I		

Table 2: SEVA

SEVA (Social Empowerment through Various Activities)			
Module	**Title**	**Courses**	**CODE**
SEVA-I	**SOCHO BHARAT**	Study of Green & White Revolutions in India	SV10
		Government Missions [Study of any 2]	SV11
		Study of India's top 2 problems	SV12
		Study of World's top 2problems	SV13
		How Government Works? [Study of one department of the Central/ State Government]	SV14
		Study of one of the identified Books	SV15
		Study of two National policies	SV16
		Any other activity approved by Dean Academics	SV1X
Module	Title	Courses	CODE
SEVA-II	**SWACCH BHARAT**	River/Beach/Mohalla/School/Campus/Govt offices Cleaning	SV20
		Waste Segregation Surveys	SV21
		NSS camp in village for a week	SV22
		Medical camps in schools	SV23
		First Aid training for a week	SV24
		Surveys and Estimation for roof top solar	SV25
		NCC participation	SV26
		Any activity approved by Dean Academics	SV2X
Module	Title	Courses	CODE
SEVA-III	**SHIKSHIT** BHARAT	Mentoring of School Children	SV30
		Digital Literacy for yielders	SV31
		Value addition for deprived schools	SV32
		Mentoring junior (first year) students at SPIT	SV33
		Teaching Assistantship at SPIT	SV34
		Development of learning material for schools/it is	SV35
		Participation in "Teach-for-India" movement	SV36
		Any other activity approved by Dean Academics	SV3X
Module	Title	Courses	CODE
SEVA-IV	**SAMRUDDHA** BHARAT	Great Grass Root Innovations	SV40
		Innovation and Creativity	SV41
		Critical Thinking and Problem solving	SV42
		Team work and collaboration	SV43
		Leadership & Entrepreneurship	SV44
		Design Thinking	SV45
		Study of one of the identified books	SV47
		Work with START-UP at SPIT	SV48
		Any other activity approved by Dean Academics	SV49

Table 3: SATVA

SATVA (Self Accomplishment Through Various Activities)			
Module	**Title**	**Courses**	**CODE**
SATVA-I	**SANSKARIT** BHARAT	Values and Ethos of Bhavan	ST10
		Essence of Indian traditional knowledge	ST11
		Philosophy of religion (any)	ST12
		Study of Life Management / Kindle Life / Life Empowerment and Enriching Program or any other book cited.	ST13
		Study of any of GREAT sons of INDIA [Ex. Gandhi, Ambedkar, Phule, Savarkar, Sardar Patel, Nehru, Shivaji, JRD Tata etc]	ST14
		Any other course approved by Dean Academics	ST1X
SATVA-II	**SAKSHAM** BHARAT	Target based Physical Exercise for example-Running [Test 5 kms in a stretch], Swimming [Test 1 km in a stretch], Walking [Test 20 kms in a stretch], Trekking [7days], Cycling	ST20
		Sports – Representation of Institute at University level/Inter college level and above in ANY sport	ST21
		Participation in National Tech Fest, AICTE-Hackathon, Industry floated global and national competitions, Robocon, BAHA etc	ST22
		Yoga vidya –I	ST23
		Any other activity approved by Dean Academics	ST2X
SATVA-III	**SUNDER** BHARAT	Institute representation in prestigious cultural fests/competitions	ST30
		Dance [Bharatanatyam /Kathak /Lavani /Western Dance]. Only for beginners	ST31
		Learning musical instrument [Any type]. Only for beginners.	ST32
		Film Appreciation/Dramatics/Seeing through Painting	ST33
		Making short film/Photography	ST34
		Yogvidya-II	ST35
		Any other activity approved by Dean Academics and DOSA	ST3X
SATVA-IV	**SURAKSHIT** BHARAT	Food that Heals	ST40
		Personal and Social Hygiene	ST41
		Intellectual Property Rights	ST42
		Etiquette and Conversational skills	ST43
		Basics of Ayurveda	ST44
		Study of one of the identified Books	ST45
		Any other course approved by Dean Academics	ST4X

Indicative SCOPE Certification

Minor/SCOPE Certification

Minor/SCOPE Track	Partner Institute if any.	Module	C
Computer Engineering	SPIT	Data Structures and Algorithms	MN11
		Database Management Systems	MN12
		Machine Learning	MN13
		Internet Technology	MN14
Industrial IoT	SPIT	Application Specific System Design	MN21
		Embedded "C" Programming & Real-time Software Development	MN22
		Software Design for Discrete time Control Algorithms	MN23
		Industrial Internet of Things (IIoT) System design and Applications	MN24
Management	S.P. Jain Institute of Management and Research [SPJIMR]	Finance and cost Management	MN31
		Supply Chain Management, operations and project Management	MN32
		IT for Business, HR and Organization	MN33
		Marketing	MN34
User Experience (UX) Design	Imagin XP, Pune	UX Design & Digitalization	SC11
		Empathy & Its Tools	SC12
		User Research & Its Application	SC13
		Design Thinking & Its Applications	SC14

CURRICULUM SCHEME FOR UNDERGRADUATE ACADEMIC PROGRAM AT SPIT

2020 ITERATION: COMPUTER DOMAIN (Information Technology)

Nomenclature of the Courses

BSC	Basic Science Course	**PC**	Program Core
BSE	Basic Science Elective	**PE**	Program Elective
ESC	Engineering Science Course	**MLC**	Mandatory Learning Course
ESE	Engineering Science Elective	**SCOPE**	Skill Certification for Outcome based Professional Education
SBC	Skilled Based Course	**OE**	Open Elective
ABL-SATVA	Self- Accomplishment Through Various Activities	**HSSE**	Humanities and Social Science Elective
ABL-SEVA	Social Empowerment Through Various Activities		

Abbreviations

L	Lecture Hour	O	Other Work (Self Study)
T	Tutorial Hour	E	Total Engagement in Hours
P	Laboratory Hour	C	Credit Assigned

Sem I									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA101	Engineering Calculus	3	1	0	8	12	4
2	BSC	AS102	Engineering Chemistry	2	0	2	3	07	3
3	BSC	AS103	Biology for Engineers	2	0	0	3	05	2
4	ESC	AS105	Engineering Mechanics	2	0	2	4	08	3
5	ESC	CS101	Problem solving using Imperative Programming	2	0	2	4	08	3
6	ESC	EC101	Digital Systems and Microprocessors	3	0	2	5	10	4
7	SBC	AS107	Communication Skills	1	0	2	2	05	2
TOTAL				**15**	**1**	**10**	**29**	**55**	**21**

Sem II

No.	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA102	Differential Equations and Complex Analysis	3	1	0	8	12	4
2	BSC	AS101	Engineering Physics	2	1	2	5	10	4
3	ESC	AS104	Engineering Graphics	1	0	4	2	07	3
4	ESC	ET101	Basic Electrical Engineering	3	0	2	6	11	4
5	ESC	CS102	Problem Solving using OOP	2	0	2	3	07	3
6	SBC	AS106	Skill Shop	0	0	2	0	02	1
7	ABL	SV1X/ ST1X	SEVA-I or SATVA-I	0	0	0	2	02	1
TOTAL				**11**	**2**	**12**	**26**	**51**	**20**

FIRST SUMMER									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	SBC	AS108	ENGINEERING EXPLORATION (Project to solve social problem)	0	0	0	100	100	2

Sem III									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
1	BSC *	MA202	Foundation of Mathematics-I*	2	1	0	6	09	3
2	PC	IT201	Discrete Structures and Graph Theory	3	0	0	4	07	3
3	PC	IT 202	Data Structures	3	0	2	5	10	4
4	PC	IT 203	Computer Architecture and Organization	3	0	2	4	09	4
5	PC	IT 204	Database Management Systems	3	0	2	5	10	4
6	ABL	SVXX/ STXX	SEVA II or III /SATVA II or III	0	0	0	3	03	1
7	HSSE	HSEX1	HSS-I	2	0	0	3	05	2
TOTAL				**17**	**0**	**6**	**29**	**52**	**21**

**Only for Lateral Entry Students*

Sem IV									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC *	MA204	Foundation of Mathematics-II	3	0	0	6	09	3
2	PC	IT205	Design and Analysis of Algorithms	3	0	2	5	10	4
3	PC	IT206	Operating Systems	3	0	2	5	10	4
4	PC	IT207	Computer Communications and Networks	3	0	2	5	10	4
5	SBC	IT208	Mini Project-I	0	0	0	4	04	2

6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	01	1
7	HSSE	HSEX2	HSS-II	2	0	0	3	05	2
8		AS201	Professional Communication Skills	1	0	2	2	05	2
9	S/M	SCX1/MNX1	SCOPE-I/Minor-I						3
TOTAL				**14**	**0**	**10**	**32**	**56**	**22**

**Only for Lateral Entry Students*

Second Summer for HSC students									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	MLC	AS202	Constitution of India	1	0	0	05	06	NC

Second Summer (For Lateral Entry Students)									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
2	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
3	MLC	AS202	Constitution of India	1	0	0	5	06	NC

Sem V									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	PC	CS301	Theory of Computation	3	0	0	6	9	3
2	PC	CS302	Software Engineering	3	0	2	5	10	4
3	PC	CS303A/ CS303B	Cryptography and System Security/Artificial Intelligence and Machine Learning	3	0	2	5	10	4
4	PC	CS304	Distributed Computing	3	0	2	5	10	4
5	SBC	CS305	Internet Technology Lab	1	0	2	5	08	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	2	02	1
7	HSSE	HSEX3	HSS-III	2	0	0	3	05	2
8	S/M	SCX2/MNX2	SCOPE-II/Minor-II						3
TOTAL				**15**	**0**	**8**	**32**	**55**	**20**

Sem VI For Cat 1 students (who have NOT preferred semester long internship)									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-I	2	0	2	4	08	3
2	PC	IT306	Big Data Analytics	3	0	2	5	10	4
3	PC	IT307	Foundation of Signal Processing	3	0	2	5	10	4
4	PE	1T3X1	Program Elective-I	2	0	2	4	08	3
5	PE	1T3X2	Program Elective-II	2	0	2	4	08	3
6	SBC	IT308	Mini Project-II	0	0	0	8	08	3

8	S/M	SCX3/MNX3	SCOPE-III/Minor-III						3
				12	**0**	**10**	**33**	**55**	**20**

Sem VI For Cat 2 students (who have preferred semester long internship)									
No.	Type	Code	Course	L	T	P	O	E	C
1	PE*	1T3X1	Program Elective-I	2	0	2	4	08	3
2	PE*	1T3X2	Program Elective-II	2	0	2	4	08	3
3	SBC	IT310	Industry Internship	0	0	0	40	40	15
4	S/M*	SCXX/MNXX	SCOPE-III/Minor-III						3
			TOTAL	**4**	**0**	**4**	**48**	**56**	**21**
			*To be completed online mode or allied courses from MOOCs						

Sem VII									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-II	2	0	2	4	08	3
2	OE	OEXXX	Open Elective--III*	2	0	2	4	08	3
3	PE	1T4X3	Program Elective-III	2	0	2	4	08	3
4	PE	1T4X4	Program Elective-IV	2	0	2	4	08	3
5	SBC	IT401	Main Project Stage-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA-III/SATVA-III	0	0	0	4	04	2
7	S/M/H	SCX4/MNX4 / HOXX	SCOPE-IV/Minor-IV/Honors-I						3
		*OE-III must be from Basic Science Elective or Engineering Science Elective							
			TOTAL	**8**	**0**	**8**	**24**	**40**	**16**

Sem VIII (Option A: Cat1/Cat2)									
No.	Type	Code	Course	L	T	P	O	E	C
1	OE*	OEHXX	Open Elective –IV	2	0	2	4	08	3
2	PE	1T4X5	Program Elective –V	2	0	2	4	08	3
3	PE	1T4X6	Program Elective –VI	2	0	2	4	08	3

4	SBC	IT402	Main Project Stage-II	0	0	0	12	12	6
5	ABL	SVXX / STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	2
6	H	HOXX	Honors-II						3
	*must be from Humanities and Management group, May be taken from MOOCs								
			TOTAL	**6**	**0**	**6**	**28**	**40**	**17**

Sem VIII (Option B-Only for Cat 1 students)									
No.	Type	Code	Course	L	T	P	O	E	C
1	SBC	IT403	Main Project Stage-II	0	0	0	36	36	15
2	ABL	SVXX / STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	2
3	H	HOXX	Honors-II						3
			TOTAL	0	**0**	**0**	**40**	**40**	**17**

Table 2: Program Electives

PE/TD	Program Elective-I	Program Elective-II	Program Elective- III	Program Elective- IV	Program Elective- V	Program Elective- VI
Machine Learning	1T311 : Machine Learning	1T312: Soft Computing	1T413: Natural Language Processing	1T414: Deep Learning	1T311, 1T312, 1T321, 1T322, 1T331, 1T332, CS311, CS312, CS321, CS322, CS331, CS332	1T311, 1T312, 1T321, 1T322, 1T331, 1T332, CS311, CS312, CS321, CS322, CS331, CS332
Information Security	1T321: Ethical Hacking	1T322: Digital Forensics	1T423: Security Operations Center	1T424: Blockchain Technology		

General	1T331 : Advanced Database Systems 1T311, 1T312, 1T321, 1T322, 1T332, CS311, CS312, CS321, CS322 CS331, CS332	1T332 : Data Science 1T311, 1T312, 1T321, 1T322, 1T331, CS311, CS312, CS321, CS322 CS331, CS332	1T433 : Digital Image Processing 1T413, 1T414, 1T423, 1T424, 1T434, CS413, CS414, CS423, CS424, CS433, CS434	1T434 : Project Management 1T413, 1T414, 1T423, 1T424, 1T433, CS413, CS414, CS423, CS424, CS433, CS434		

SEMESTER V

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Theory of Computation	3	0	0	6	9	3	0	0	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT301		Theory	75		75		150			300
		Laboratory	--		--		--			--

Pre-requisite Course Codes, if any.	IT201: Discrete Structures and Graph Theory
Course Objective: To give an overview of the theoretical foundations of computer science from the perspective of formal languages which provides the mathematical foundation of formal	

models of computation, and fundamentals of formal grammars and languages that is used in most areas of computer science.	
Course Outcomes (CO): ***At the end of the course students will be able to***	
IT301.1	Design finite automaton for a regular expressions and languages.
IT301.2	Apply the properties of regular languages.
IT301.3	Construct the grammar for a language and convert it into normal forms.
IT301.4	Design and Evaluate Pushdown Automata and Turing Machine for a language.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
IT301.1	3	3	2	-	1	-	-	-	1	1	-	-
IT301.2	3	2	-	-	-	-	-	-	1	1	-	-
IT301.3	2	3	-	-	1	-	-	-	1	1	-	-
IT301.4	2	2	2	-	1	-	-	-	1	1	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT301.1	2	1	-	-	-	-	-
IT301.2	2	1	-	-	-	-	-
IT301.3	2	1	-	-	-	-	-
IT301.4	2	1	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Sets, Relations and Languages**	**T1, R3**	**3**
	1.1	Relations and functions		
	1.2	Alphabets and languages		
	1.3	Types of proof		

2	**Title**	**Finite Automata**	**T1, R1, R3**	**7**
	2.1	Regular languages and regular expressions		
	2.2	Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with **ϵ**-transitions		
	2.3	Kleene's theorem		
	2.4	NFA to DFA Conversion		
	2.5	Finite Automata with output (Moore and Mealy Machine)		
3	**Title**	**Regular Languages**	**T1, R1**	**6**
	3.1	The pumping lemma for regular languages, Applications of the pumping lemma		
	3.2	Closure properties for regular languages		
	3.3	Equivalence and minimization of automata: Testing equivalence of states, Minimization of DFA's		
4	**Title**	**Context-Free Grammars and Languages**	**T1, R3**	**5**
	4.1	Context free grammars: Definition of context free grammars, Derivations using a grammar, The language of a grammar, Sentential forms		
	4.2	Parse trees: Constructing parse trees, From inferences to trees, From trees to derivations, From derivations to recursive inferences		
	4.3	Ambiguity in grammars and languages: Ambiguous grammars, Removing ambiguity from grammars		
5	**Title**	**Pushdown Automata**	**T1, T2**	**6**
	5.1	Definition of the pushdown automaton: The formal definition of pushdown automata, A graphical notation for PDA's, Instantaneous descriptions of a PDA		
	5.2	The languages of a PDA: Acceptance by final state, Acceptance by empty stack, From empty stack to final state, From final state to empty stack		
	5.3	Equivalence of PDA's and CFG's: From grammars to pushdown automata, From PDA's to Grammar		
	5.4	Deterministic pushdown automata: Definition of a deterministic PDA, Regular languages and deterministic PDA's, DPDA's and context free languages		
6	**Title**	**Properties of Context-Free Languages**	**T1, T2, R1**	**5**
	6.1	Eliminating useless symbols, Computing the generating and reachable symbols, Chomsky normal form, Greibach normal form		
	6.2	The Pumping lemma for context free languages: Applications of the pumping lemma for CFL's		
7	**Title**	**Introduction to Turing Machines**	**T1, T2**	**6**
	7.1	Turing machines: Formal definition of a Turing machine, Examples of Turing machines		
	7.2	Halting Problem, Post Correspondence Problem (PCP)		
	7.3	Variants of Turing machines: Multitape Turing Machines		

	7.4	Church-Turing hypothesis		
8	**Title**	**Recursively Enumerable Languages**	**R1**	**4**
	8.1	Recursively Enumerable and recursive		
	8.2	Enumerating a language		
	8.3	Context sensitive languages and the Chomsky hierarchy		
	Self Study	**Tractable and Intractable Problems:** Tractable and Possibly Intractable Problems: P and NP, Polynomial-Time Reductions and NP-Completeness, Cook's Theorem	**R1**	**5***
Total				**42**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Automata Theory, Languages, and Computation	Third Edition	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman	Pearson	2008
2	Introduction to the Theory of computation	Third Edition	Michael Sipser	Cengage	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Languages and the Theory of Computation	Fourth Edition	John C. Martin	McGraw-Hill	2010
2	Elements of the Theory of Computation	Second Edition	Harry R. Lewis, Christos H. Papadimitriou	Pearson	2015
3	Automata and Computability	--	Dexter C. Kozen	Springer	1997

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Software Engineering	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
IT302		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	CS102: Object-oriented programming language IT204: Database Management Systems

Course Objective: To understand the best practices in software engineering and gain knowledge to analyze, design, implement and test software project.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT302.1	Analyze software requirements.
IT302.2	Apply UML models for a project.
IT302.3	Evaluate system architecture and develop detailed task schedule from the overall estimates and planning.
IT302.4	Illustrate different coding principles with unit test process.
IT302.5	Understand the need for DevOps.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT302.1	-	3	-	-	-	-	-	-	2	2	-	-
IT302.2	-	2	-	-	2	-	-	-	2	2	-	-
IT302.3	-	3	2	1	2	-	-	-	2	2	2	-
IT302.4	-	-	3	-	2	-	-	-	2	-	-	-
IT302.4	-	1	1	-	-	-	-	-	-	-	-	1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT302.1	3	-	-	-	-	-	-
IT302.2	3	2	-	-	-	-	-
IT302.3	3	2	-	-	2	-	-
IT302.4	3	-	-	-	2	-	-
IT302.5	1	2	1	-	-		1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✔	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction**		**06**
	1.1	Software Development Challenges, Software Scope, The Human Side of Software Development	**T1,T2**	
	1.2	Software Methodologies and Related Process Models with applications, Traditional Life Cycle Models, Waterfall, Incremental, Iterative models, Agile Software Engineering Process Models, SCRUM, Extreme Programming	**T1,T2**	

2	**Title**	**Requirements Management and Project Planning**		**10**
	2.1	Requirements Development Methodology, Specifying Requirements, Eliciting Accurate Requirements, Documenting Business Requirements, SRS, Defining User Requirements, Validating Requirements, Achieving Requirements Traceability, Managing Changing Requirements, Agile Requirements Engineering	**T1,T2**	
	2.2	Scheduling, Work Breakdown Structure, Gantt Chart, Pert Chart, Critical Path, Earned Value Analysis, Schedule and Cost slippage, Estimation, Decomposition techniques, Empirical estimation models, Software Risk Management**:** Risk Identification, Risk Projection, Risk Refinement, RMMM Plan	**T1,T2**	
3	**Title**	**Software Analysis**		**08**
	3.1	Difference between Structured and Object-Oriented analysis, Structured Analysis, Data Flow Diagrams	**R2,R3**	
	3.2	Object Oriented Analysis, Uses Case, Class diagram, Interaction diagrams, Activity diagram, State Chart diagram, Component and Deployment diagram	**R2,R3**	
4	**Title**	**Software Design & Development**		**08**
	4.1	Software Architecture, Architectural and Pattern-Based Design, Model Driven Architectures	**T1,T2**	
	4.2	Software Development, Component Infrastructures, Refactoring, Test Driven Development (TDD)	**T1,T2**	
	4.3	DevOps, Continuous Integration, Continuous Deployment, System Provisioning and Configuration Management	**R1**	
	4.4	Software Change Management, Change Control, Version Control	**T1,T2**	
5	**Title**	**Software Quality & Testing**		**10**
	5.1	Software Quality Concepts, Quality Assurance, Quality Control, Formal Technical Reviews	**T1,T2**	
	5.2	Software Metrics, Product Metrics – McCall's Quality Factor, Metrics for Analysis Model and Design Model, Project Metrics, Process Metrics, Metrics for Source Code	**T1,T2**	
	5.3	Software Testing, Unit Testing, Integration Testing, System Testing	**T1,T2**	
6	**Title**	Advance Topic in software Engineering		**5***
	Self Study	• Design Pattern		
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Gather requirements and write a project proposal for case study. Prepare SRS document. (Use IEEE template)
2	Design UML diagram -Use Case, Class diagram
3	Design UML diagram -Interaction diagrams
4	Design Data flow diagram (level 0 and1) for the case study.
5	Create work breakdown structure and schedule the activities

6	Develop Risk Mitigation, Monitoring and Management Plan for the case study.
7	Create versions of software using version control tool.
8	Implement any one Module from chosen case study.
9	Prepare test cases and perform Unit Testing (test scenario, test cases, test data)
10	Study on continuous Integration using DevOp

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Software Engineering: A Practitioner's Approach	Ninth Edition	Roger S. Pressman and Bruce Maxim	McGraw-Hill	2019
2	Fundamentals of Software Engineering	Fifth Edition	Rajib Mall	PHI Learning	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations	--	Gene Kin, Patrick Debois, John Willis, Jez Humble and John Allspaw	IT Revolution Press	2016
2	UML for Java Programmers	--	Robert C. Martin	Pearson	2006
3	UML Distilled: A Brief Guide to the Standard Object Modeling Language	Third Edition	Martin Fowler	Addition Wesley	2003

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Cryptography and System Security	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
CS303A		Theory	75		75		150			300

		Laboratory	**50**	**-**	**50**	**100**

Pre-requisite Course Codes, if any.	CS207
Course Objective: To apply and analyze different cryptography and system security protocols/techniques	
Course Outcomes (CO):*At the End of the course students will be able to*	
CS303A.1	Describe the different types of the cryptographic algorithms to secure information.
CS303A.2	Apply different cryptographic techniques to solve security-related problems.
CS303A.3	Create a message digest from data to authenticate authorized user
CS303A.4	Use system security practices

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CS303A.1	3	-	-	-	-	-	-	-	-	-	-	-
CS303A.2	3	3	-	-	-	-	-	-	-	-	-	-
CS303A.3	-	3	-	-	-	-	-	-	-	-	-	-
CS303A.4	-	3	3	3	2	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**
CS303A.1	-	-	-	-	-	-	-
CS303A.2	-	-	-	-	-	-	-
CS303A.3	-	-	-	-	-	-	-
CS303A.4	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create✓**

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Security and Cryptography**		10
	1.1	Introduction Security Attacks, Security Goals, Computer criminals, Methods of defense, Security Services, Security Mechanisms	1,4	
	1.2	Basics of Cryptography Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties-Confusion, Diffusion, Block and Stream Ciphers.	1,2,3	
2	Title	**Secret and Public Key Cryptography Techniques**		10
	2.1	Secret Key Cryptography Data Encryption Standard(DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, AES	1,2,3	
	2.2	Public Key Cryptography Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange	1,2,3	
3	Title	**Hashing Algorithms and Authentication Protocols**		12
	3.1	Cryptographic Hash Functions Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Digital Signature Standards.	1,2,3	
	3.2	Authentication Protocols, Kerberos, Key Management and Distribution, X.509 Directory, Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Key Identified Mail (DKIM).	1,2,3	
4	Title	**Security**		10
	4.1	IDS and Firewalls: Intrusion Detection System, Types of IDS, Firewalls Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration,	1,2,3,4	
	4.2	Internet Protocol Security (IPSec) Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange,	1,2,3,4	
	4.3	Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment. Non-cryptographic protocol Vulnerabilities, DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities-Phishing, Buffer Overflow, Format String Attacks, SQL Injection.	1,2,3,4	
	Self Study	International Data Encryption algorithm (IDEA) algorithm, Blowfish algorithm, Elliptic Curve Cryptography, DMZ Architecture, and QR Code generation and scanning, Honeypots, DNSSEC		***8**
			Total(* Not included)	**42**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Implement different substitution techniques.
2	Implement different transportation techniques.
3	Implementation of RSA algorithm.
4	Implementation of Diffie-Hellman key exchange algorithm.
5	Generate and calculate Hashes and checksum files.
6	Implement Pretty Good Privacy (PGP) security method.
7	Implement SNORT Intrusion Detection System.
8	Configure Firewall rules using IP tables.
9	Implement SQL Injection.
10	Implement Session Hijacking attack.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Cryptography and Network Security: Principles and Practice	Fifth Edition	William Stallings	Pearson	2011
2	Network Security and Cryptography	Second Edition	Bernard Menezes	Cengage Learning	2011
3	Cryptography and Network Security	First Edition	Behrouz A Fourouzan	TMH	2007
4	Security in Computing	Fifth Edition	Charles P. Pfleeger	Pearson Education	2015

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	Cryptography and Network	Second Edition	Behrouz A Fourouzan, Debdeep Mukhopadhyay	TMH	2010
2.	Computer Security Art and Science	First Edition	Matt Bishop	Addison-Wesley	2002

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Artificial Intelligence and Machine Learning	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
IT303B		Theory		75		75		150		300
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	IT 202: Data Structures, MA203: Probability and Statistics
Course Objective: This course covers the fundamental concepts of Artificial Intelligence and machine learning.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT303B.1	Understand AI building blocks presented in intelligent agents
IT303B.2	Solve the problems using suitable searching methods.
IT303B.3	Solve the problems using suitable reasoning and knowledge representation methods.
IT303B.4	Apply suitable machine learning technique for a given problem
IT303B.5	Design an intelligent system using different AIML techniques for real life problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT303B.1	2	3	-	-	2	-	-	-	-	-	2	-
IT303B.2	2	3	2	2	-	-	-	-	-	-	2	-
IT303B.3	2	3	2	2	-	-	-	-	-	1	2	-
IT303B.4	2	3	-	-	2	-	-	-	-	2	2	-
IT303B.5	2	3	2	2	2	-	-	-	-	2	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT303B.1	-	-	-	-	-	-	-
IT303B.2	-	-	-	-	-	-	-
IT303B.3	-	-	-	-	-	-	-

IT303B.4	1	1	1	-	-	-	-
IT303B.5	2	2	2	-	2	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Artificial Intelligence**	**T1**	**04**
	1.1	Definition of AI, History and Future of AI, Problem solving Approach to Typical AI problem.		
	1.2	**Intelligent Agents and Environment** What is an Intelligent Systems, Types of Agents, structure of agent		
	1.3	Environments and Its Properties, PEAS Representation for an Agent		
2	**Title**	**Problem solving by Searching**	**T1**	**10**
	2.1	Searching: characteristics and issues in design of search programs		
	2.2	**Uninformed search techniques:** State Space Search, Depth First Iterative Deepening		
	2.3	**Informed Search methods:** Heuristic Search, Hill Climbing.		
	2.4	**Adversarial Search:** Game playing, Min-Max Search, Alpha-Beta Pruning		
3	**Title**	**Knowledge Representation and Reasoning**	**T1**	**08**
	3.1	Reasoning: Representing and Reasoning with Uncertain Knowledge		
	3.2	Knowledge representation: A Knowledge-Based Agent, The Wumpus World.		
	3.3	Propositional Logic, First-order predicate logic, Forward and Backward Chaining		
4	**Title**	**Introduction to Machine Learning**	**T2, T3**	**12**
	4.1	Introduction: What is Machine Learning, History and overview of machine learning,		
	4.2	Types of Machine Learning – Supervised, Unsupervised Semi-Supervised Learning and Reinforcement Learning, Design a Learning System, The curse of dimensionality		
	4.3	Evaluating a hypothesis: Model selection, training/validation/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves		
5	**Title**	**Linear Models for Regression**	**T4**	**8**
	5.1	Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors		
	5.2	Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods		

6	**Self Study**	**Linear model for Classification**: Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines, PCA	**T3, T4**	**5***
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement an Intelligent agent.
2	Implement a given problem using the searching technique.
3	Implement a given problem using knowledge representation and reasoning rules
4	To design and implement an intelligent system, incorporating the matching algorithm and the rule language. 1. It should provide a fact base updating function. 2. It should provide a function that checks the rules' LHS and return which rules were matched. 3. It should support firing RHS according to matches. Using SWISH Prolog or Java or Python or any other open-source tool
5	Implement supervised learning algorithms.
6	Implement unsupervised learning algorithms.
7	Implement the regression model
8	Minor project covering the concepts of AIML on the real life problem statements.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: A Modern Approach	Third Edition	Stuart Russell and Peter Norvig	Prentice-Hall	2009
2	Machine Learning A Probabilistic Perspective	First Edition	Kevin P. Murphy	Massachusetts Institute of Technology	2012
3	Machine Learning,	First Edition	Tom. M. Mitchell	McGraw Hill International Edition	1997
4	The Elements of Statistical Learning	Second Edition	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2009

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: Making a System Intelligent	First Edition	Nilakshi Jain	Wiley Publication	2019
2	Pattern Recognition and Machine Learning	First Edition	C. M. Bishop	Springer	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Distributed Computing	3	0	2	5	10	3	0	1	4
IT304		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating Systems IT207: Computer Networks and Communications
Course Objective: To familiarize students with the fundamental concepts, techniques and design of Distributed Systems and use of distributed computing applications domains.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT304.1	Understand the principles and desired properties of distributed systems.
IT304.2	Apply the various communication techniques for distributed communication.
IT304.3	Apply the concepts of process, naming, consistency, replication and faults tolerance in distributed environment.
IT304.4	Apply the algorithms such as clock synchronization, election, and mutual exclusion in distributed applications.
IT304.5	Identify the challenges in developing distributed applications.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT304.1	2	1	-	-	-	-	-	-	-	-	-	2
IT304.2	2	2	2	1	-	-	-	2	2	1	-	2
IT304.3	2	2	2	1	-	-	-	2	2	1	-	2
IT304.4	2	2	2	1	-	-	-	2	2	1	-	2
IT304.5	2	2	2	1	-	-	-	1	2	1	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PE04	PSO1	PSO2	PS03
IT304.1	1	1	1	-	-	-	-
IT304.2	1	1	1	-	-	1	-
IT304.3	1	1	1	-	-	1	-
IT304.4	1	1	1	-	-	1	-
IT304.5	1	1	1	-	-	1	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✓		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Distributed Systems**		
	1.1	Definition, Type, Goals, Distributed Computing Models, Issues in Distributed Systems.	**T1, T2**	**08**
	1.2	Hardware Concepts, Software Concepts, The Client-Server Model, Positioning Middleware, Models of Middleware, Services offered by Middleware, models of Distributed Algorithms and some fundamental problems.	**T1, T2**	
2	**Title**	**Communication In Distributed Systems**		**12**
	2.1	Introduction to Message Passing, Desirable Features of a Good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Group Communication.	**T1, T2, R1**	
	2.2	Remote Procedure Call (RPC): Basic RPC Operations, Parameter Passing, Extended RPC Models. Remote Object Invocation: Distributed Objects, Binding a Client to an Object, Static Vs Dynamic RMI Message Oriented Communication: Persistence and synchronicity in communication, Message Oriented Transient and Persistent Communications	**T1, T2**	
3	**Title**	**Process in Distributed Systems**		**6**
	3.1	Introduction to Threads, Threads in Distributed Systems, Clients, Server	**T1, T2**	
	3.2	Code Migration: Approaches to Code Migration, Models, Migration and Local Resources, Migration in Heterogeneous Systems	**T1, T2**	
4	**Title**	**Synchronization in Distributed Systems**		**10**
	4.1	Clock Synchronization: Physical Clocks, Global Positioning System, Clock Synchronization Algorithms; Logical Clocks: Lamport's Logical Clocks, Vector Clocks	**T1, T2**	
	4.2	Election Algorithms: Bully and Ring; Mutual Exclusion: Centralized Algorithm, Decentralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Algorithms;	**T1, T2,**	

		Load Balancing: Goals, Types, Strategies.		
5	**Title**	**Consistency and Replication**		**6**
	5.1	Reasons for Replication, Object Replication, Replication as Scaling Technique Data Replication in Distributed Systems, Goals, Types, Schemes,	**T1**	
	5.2	Data-Centric Consistency Models, Client Centric Consistency Models Continuous Consistency, Consistent Ordering of Operations	**T1**	
6	**Self Study**	Naming Entities, Locating Mobile Entities, Distribution Protocols, Consistency Protocols, Faults Tolerance: Process Resilience, Distributed Commit, Recovery	**T1, T2, R1, R2**	**8**
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiments
1	Implementation of Client Server Communication using RPC/RMI.
2	Implementation of Clock Synchronization (logical/physical).
3	Implementation of Election algorithm.
4	Implementation of Mutual Exclusion algorithm.
5	Implementation of Client Server based program to check data consistency.
6	Implement Load Balancing Algorithms.
7	Mini Project.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Distributed Systems–Principles and Paradigms.	First Edition	Andrew S. Tanenbaum, Maarten Van Steen	PHI	2004
2	Distributed Operating Systems Concepts and Design	Second Edition	P. K. Sinha	PHI	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Distributed Systems – Concept and Design	Fourth Edition	George Coulouris, Jean Dollimore, Tim	Pearson	2010

			Kindberg & Gordon Blair		
2	Distributed VOD Systems	First Edition	Sudhir D. & Bandu B.M	Research India Publication	2011

Course (Category) Code	**Course Name**	**Teaching Scheme (Hrs/week)**					**Credits Assigned**			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
SBC	**Internet Technology Lab**	**1**	**0**	**2**	**5**	**8**	**1**	**0**	**1**	**2**
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**			**Total**
IT305A		**Theory**	**--**		**--**		**--**			**--**
		Laboratory	**100**		**--**		**100**			**200**

Pre-requisite Course Codes, if any.	CS208/IT208 Mini Project
Course Objective: To impart knowledge of different Internet Technologies.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT305A.1	Develop a sophisticated web UX
IT305A.2	Create, integrate and test REST based web services
IT305A.3	Design secured web application/ web services
IT305A.4	Demonstrate behaviour of web crawlers and testing of web application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**
IT305A. 1	-	-	1		3	-	-	-	-	-	-	-
IT305A. 2	-	-	-	2	3	-	-	-	-	-	-	-
IT305A. 3	-	-	-	1	3	-	-	-	-	-	-	-
IT305A. 4	-	-	-	1	3	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**

IT305A.1	-	-	-	-	-	-	3
IT305A.2	-	-	-	-	-	-	3
IT305A.3	-	-	-	-	-	-	3
IT305A.4	-	-	-	-	-	-	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✔

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Designing UI**		**2**
	1.1	Fundamentals of UX Design, Defining UX Solutions, Design Communication and Visualizing Ideas	T1	
2		**Web content management system**		**1**
	2.1	Introduction to Web CMS, different types of Web CMS	T2,R1	
3		**Web services**		**2**
	3.1	Introduction to web service, REST architecture	T3,R3	
4		**Web mashups**		**1**
	4.1	Introduction to web mashups, server side mashups, client side mashups	T2	
5		**Secured Web application**		**2**
	5.1	Introduction to Web Tokens, Auth2.0, OAuth, Access token	T2	
6		**Integration of web services**		**2**
	6.1	Introduction to Mule ESB, Introduction to Anypoint studio, Integrating Web Services using Any point studio	T4,R2	
7		**Web crawlers**		**2**
	7.1	Introduction to web crawler, role of crawler in the internet, concept of page ranking	T3	
8		**Testing web applications**		**2**
	8.1	Introduction to different types of testing, manual testing, automated testing, performance testing and functional testing, open source tools used for testing	T2	
Total				**14**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Design web pages using HTML, CSS and javascript
2	Design UX for a given problem definition by using open source UX tools

3	Create a website using web CMS (Node Js/Angular Js/React Js/Flask/Django/Wordpress/Joomla etc.)
4	Create a Restful webservice to demonstrate different HTTP methods
5	Testing of restful web service using Postman/ARC
6	Create a web mashup of web services using open source framework
7	Design secured Web application using web token
8	Integration of web services using open source integration tools like Mulesoft
9	Demonstrate the behavior of Web Crawlers/ spiders (use XPATH,CSS PATH),extract information and store it in the database.
10	Test the web application using open source testing tools like Selenium, Test runner and Junit

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Sketching the User experiences	Second Edition	Bill Buxton	Diane Cerra	2010
2	Rich Internet Application AJAX and Beyond	Third Edition	Dana Moore, Raymond Budd, Edward Benson	WROX Publisher	2017
3	Web Technology	Second Edition	Srinivasan	Pearson	2014
4	API Recipes with Mulesoft(r) Anypoint Platform	First Edition	WHISHWORKS Editorial Board	White falcon	2017

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Internet Technology And Web Design	First Edition	R. K. JAIN	Khanna Book Publishing Company	2015
2	Understanding the Internet: A Clear Guide to Internet Technologies	First Edition	Keith Sutherland	A Butterworth-Heinemann Title	2016
3	RESTful Web APIs: Services for a Changing World	Third Edition	Leonard Richardson, Mike Amundsen, Sam Ruby	O'REILLY	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Object Oriented Programming Lab	1	0	2	1	4	1	0	1	2
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
IT305B		Theory	50		--		--		200	
		Laboratory	100		--		100			

Pre-requisite Course Codes, if any.	ES11- Structured Programming Approach ESL25- Python Programming Lab
Course Objective: To learn Object-Oriented programming paradigm using Java programming language	
Course Outcomes (CO): At the End of the course students will be able to	
IT305B.1	Demonstrate programming using basic constructs of JAVA
IT305B.2	Apply Inheritance and polymorphism for a given scenario
IT305B.3	Apply abstraction and exception handling to create an efficient program.
IT305B.4	Use Generic classes and collection for solving problem

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT305B.1	3				2							2
IT305B.2	2				2							2
IT305B.3	2				2							2

IT305B.4	**2**				**2**							**2**
IT305B.5	**2**	**1**	**1**	**1**	**2**	**1**			**2**	**2**		**2**

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**
IT305B.1		**2**			**2**		**2**
IT305B.2		**2**			**2**		**2**
IT305B.3		**2**			**2**		**2**
IT305B.4		**2**			**2**		**2**
IT305B.5		**2**			**2**		**2**

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	**Understand**	**Apply ✔**	**Analyze**	**Evaluate**	**Create**

Theory Component

Module No.	**Unit No.**	**Topics**	**Ref.**	**Hrs.**
1	**Title**	**Introduction to JAVA**	**T1, T2, R1**	**03**
	1.1	Fundamentals of Java Programming: Classes, JDK, JRE, JVM, Unicode system, I/O using Scanner class and BufferedReader class		
	1.2	Instance variables, Methods, Constructors		
	1.3	Object class, Nested class, Access Specifiers, Abstract Classes and Wrapper Classes		
2	**Title**	**OOP Concepts Mapping to JAVA**	**T1, T2, R1**	**04**
	2.1	Inheritance (IS – A), Aggregation & Composition (Has – A) Method overloading & overriding, this, super, final keyword, static		
	2.3	Autoboxing and Unboxing, Polymorphism		

	2.4	Packages and Interfaces: Package concept, Creating user defined package, Access control protection, Interface		
3	**Title**	**Exception Handling and Multithreading**	**T1, T2, R1**	**04**
	3.1	try and catch block, Multiple catch block, nested try, finally block, throw and throws keyword, Exception propagation, Custom exception		
	3.2	Create thread using Thread and Runnable class. Thread methods, schedule, sleep, join, Thread priority, Thread group, perform multiple tasks using multiple thread, Thread synchronization		
4	**Title**	**Generics and Collection**	**T1, T2, R1**	**03**
	4.1	Creating Generic Classes, Generic Methods, Bounded Type		
	4.2	Collection's framework, methods of collection interface (Arraylist, Linked list, Queue etc.)		
			Total	**14**

Laboratory Component.

Sr. No	**Title of the Experiment**
1	Program on I/O using command line arguments, scanner class, BufferedReader etc.
2	Program on Constructor, types of constructor and constructor overloading
3	Program on Polymorphism, Runtime polymorphism.
4	Program on Inheritance, Abstract Class, Interface.
5	Program on Nested Class, Aggregation, Composition.
6	Program on Multithreading
7	Program on Exception Handling. (built in and User defined)
8	Program on Package and access modifiers.
9	Program on Generics
10	Program on Collection

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Java Programming From the Group Up	First	Ralph Bravaco, Shai Simoson	TataMcGrawHill	2009
2	Java The Complete Reference	Eleventh	Herbert Schildt	TataMcGrawHill	2019

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	An introduction to Programming and Object Oriented Design using Java	Third	Jaime Nino, Frederick A. Hosch	Wiley Student Edition	2008
2	Java Programming A Practical Approach	First	C Xavier	TataMcGrawHill	2011
3	Java™ Programming Language	Fourth	Ken Arnold, James Gosling, David Holmes	The (Java Series) by Sun	2005

SEMESTER VI

SEM VI FOR CAT 1 STUDENTS (NORMAL STUDENTS)

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PC	Big Data Analytics	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
IT306		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	IT204:Database Management Systems
Course Objective: To understand the concept of big data and the tools used for accessing the big data	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT306.1	Apply rules of linear algebra for processing big data.
IT306.2	Choose appropriate storage structures to make sense out of big data.
IT306.3	Apply scalable algorithms based on Hadoop and Map Reduce to perform Big Data Analytics.

IT306.4	Analyze information from social network graphs.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
IT306.1	2	-	-	-	-	-	-	-	-	-	-	-
IT306.2	-	-	2	-	-	-	-	-	-	-	-	-
IT306.3	-	-	-	-	3	-	-	-	-	-	-	-
IT306.4	-	-	-	2	-	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT306.1	-	-	-	-	-	-	-
IT306.2	-	-	-	-	-	-	-
IT306.3	-	-	-	-	-	-	-
IT306.4	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Big data and Linear Algebra**		**8**
	1.1	Big Data characteristics, types of Big Data, Traditional vs. Big Data, Big data challenges	T1,R1	
	1.2	Matrices as linear transformations, Linear systems and vector spaces, Solving linear systems, role of Eigen values and eigenvectors in data analytics, SVD - Singular Value Decomposition	T3	
2	**Title**	**Memory-efficient data structures**		**12**
	2.1	Introduction to data streams, problems related to handling data stream, Need of dimensionality reduction - PCA, Mining Data Streams using DGIM algorithm	T3,R1	
	2.2	Hash functions, universal / perfect hash families, Bloom filters, Sketches for distinct count, Flajolet Martin Sketch, Majority Algorithm, Misra-Gries sketch, Count-Min Sketch, Count Sketch, kd-trees, LSH, MinHash, SimHash	T2	

3	**Title**	**Scaling with Big Data using Hadoop**		**10**
	3.1	HDFS - Data in Hadoop	T1	
	3.2	Hadoop Ecosystem architecture **Hive** - Architecture, various data operations using Hive **HBase** - Architecture, General Commands **Pig** - What is Pig, advantages	T1	
	3.3	Relational Algebra using Big data framework - Map Reduce Selection,Projections, Union, Intersection, Natural Join, Grouping and Aggregation by Map Reduce, Matrix Multiplication	T1	
4	**Title**	**Frequent Itemsets And Clustering**		**5**
	4.1	Handling Larger Data sets in Main Memory Algorithm - Park, Chen and Yu Algorithm, The Multi stage Algorithm, The Multihash Algorithm. The SON Algorithm, BFR clustering algorithm, CURE algorithm	T1,R3	
5	**Title**	**Mining Social- Network Graphs and Link Analysis**		**7**
	5.1	Clustering of Social-Network Graphs - Clique Percolation Method, counting triangles, PageRank, Efficient Computation of PageRank, Topic-Sensitive PageRank, Link Spam, Hubs and Authorities	T1,R3	
6	**Self Study**	Scaling with Big Data using Apache SPARK SPARK Ecosystem, SPARK streaming, Distributed Batch Processing with Spark	T4	**5***
Total (*Not included)				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Installation of Hadoop and execution of HDFS commands
2	Study of any latest research paper on memory efficient data structure for big data.
3	Implement algorithms in Map-Reduce on Strings and integers
4	Implement algorithms in Map-reduce on Relational Algebra
5	Download a real world dataset and find insights using map reduce. For e.g for a movie dataset list all the movies and the number of ratings, list all the Movie IDs which have been rated (Movie Id with at least one user rating it), list all the Users who have rated the movies (Users who have rated at least one movie), list of all the User with the max, min, average ratings they have given against any movie
6	Explore and present interactive data insights from real world dataset (Dashboards) using Tableau
7	Extract facts in real world dataset using Hive
8	Extract sessions in real world dataset using Pig

9	Implement word count using Apache Spark.
10	Demonstrate use of modern tools like Matlab for Exploratory Data Analysis.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Mining of Massive Datasets	Third Edition	Anand Raja Raman and Jeff Ullman	Cambridge University	2019
2	Algorithms and models of computation	First Edition	Jeff Erickson	University of Illinois	2015
3	Introducing Data Science	Third Edition	Davy Cielen, Meysman, Mohamed Ali	Dreamtech Press	2014
4	Learning Apache Spark 2	Second Edition	Muhammad Asif Abbasi	Packt Publishing	2017

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Data streams :Algorithms and applications.	Second Edition	Muthukrishnan. S.	now publishers Inc	2005
2	Introducing Data Science	Third Edition	Davy Cielen, Meysman, Mohamed Ali	Dreamtech Press	2015
3	Hadoop, the Definitive Guide	Third Edition	Tom White	O'Reilly	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
PC	**Foundation of Signal Processing**	**3**	**0**	**2**	**5**	**10**	**3**	**0**	**1**	**4**
		Examination Scheme								
		Component		**ISE**		**MSE**		**ESE**		**Total**
IT307		**Theory**		**50**		**50**		**100**		**200**
		Laboratory		**50**		**--**		**50**		**100**

Pre-requisite Course Codes, if any.	
Course Objective: Foundations of Digital Signal Processing! The study of digital signal processing explores how we transform data into new representations to better understand, compress, and leverage it. The course begins with a rigorous review of tools from Signals and Systems: sampling, convolution, Fourier representations and flow graph, fast linear filtering algorithms. It also comoares DSP Processor and General Purpose Processor.	

Course Outcomes (CO): *At the End of the course students will be able to*	
IT307.1	Interpret DT signal and perform signal manipulation in Time Domain and Frequency Domain
IT307.2	Develop FFT flow-graph
IT307.3	Implement Fast Linear filtering algorithms
IT307.4	Compare the DSP processor with General Purpose Processor (GPP)

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT307.1	**2**	**2**		-	-	-	-	-	-	-	-	-
IT307.2	-	-	**3**	-	-	-	-	-	-	-	-	-
IT307.3	-	-	**3**	-	-	-	-	-	-	-	-	-
IT307.4	-	**2**	-	-	-	-	-	-	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT307.1	-	-	-	**3**	-	-	-
IT307.2	-	-	-	**3**	**3**	-	-
IT307.3	-	-	-	**3**	**3**	-	-
IT307.4	-	-	-	**3**	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		✓	✓	✓	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Discrete-Time Signal**	**T1,T2**	**12**
	1.1	Introduction: Signals, Systems, and Signal, Continuous Time signal, Discrete - Time signal and representation, Digital signal, The Sampling theorem, Some elementary discrete time signals, Classification of Discrete - Time Signals, Modifications of Discrete - Time Signals.	**T1,T2**	**04**
	1.2	Operations on Discrete - Time Signals: Linear Convolution, Circular Convolution, Matrix Representation of Circular Convolution, Linear Convolution using Circular Convolution, Auto and Cross Correlation.	**T1,T2**	**05**
	1.3	Discrete - Time systems:	**T1,T2**	**03**

		Static and dynamic, time variant and time invariant, linear and nonlinear, causal and non causal. Representation of system using impulse response, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) system, Response of the FIR system using convolution.		
2	**Title**	**Discrete Fourier Transform**	**T1,T2**	**08**
	2.1	Introduction to DTFT, Relation between DFT and DTFT, DFT of DT signal, Inverse DFT.	**T1,T2**	**02**
	2.2	Properties of the DFT: Scaling and Linearity, Symmetry for real valued signal, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals Energy Theorem.	**T1,T2**	**06**
3	**Title**	**Fast Fourier Transform**	**T1,T2**	**08**
	3.1	Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm	**T1,T2**	**04**
	3.2	Flow graph for N=4 and 8 using Radix-2 DIT-FFT, Inverse FFT algorithm, Comparison of complex and real, multiplication and additions of DFT and FFT	**T1,T2**	**04**
4	**Title**	**DSP Algorithms**	**T1,T2**	**08**
	4.1	Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm.	**T1,T2**	**04**
	4.2	Linear FIR filtering using Overlap Add Algorithm and Overlap Save Algorithm and implementation using FFT.	**T1,T2**	**04**
5	**Title**	DSP Processors and Applications of DSP	**T3**	**06**
	5.1	Need DSP processor, Difference between DSP processor & General Purpose (GP) Processor.	**T3**	**02**
	5.2	Case study of DSP applications to Speech Signal Processing and Biomedical Signal Processing.	**T3**	**04**
6	**Self Study ***	Multi-rate Signal Processing: Up sampling and Down sampling, Signal Compression, Carl Correlation Coefficient for measurement of degree of similarity between two signals.	**T1, T2, T3,R1 ,R2**	**02 02 01**
Total				**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment	Marks
1	Signal Operations	5
2	Discrete Convolution	5
3	Discrete Correlation	5
4	Discrete Fourier Transform	5
5	Magnitude and Phase Spectrum	5
6	Fast Fourier Transform	5
7	Overlap Add Method using FFT	5
8	Overlap Save Method using FFT	5
9	Application of DSP Part I	5
10	Application of DSP Part II	5

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Signal Processing : Principles, Algorithms and Applications	Fourth Edition	Proakis Manolakis	Pearson Education, ISBN 81-317-1000-9	2007
2	Digital Signal Processing	First Edition	S. Salivahanan, A. Vallavaraj, C. Gnanapriya	TataMcgraw Hill ISBN 978-0-07-066924-6	2010
3	Digital Signal Processing: A Computer Science Perspective	First Edition published on 25th Sept, 2000	Jonathan (Y) Stein	Copyright © 2000 John Wiley & Sons, Inc Print ISBN:9780471295464 |Online ISBN:9780471200598 |DOI:10.1002/047120059X	2000

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Signal Processing: A Practical Approach	--	Emmanuel C. Ifeachor, Barrie W. Jervis	Pearson Education ISBN 0-201-59619- 9	2001
2	Digital Signal Processing	Sixth Edition	P. Ramesh Babu	Scitech Publication	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PE1)	Machine Learning	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
1T12		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance.	
Course Outcomes (CO):*At the End of the course students will be able to*	

1T11.1	Define the fundamental principles of Machine learning.
1T11.2	Apply understanding of techniques, mathematical concepts, and algorithms used in machine learning.
1T11.3	Interpret limitations of various machine learning algorithms and the way to evaluate performance of machine learning algorithms
1T11.4	Design an application through software implementation of different concepts and algorithms covered in the course.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1T11.1	2	2	--	--	--	--	--	--	2	2	2	2
1T11.2	2	2	2	--	2	--	--	--	2	2	2	2
1T11.3	2	2	2	--	2	--	--	--	2	2	2	2
1T11.4	2	2	2	2	2	--	--	--	2	2	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**
1T11.1	2	2	1	1	1	--	2
1T11.2	2	2	1	1	2	--	2
1T11.3	2	2	1	1	2	--	2
1T11.4	2	2	1	1	2	1	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create✔**

Theory Component

Module No.	**Unit No.**	**Topics**	**Ref.**	**Hrs.**
1	**Title**	**Introduction Machine learning**	**1,2, 3**	**8**
	1.1	Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning		

		Supervised Learning: Vapnik-Chervonenkis (VC) Dimension,Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization. Parametric methods: Introduction, Maximum Likelihood Estimation: Bernoulli Density; Multinomial Density: Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator Parametric Classification and Regression, Tuning Model Complexity, Model Selection Procedures. Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Regression: Smoothing Models.		
2	**Title**	**Dimensionality Reduction**	**1,2, 3**	**4**
	2.1	Introduction. Curse of Dimensionality, Feature selection, Feature Extraction, Subset Selection, Forward and backward selection, Univariate, Multivariate Feature selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis.		
3	**Title**	**Algorithms and Performance Measures**	**1,2, 3**	**10**
	3.1	**Supervised learning Algos**: Linear Regression and Classification (Logistic Regression, Decision Tree, Naïve Bays, KNN, Random Forest), Support Vector Machine (SVM): Maximum Margin Linear Separators; Kernel SVM; Kernels for learning non-linear functions. **Unsupervised Learning Algos:**Association Rules: Market Basket Analysis; The Apriori Algorithm; Example: Market Basket Analysis; Frequent Pattern Tree (FPT)Unsupervised as Supervised Learning; Generalized Association Rules, k-Means Clustering; Expectation-Maximization Algorithm; Mixtures of Latent Variable Models; Supervised Learning after Clustering, Hierarchical Clustering; Choosing the Number of Clusters.		
	3.2	Cross-Validation and Resampling Method, k-Fold Cross-Validation, Bootstrapping, Measuring Error, Interval Estimation, Hypothesis testing, Ensemble Methods, Bagging,Adaboost Gradient Boosting, Grid Search, XGBoost. T-test, P-test.		
4	**Title**	**Graphical Models**	**1,2, 3**	**6**
	4.1	Bayesian Networks, Markov Random Fields, Hidden Markov Model: Discrete Markov Processes; Hidden Markov Models; Problems of HMMs; Evaluation Problem; Finding the State Sequence; Learning Model Parameters; Continuous Observations; The HMM with Input; Model Selection in HMM.		
5	**Self Study**	**Reinforcement Learning**		

		Elements of Reinforcement Learning, Q Learning, Non deterministic rewards and actions, Temporal Difference Learning, Generalization	**1**	**5***
			Total	**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

All experiments should be performed through PYTHON Language

Sr. No	Title of the Experiment
1	Implement and analyse Regression (Regression/Classification) Algorithm.
2	Implement and analyse k-nearest Neighbors algorithm
3	Implement and analyse classification using SVM algorithm
4	Implement Association rules for given problem statement
5	Implement K-means/ K-Modes Clustering/ Expectation-Maximization(EM) algorithm to Find Natural Patterns in Data
6	Implement and analyse Principle Component Analysis for Dimensionality Reduction
7	To implement Linear Discriminant Analysis (LDA) for Dimensionality Reduction
8	Implement HMM algorithm for given problem statement.
9& 10	Capstone project covering the concepts of Machine Learning.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Introduction to Machine Learning	3rd	Ethem Alpaydın	MIT , PRESS	2012
2	Pattern Recognition and Machine Learning,	1st Edition	C. M. Bishop	Springer	2013
3	Elements of Statistical Learning	2nd Edition	Trevor Hastie Robert Tibshirani Jerome Friedman	Springer	2001

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
4	Machine Learning	1st Edition	Tom Mitchell	Mc-Grawhill	1997
5	Machine Learning In Action	1st	Peter Harrington	DreamTech Press	2001

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Soft Computing	2	0	2	4	8	2	0	1	3
		Examination Scheme								
1T312		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	
Course Objective: This course introduces three important soft computing techniques like Neural network, Fuzzy Logic and Genetic algorithms in brief. Students will be able to understand the supervised and unsupervised learning algorithm for real world applications. The design of fuzzy logic controller helps them to develop an adaptive control system for industrial operations. This course also covers the importance of optimizations and its use in computer engineering fields.	
Course Outcomes (CO):*At the End of the course students will be able to*	
1T312.1	Illustrate the basic principles of soft computing techniques.
1T312.2	Apply the supervised and unsupervised neural network learning algorithm for real world applications.
1T312.3	Design a fuzzy controller system using different FIS.
1T312.4	Apply genetic algorithms to solve optimization problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1T312.1	2	-	-	-	-	-	-	-	-	-	-	-
1T312.2	2	2	-	-	-	-	-	-	2	2	-	2
1T312.3	3	2	2	-	-	-	-	-	2	2	-	2
1T312.4	3	2	2	-	-	-	-	-	-	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T312.1	1	1	1	-	-	-	-
1T312.2	2	2	2	-	-	-	-
1T312.3	2	2	2	-	-	-	-
1T312.4	2	2	2	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		✓			

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Soft Computing**	T3,T4	04
	1.1	Soft computing Constituents, Characteristics of Neuro Computing and Soft Computing		
	1.2	Difference between Hard Computing and Soft Computing, Concepts of Learning and Adaptation		
2	Title	**Neural Networks**	T1,T3,R1,R2,R5	10
	2.1	Basics of Neural Networks: Introduction to Neural Networks, Biological Neural Networks and their artificial models		
	2.2	McCulloch Pitt model, Hebb Network, Linear separability		
	2.3	Supervised Learning algorithms: Perceptron (Single Layer, Multilayer), Delta learning rule, Back Propagation algorithm.		
	2.4	Un-Supervised Learning algorithms: Winner take all, Self-Organizing Maps, Learning Vector Quantization.		
3	Title	**Fuzzy Set theory**	T2,T3,R1,R3	10
	3.1	Classical Sets and Fuzzy Sets, Membership functions, Classical Relations and Fuzzy Relations		
	3.2	Fuzzy Max-Min and Max-Product Composition, Fuzzy extension principle		
	3.3	Fuzzy Systems- fuzzification, defuzzification methods, and design of fuzzy controllers.		
4	Title	**Genetic Algorithms**	T3,T4,R4	04
	4.1	Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Selection, Traditional Optimization and Search Techniques		
	4.2	Simple GA, Operators in GA, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA .Applications of GA.		
5	Self Study	Recurrent Neural Networks, Deep Learning: Deep Belief Network, Deep Reinforcement Learning		04*
Total				28

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

<table>
<tr><th>Sr. No.</th><th>Title of the Experiment</th></tr>
<tr><td>1</td><td>To implement (MP-Neuron) Mc-Culloch Pitts Model.</td></tr>
<tr><td>2</td><td>To implement Transfer/Activation Functions.
A symmetric hard limit transfer function.
A Binary step activation function.
A Bipolar step activation function.
A saturating linear transfer function.
A hyperbolic tangent sigmoid (tansig) transfer function.
A log-sigmoid transfer function</td></tr>
<tr><td>3</td><td>To implement Basic Neural Network learning rules.

PROBLEM TO DISTINGUISH BETWEEN APPLES AND ORANGES
A produce dealer has a warehouse that store a variety of fruits & vegetables. When fruit is brought to the warehouse , a various types of fruits may be mixed together. The dealer wants a machine that will sort the fruit according to type . There is a conveyer belt on which the fruit is loaded .This conveyer passes through a set of sensors, which measure three properties of fruits :shape , texture and weight.
Bias= < Any Value>

<table>
<tr><td>Type of sensor</td><td>Output of sensor</td><td>Condition</td></tr>
<tr><td rowspan="2">Shape sensor</td><td>1</td><td>if fruit is approx. round</td></tr>
<tr><td>0</td><td>if fruit is elliptical.</td></tr>
<tr><td>Texture Sensor</td><td>1</td><td>If surface is smooth</td></tr>
<tr><td></td><td>0</td><td>If surface is rough</td></tr>
<tr><td rowspan="2">Fruit sensor</td><td>1</td><td>Apple</td></tr>
<tr><td>0</td><td>Orange</td></tr>
</table>
Design a perceptron to recognize these patterns using Joone Editor.</td></tr>
<tr><td>4</td><td>Write a program to design a perceptron to recognize these patterns for the problem statement in experiment No.3.(Use any Open source tools)</td></tr>
<tr><td>5</td><td>To implement Multilayer Perceptron Learning algorithm.(EBPTA)</td></tr>
<tr><td>6</td><td>To implement an unsupervised learning algorithm (KSOFM) for pattern classification problem.</td></tr>
<tr><td>7</td><td>To implement an unsupervised learning algorithm (LVQ) for pattern classification problem.</td></tr>
<tr><td>8</td><td>To implement fuzzy set and fuzzy relations for a given problem.</td></tr>
<tr><td>9</td><td>To design and implement Fuzzy Controller for a given problem</td></tr>
<tr><td>10</td><td>To apply genetic algorithms for a given problem.</td></tr>
</table>

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Artificial Neural Systems	--	Jacek M. Zurada	Jaico Publishing House	1992
2	Fuzzy Logic with Engineering Applications	Third Edition	Timothy J. Ross	Wiley India	1995
3	Principles of Soft Computing	Second Edition	S. N. Sivanandam and S. N. Deepa	Wiley, India	2011
4	Neural Networks, Fuzzy Logic and Genetic Algorithms	Kindle Edition	S.Rajasekaran and G.A.Vijayalaks	PHI Learning	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Neuro-Fuzzy and Soft Computing– A Computational Approach to Learning and Machine Intelligence	First Edition	Jang J.S.R, Sun C. T. and Mizutani E.	PHI	1997
2	Fundamentals of Neural Networks – Architectures, Algorithms, And Applications	First Edition	Laurene Fausett	Pearson Education	2004
3	Fuzzy Set Theory and its Applications	Second Edition	H.J. Zimmermann	Allied Publishers Ltd.	1996
4	An Introduction to Genetic Algorithms	Fifth Edition	Melanie Mitchell	The MIT Press	1999
5	Neural Network Design	Second Edition	Hagan, Demuth, Beale	CENGAGE Learning, India Edition	1996

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PE)	Ethical Hacking	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
1T321		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	IT206: Operating Systems IT207:Computer Communications and Networks IT303A: Cryptography and System Security
Course Objective: To understand the techniques involved in ethical hacking	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T321.1	Demonstrate the understanding of attack vectors
1T321.2	Perform network scanning to identify live and vulnerable machines in a network.
1T321.3	Identify and use viruses, computer worms, and malware to exploit systems.
1T321.4	Perform web application hacking and wireless hacking

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1T321.1	3				3	2		1				1
1T321.2	3	2	1	2	3	2		1				1
1T321.3	3	2		2	3	2		1				1
1T321.4	3	2		2	3	2		1				1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T321.1	2	2		1			
1T321.2	2	2	2	1			
1T321.3	2	2	2	1			
1T321.4	2	2	2	1			

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✔	Understand ✔	Apply ✔	Analyze ✔	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to hacking**	T1	8
	1.1	Introduction: Hacking, Types of Hacking/Hackers, Cybercrime, Types of cybercrime, Hacker Mind set, Threats, Concept of ethical hacking, Phases involved in hacking, Role of Ethical Hacking, Common Hacking Methodologies, Profiles of Hackers, Benefits of Ethical Hacking, Limitations of Ethical Hacking		
	1.2	Foot Printing & Reconnaissance: Introduction to foot printing, use of foot printing, Types of foot printing, Understanding the information gathering process, Information on a company website, methodology of the hackers, Tools used for the reconnaissance phase.		
	1.3	System Hacking: System hacking, Types of System hacking, hacking tools, Computer Hole, Hacking Process, Various methods of password cracking, Remote Password Guessing, Role of eavesdropping, Keystroke Loggers, Types of Keystroke Loggers, Detection, Prevention and Removal		
	1.4	Sniffers: Introduction, Sniffer, Types of sniffers, Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Spoofing, ARP Spoofing, ARP Poisoning, DNS Spoofing Techniques, MAC Flooding, Sniffing Countermeasures.		
2	Title	**Hacking Techniques**	T1,T2, R1	10
	2.1	Trojans, Backdoors, Viruses, and Worms: Trojans and Backdoors, Overt and Covert Channels, Types of Trojans, Reverse-Connecting Trojans, Netcat Trojan ,Indications of a Trojan Attack, Wrapping, Trojan Construction Kit and Trojan Makers , Countermeasure Techniques in Preventing Trojans, Trojan-Evading Techniques, System File Verification Sub objective to Trojan Countermeasures Viruses and Worms, Difference between a Virus and a Worm, Types of Viruses, Understand Antivirus Evasion Techniques, Understand Virus Detection Methods		
	2.2	Session Hijacking: Understanding Session Hijacking, Phases involved in Session, Hijacking, Types of Session		

		Hijacking, and Session Hijacking Tools.		
	2.3	Social Engineering Social Engineering, Common Types of Attacks, Insider Attacks, Identity Theft, Phishing Attacks, Online Scams, URL Obfuscation, Social-Engineering Countermeasures.		
	2.4	Denial of Service: Denial of Service, Types of DoS Attacks, DDoS Attacks, BOTs/BOTNETs, "Smurf" Attack, "SYN", Flooding, DoS/DDoS Countermeasures		
3	**Title**	**Hacking Web applications and Wireless Networks**	T1,T2,R 2	10
	3.1	Hacking Web Applications & SQL Injection: Hacking Web Servers, Types of Web Server Vulnerabilities, Attacks against Web Servers, IIS Unicode Exploits, Patch Management Techniques, Web Server Hardening Methods Web Application Vulnerabilities, Objectives of Web Application Hacking, Anatomy of an Attack, Web Application Threats, Google Hacking, Web Application Countermeasures Web-Based Password Cracking Techniques, Authentication Types, Password Cracker, Password Attacks: Classification ,Password Cracking Countermeasures.		
	3.2	SQL Injection and Buffer Overflows: SQL Injection, Steps to Conduct SQL Injection, SQL Server Vulnerabilities, SQL Injection, Countermeasures Buffer Overflows, Types of Buffer Overflows and Methods of Detection, Stack-Based Buffer Overflows, Buffer Overflow Mutation Techniques		
	3.3	Hacking Wireless Networks: Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS, attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing, Wireless Networks.		
4	**Self-study**	Steganography, cryptography.		
			Total	**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No	**Title of the Experiment**
1	Foot printing a target network.
2	Scanning a network using: a) Nmap Network Mapper b) Nessus vulnerability scanner
3	Exploit Windows vulnerability to get unauthorized access.
4	Exploiting Client-side vulnerabilities and establishing a VNC session
5	Performing Man-in-the-Middle Attack using Wireshark & Ettercap
6	Creating a Trojan using Social-Engineer Toolkit.
7	Implementing the DoS attack.

8	Performing SQL injection A. Manual SQL Injection, John the Ripper. B. Automate SQL Injection with Sql Map.
9	Demonstrating the Wireless hacking
10	Case study

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	Certified Ethical Hacker Study Guide v9	Study Guide Edition	Sean-Philip Oriyano	Sybex-Wiley	2017
2.	CEH official Certified Ethical Hacking Review Guide	Revised Edition	Kimberly Graves	Wiley	2007

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Certified Ethical Hacker	1	Michael Gregg	Pearson Education	2011
2	Certified Ethical Hacker	3	Matt Walker	McGraw-Hill Education	2016

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Digital forensics	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
1T322		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating Systems IT207: Computer Communications and Networks
Course Objective: To emphasize the fundamentals and importance of digital forensics	
Course Outcomes (CO): At the End of the course students will be able to	
1T322.1	Explain the principles and techniques associated with the digital forensic practices.
1T322.2	Understand the importance of evidence handling and storage for various devices.
1T322.3	Analyze the adequate perspectives of digital forensic investigation in various applications.
1T322.4	Analyze the Post-mortem investigation.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1T322.1	3	-	-	-	-	-	-	-	3	-	-	-
1T322.2	-	3	-	3	-	-	-	-	-	-	2	-
1T322.3	-	-	3	-	3	-	-	-	-	-	-	2
1T322.4	-	-	-	-	-	3	-	3	-	-	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T322.1	-	-	-	-	-	-	-
1T322.2	-	-	-	-	-	-	-
1T322.3	2	-	2	-	-	-	2
1T322.4	-	-	-	-	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Digital Forensics**	T1, T2, R1	5
	1.1	Introduction , A brief history of digital forensics, Digital forensics methodology, The need for digital forensics as technology advances, Commercial tools available in the field of digital forensics, Lab setup for digital forensics. Operating systems forensics , Anti-forensics: threats to digital forensics.		
	1.2	Understanding File systems and Storage Media, Filesystems and operating systems, Data volatility ,The paging file and its importance in digital forensics		
2	Title	**Incident Response and Data Acquisition**	T1, T2	7
	2.1	Introduction, Digital evidence acquisitions and procedures, Incident response and first responders, Documentation and evidence collection.		
	2.2	Chain of Custody ,Powered-on versus powered-off device acquisition, Write blocking, Data imaging and hashing, Device and data acquisition guidelines and best practices		
3	Title	**Digital forensics tool**	T1, R2	8
	3.1	Evidence Acquisition and Preservation ,Drive and partition recognition in Linux, Maintaining evidence integrity, Image acquisition using Guymager.		
	3.2	File Recovery and Data Carving with Foremost, Scalpel, and Bulk Extractor, Forensic test images used in Foremost and Scalpel, Using Foremost for file recovery and data carving, Using Scalpel for data carving, Bulk extractor. Memory Forensics with Volatility, About the Volatility Framework, Downloading test images for use with Volatility		
4	Title	**Post-mortem analysis**	T1, R2	7
	4.1	Autopsy – The Sleuth Kit, Kit, Sample, Digital forensics with Autopsy		

	4.2	Network and Internet Capture Analysis with Xplico , Software required, Packet capture analysis using Xplico, Revealing Evidence Using DFF, Installing DFF		
5	**Self-study**	Use python libraries to develop forensics tools for portable devices or tiny OS. Cloud forensics, mobile and portable device forensics.	**R3, R1**	**6***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To acquire a disk image
2	To study the use of md5deep hashing tool to compute the hashes of the directories and compare them to check the integrity of the directories.
3	Imaging a disk using AccessData FTK imager on windows
4	a. To use a forensic tool Foremost in order to recover files b. To use Vinetto forensic tool to analyze Thumps.db files and extract data.
5	Use of Galleta tool to study cookie created in during browsing.
6	a. Use of password forensics tool to crack zip and rar password protected files b. Use of password forensic tool to get an access to a windows machine
7	Learn art of steganography
8	Memory forensic tool to capture and analyze RAM's image
9	Use of wireshark to do network forensics
10	Analyze a PDF file to check if its malicious or not.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Forensics with Kali Linux	Second Edition	Shiva V. N. Parasram	Packt	2017
2	Computer Forensics: Incident Response	Essentials	First Warren G. Kruse II and Jay G. Heiser	Addison-Wesley Professional	2001

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year

1	Guide to Computer Forensics and Investigations	Second Edition	Nelson, B, Phillips, A, Enfinger, F, Stuart, C	Thomson Course Technology	2006
2	Computer Forensics, Computer Crime Scene Investigation	First Edition	Vacca, J	Charles River Media,	2005
3	Learning Python for Forensics	Second Edition	Preston Miller,Chapin Bryce	Packt Publishing	2019

Course (Category) Code	**Course Name**	**Teaching Scheme (Hrs/week)**					**Credits Assigned**			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
PE	**Advanced Database Systems**	**2**	**0**	**2**	**4**	**8**	**2**	**0**	**1**	**3**
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**			**Total**
1T331		**Theory**	**50**		**50**		**100**			**200**
		Laboratory	**50**		**--**		**50**			**100**

Pre-requisite Course Codes, if any.	IT204: Database Management Systems
Course Objective: To get knowledge of Query optimization, data warehousing, data models, graph databases, Parallel and distributed database systems,	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T331.1	Evaluate the performance of query.
1T331.2	Apply NO SQL, graph databases and enhanced data model concepts for a given scenario.
1T331.3	Apply data warehousing concepts for a given scenario.
1T331.4	Design parallel and distributed databases.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
1T331.1	2	-	-	-	2	-	-	-	-	-	-	2
1T331.2	-	2	-	-	2	-	-	-	2	-	-	2
1T331.3	-	-	-	-	3	-	-	-	2	1	-	2
1T331.4	-	-	-	2	3	-	-	-	2	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T331.1	1	-	-	-	-	-	-
1T331.2	-	2	2	2	1	-	-
1T331.3	-	-	2	2	-	-	1
1T331.4	-	-	-	1	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✔	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Parallel Database**	**T1,T2**	**4**
	1.1	Introduction, Architectures for parallel database,		
	1.2	Parallel query Evaluation, Parallelizing individual operation, Parallel Query Optimization		
2	**Title**	**Distributed Database Systems**	**T1,T2**	**8**
	2.1	Distributed Database Concepts , Types of Distributed Database Systems, Distributed Database Architectures		
	2.2	Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Query Processing and Optimization in Distributed Databases, Overview of Transaction Management in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, Current Trends in Distributed Databases		
3	**Title**	**NOSQL And Graph Databases**	**T4**	**6**
	3.1	No SQL, Weaknesses of the Relational Data Model, Inadequate Representation of Data, Semantic Overloading.		
	3.2	Graph database: Graphs and Graph Structures, The Property Graph Model, Storing Property Graphs in Relational Tables, Advanced Graph Models, Neo4J, Hyper Graph DB		
4	**Title**	**Enhanced Data Models**	**T1**	**4**
	4.1	Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Image database		
	4.2	Applications of Enhanced Data Models		

5	**Title**	**Overview of Data Warehousing and OLAP**	**T3,R 1**	**6**
	5.1	Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse ,		
	5.2	Typical Functionality of a Data Warehouse, Data Warehouse versus Views , Difficulties of Implementing Data Warehouses, OLTP, OLAP		
6	**Self Study**	Applications of Hyper Graph DB, cloud database, Block chain databases, data warehousing tools.	**T2,T3 ,T4,R 1**	**5***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Demonstrate the concept of deadlock in distributed systems.
2	Design a distributed database by applying the concept of horizontal fragmentation.
3	Design a distributed database by applying the concept of vertical fragmentation.
4	To implement the replication technique for a given scenario.
5	Demonstration of use of Cloud Database.
6	Demonstration of graph database.
7	Demonstration of Multimedia database
8	Build Data Warehouse and explore WEKA tool.
9	Create a data model for a given scenario.
10	Apply OLAP operations on a given scenario.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Fundamentals of Database Systems	Seventh Edition	Ramez Elmasri & Shamkant B.Navathe	Pearson Education	2016
2	Principles of Distributed Database Systems	Fourth Edition	M. Tamer Ozsu ,Patrick Valduriez	Springer	2019
3	Data Warehousing, Data Mining & OLAP	Tenth Edition	Alex Berson and Stephen J. Smith	TataMc Graw Hill Edition	2007
4	"Advanced Data Management: For Sql, Nosql, Cloud And Distributed Databases	First Edition	Lena Wiese	De Gruyter Oldenburg	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Database Systems – Design, Implementation and Management	Ninth Edition	Peter Rob and Corlos Coronel	Thompson Learning, Course Technology	2011
2	Database System Concepts	Seventh Edition	Henry F Korth, Abraham Silberschatz, S. Sudharshan	McGraw Hill	2010

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Data Science	2	0	2	4	8	2	0	1	3
		Examination Scheme								
1T332		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	IT303B: Artificial Intelligence and Machine Learning MA203: Probability and Statistics
Course Objective: To choose and apply tools, methodologies to solve *data science* tasks.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T332.1	Make use of data to perform exploratory data analysis.
1T332.2	Apply supervised and unsupervised learning on a dataset.
1T332.3	Apply Association rule mining on a dataset.
1T332.4	Develop a data science application using ethical practices.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1T332.1	-	1	2	-	2	-	-	-	-	-	-	2
1T332.2	-	1	2	-	2	-	-	-	-	-	-	2
1T332.3	-	1	2	-	2	-	-	-	-	-	-	2

1T332.4	-	1	2	-	2	-	-	2	2	-	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**
1T332.1	-	-	2	-	-	-	2
1T332.2	-	-	2	-	-	-	2
1T332.3	-	-	2	-	-	-	2
1T332.4	-	-	2	-	2	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
					✔

Theory Component

Module No.	**Unit No.**	**Topics**	**Ref.**	**Hrs.**
1		**Introduction**	**T1, T2**	**04**
	1.1	Introduction : Data Science, data science process, stages of a data science project		
	1.2	Preliminaries for Data Science: Data Cleaning, mean, median, mode, standard deviation, correlation coefficient, regression coefficient		
2		**Exploratory Data Analysis and Data visualization**	**T1, T2**	**06**
	2.1	Data Integration; Data Reduction: Attribute subset selection, Dimensionality Reduction, Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation		
	2.2	Visualizing Geographical data, network data, Temporal data		
3		**Supervised and Unsupervised Learning**	**T1, T2**	**06**

	3.1	Supervised Learning: Basic Concepts, Statistical Model Fitting, Classification using Decision Tree Induction, Attribute Selection Measures, Tree pruning		
	3.2	Unsupervised Learning: Basic Concepts; Partitioning Methods: K-Mediods; Hierarchical Methods: Agglomerative, Divisive, BIRCH; Density-Based Methods: DBSCAN, OPTICS		
4		**Association Rule Mining**	**T1, T2**	**06**
	4.1	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules		
	4.2	The Apriori Algorithm, The FP Growth algorithm, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules		
5		**Applications and Ethics of Data Science**	**T1, T2**	**06**
	5.1	Data Science for Business Applications: Recommendation Systems, Text Mining, Mining Social-Network graphs, Fraud Detection, Click stream Mining, Time Series, Market Segmentation, retail industry, etc.		
	5.2	Data Privacy, data security and ethics in data science. Qualities of data scientist		
6	**Self Study**	Applications of data science using Neural Networks, Deep Learning and Big Data	**R1**	**04***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To identify various tools and types of data
2	To perform the data exploration on a dataset
3	To Identify the data needed in terms of attributes, class inputs, training, validating, and testing files.
4	To perform data visualization
5	To perform supervised learning on a dataset
6	To perform unsupervised learning on a dataset
7	To perform density based clustering on a dataset
8	To perform association rule mining on a dataset
9	Mini Project Phase-I: To develop an application on a real life scenario
10	Mini Project Phase-II : To develop an application on a real life scenario

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Learning From Data	First Edition	Yaser S. Abu-Mostafa, Malik Magdon-Ismai	AMLBook	2012

			l, Husan-Tien Lin		
2	Doing Data Science	First Edition	First Cathy O'Neil, Rachel Schutt	O'Reilly	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Python Data Science Handbook: Essential Tools for Working with Data	First Edition	Jake VanderPlas	O'Reilly	2016

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Mini Project-II	0	0	0	8	8	0	0	0	3
		Examination Scheme								
IT308		Component	ISE		MSE		ESE		Total	
		Theory	--		--		--		--	
		Laboratory	200		--		100		300	

Pre-requisite Course Codes, if any.	
Course Objective: This course inculcates self-learning, research and entrepreneurship attitude in students. Students will be able to understand the formal project development process to complete a project in a team. It will help students to develop communication, organizational skills and maturity through discussion, presentation etc.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
IT308.1	Conduct a survey of basic and contemporary literature in the preferred field by identifying problems based on societal /research needs.
IT308.2	Formulate the problem statement by making judgments on validity of ideas.
IT308.3	Conclude suitable inferences from obtained results through theoretical/experimental/simulations based analysis.

IT308.4	Develop interpersonal skills to work as member of a team.
IT308.5	Prepare a report of the findings for the study conducted in the preferred domain.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12
IT308.1	2	2	-	-	-	2	1	3	3	3	-	2
IT308.2	2	3	2	2	-	-	1	3	3	3	-	2
IT308.3	2	2	2	2	2	-	-	3	3	3	-	2
IT308.4	-	-	-	-	-	-	-	3	3	3	3	2
IT308.5	2	2	-	-	-	-	-	3	3	3	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT308.1	2	2	2	2	2	2	2
IT308.2	2	2	2	2	3	2	2
IT308.3	2	2	2	2	3	2	2
IT308.4	2	2	2	2	2	2	2
IT308.5	2	2	2	2	2	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Mini Project II is an opportunity to inculcate the research aptitude in students. It helps them to identify research gaps and come up with possible solutions. Students should be able to analyze these solutions for feasibility of their implementation. Mini project II is based on a small research project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

Steps for Research:

✓ Keen observation of the surrounding/society

✓ Read existing Literature to understand and identify the research gaps

✓ Analysis of the problem

✓ Formulation of the problem statement

✓ Collection of relevant information by formulating research questions

✓ Suggesting plan of action

✓ Conducting experiments and draw conclusion

✓ To find the possible solution to rectify the problem

✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be manageable in one semester.

Criteria of a good project:

✓ Appropriate idea, clear understanding and proper presentation of the concept

✓ Quality of work

✓ Project plan and its execution

✓ Credibility of the work

✓ Probable impact of the work on the attitude of students and society

✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation

✓ Utility and innovation of the remedial measures

✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Mini Project II may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- ✔ Learning additional skills
- ✔ Development of ability to define and design the problem and lead to its accomplishment with proper planning
- ✔ Learn the behavioral discipline by working in a team. Students should work in groups of three on the Mini Project-II.

Evaluation:

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

The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. ISE marks will be based on the performance of the individual student in three phases of

evaluation. The evaluation of the Phase I will be based on Title approval where the domain and scope of the project will be evaluated. Phase II will be on presentation of the selected approach, justification and Design and some part of implementation. Evaluation of Phase III is based on demonstration of complete implementation, testing, presentation and technical report.

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

Bhartiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

[Knowledge is Nectar]

Liberal, Pi-Model of Engineering Education @ SPIT

(Department of Information Technology)

Final Year Engineering
(Semester VII – VIII)

Sem VII									
No	Type	Code	Course	L	T	P	O	E	C
1	OE	OEXXX	Open Elective-II	2	0	2	4	08	3
2	OE	OEXXX	Open Elective--III*	2	0	2	4	08	3
3	PE	1T4X3	Program Elective-III	2	0	2	4	08	3
4	PE	1T4X4	Program Elective-IV	2	0	2	4	08	3
5	SBC	IT401	Main Project Stage-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	4	04	2
7	S/M/H	SCX4/MNX4 /HOXX	SCOPE-IV/Minor-IV/Honors-I						3
		*OE-III must be from Basic Science Elective or Engineering Science Elective							
			TOTAL	**8**	**0**	**8**	**24**	**40**	**16**

Sem VIII (Option A: Cat1/Cat2)									
No	Type	Code	Course	L	T	P	O	E	C
1	OE*	OEHXX	Open Elective –IV	2	0	2	4	08	3
2	PE	1T4X5	Program Elective –V	2	0	2	4	08	3

3	PE	1T4X6	Program Elective –VI	2	0	2	4	08	3
4	SBC	IT402	Main Project Stage-II	0	0	0	12	12	7
5	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	1
6	H	HOXX	Honors-II						3
	*must be from Humanities and Management group, May be taken from MOOCs								
			TOTAL	**6**	**0**	**6**	**28**	**40**	**17**

Sem VIII (Option B-Only for Cat 1 students)									
No	Type	Code	Course	L	T	P	O	E	C
1	SBC	IT403	Main Project Stage-II	0	0	0	36	36	16
2	ABL	SVXX/STXX	SEVA-IV/SATVA-IV	0	0	0	04	04	1
3	H	HOXX	Honors-II						3
			TOTAL	0	**0**	**0**	**40**	**40**	**17**

SEMESTER VII

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Natural Language Processing	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE	ESE			Total
1T413		Theory		50		50	100			200
		Laboratory		50		--	50			100

Pre-requisite Course Codes, if any.	IT307B: Artificial Intelligence and Machine Learning
Course Objective: To understand the basic knowledge on various morphological, syntactic and semantic NLP tasks.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T413.1	Apply the Natural language processing pipeline to solve a given problem
1T413.2	Identify use of Natural language Models

1T413.3	Analyze Parts-Of-Speech tagging, Parsing and Semantic Analysis models for a given scenario
1T413.4	Develop system to solve a Natural Language Processing problem

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
1T413.1	2	-	-	-	2	-	-	-	-	-	-	2
1T413.2	2	-	-	-	2	-	-	-	-	-	-	2
1T413.3	2	-	-	-	2	-	-	-	-	-	-	2
1T413.4	2	-	-	-	2	-	-	-	-	1	1	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T413.1	-	-	2	-	1	-	2
1T413.2	-	-	2	-	1	-	2
1T413.3	-	-	2	-	1	-	2
1T413.4	-	-	2	-	1	-	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**	**1,2**	**06**
	1.1	Introduction: NLP tasks/pipeline, syntax, semantics, classical applications in NLP, Role of Machine Learning in Natural Language Processing.		
	1.2	Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.		
2		**Language Modelling: N-gram and Neural Language Models**	**1,2**	**07**
	2.1	Language Modelling with N-gram, Simple N-gram models, Estimating parameters in Smoothing, Evaluating language models		
	2.2	Neural Networks and Neural Language Models		

3		**Parts-of-speech Tagging**	**1,2**	**07**
	3.1	Rule based Part of Speech Tagging, Transformation based Tagging (TBL)		
	3.2	POS tagging using HMM, POS Tagging using Neural Model		
4		**Parsing and Semantics**	**1,2**	**08**
	4.1	Basic concepts: Grammar Formalism, Treebank, Syntactic parsing: CKY parsing, Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs		
	4.2	Vector Semantics, Words and Vector, Measuring Similarity, Semantics with dense vectors, Embeddings from prediction: Skip-gram and CBOW		
5	**Self Study**	Applications: Sentiment Analysis, Text Summarization, chatbots, Language Translation; Word Sense, WordNet	**3,4**	**04***
Total				**28**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To perform Lexical Analysis on a given text data
2	To perform Syntax Analysis on a given text data
3	To perform n-gram model on a given text data
4	To perform N-grams smoothing on a given text data
5	To perform POS Tagging using HMM and neural model
6	To apply parsing techniques on the data
7	To perform Semantic Analysis on a given text data
8	To perform word embedding on a given text data
9	Capstone Project- Phase I: To develop an application on a real life scenario
10	Capstone Project-Phase II: To develop an application on a real life scenario

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Speech and Language Processing	Third Edition	Daniel Jurafsky, James H. Martin	Prentice Hall	2018
2	Foundations of Statistical Natural Language Processing	First Edition	Christopher D.Mannig and Hinrich Schutze,	MIT Press	1999

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Natural Language Processing and Information Retrieval	First Edition	Siddiqui and Tiwary U.S	Oxford University Press	2008
2	Natural Language Processing with TensorFlow	First Edition	Thushan Ganegedara	Pakt Publishing Ltd.	2018

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Deep Learning	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
1T414		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	IT312: Soft Computing
Course Objective:	

	To introduce the fundamental concepts of Deep learning with primary focus on the architectures and applications as appropriate to real world problems
Course Outcomes (CO):*At the End of the course students will be able to*	
1T414.1	Interpret the mathematical foundations of Deep Learning architectures.
1T414.2	Construct deep neural networks for a given problem.
1T414.3	Analyze deep learning models for a given scenario.
1T414.4	Develop real-world applications using various deep learning techniques.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1T414.1	2	2	2	-	3	-	-	-	-	-	-	1
1T414.2	3	2	3	-	3	-	-	-	-	-	-	1
1T414.3	3	2	3	2	3	-	-	-	-	-	-	1
1T414.4	3	3	3	2	3	-	-	-	3	3	2	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T414.1	1	2	2	-	-	-	2
1T414.2	1	2	2	-	-	-	2
1T414.3	1	2	2	-	-	-	2
1T414.4	2	2	2	-	3	-	3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
					✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Deep Learning**	**T1,T2**	**4**
	1.1	Revision of Learning Algorithms Concepts: Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Stochastic Gradient Descent,		
	1.2	Challenges Motivating Deep Learning		

2	**Title**	**Convolutional Neural Networks**	**T1,T2, T4,R2**	**6**
	2.1	The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior,		
	2.2	Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features		
3	**Title**	**Autoencoders**	**T1, T2,R1, R2**	**6**
	3.1	Architecture of Autoencoder, Undercomplete v/s Overcomplete Autoencoder, Regularized Autoencoders,		
	3.2	Representational Power, Layer Size and Depth, Applications of Autoencoders		
4	**Title**	**Sequence Modelling**	**T1,T2, T3,T4, R1,R2**	**6**
	4.1	Recurrent Neural Networks (RNN), Bidirectional RNNs		
	4.2	Encoder-Decoder sequence to sequence architecture		
	4.3	Deep Recurrent Network, Long short term memory (LSTM) and gated RNNs		
5	**Title**	**Generative Adversarial Networks**	**T3,R2**	**6**
	5.1	Introduction to GANs, The GAN Architecture: Discriminator, Generator,		
	5.2	Training the GAN, Applications of GAN		
6	**Self Study**	Applications of Deep Learning: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications	**T3, R1,R2**	**4***
Total				**28**

Laboratory Component:

** Lab experiments may be performed using any open-source, freely available deep learning frameworks.

Sr. No.	Title of the Experiment
1	To implement a deep feed-forward network for a given problem
2	To implement a CNN for image data.
3	To implement a CNN for textual data.
4	To implement autoencoders.
5	To implement RNN for a given problem.

6	To implement Encoder-Decoder Model for a given problem
7	To implement generative adversarial networks for a given problem
8-10 Capstone Project	Capstone project covering the concepts of Deep Learning on real world problem statements.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Deep Learning	First Edition	Ian Goodfellow, Yoshua Bengio, Aaron Courvile	An MIT Press book	2016
2	Fundamentals of Deep Learning	First Edition	Nikhil Buduma	O'Reilly	2017
3	Generative Deep Learning	First Edition	David Foster	O'Reilly	2019
4	Deep Learning using Python	First Edition	Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka	Wiley	2019

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Deep Learning: Methods and Applications	First Edition	Deng & Yu	Now Publishers	2013
2	Deep Learning CookBook	First Edition	Douwe Osinga	O'Reilly	2017

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Security Operations Center	2	0	2	2	6	2	0	1	3
		Examination Scheme								
1T423		Component	ISE		MSE		ESE			Total
		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	IT206: Operating systems IT207: Computer Communications and Networks
Course Objective: To analyze the security incidents, events and respond to it.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T423.1	Explain the SOC processes, procedures, technologies, and workflows.
1T423.2	Identify the indicators of compromise by recognizing the attacker tools, tactics, and procedures.
1T423.3	Analyze the logs and alerts from various technologies.
1T423.4	Evaluate the use cases that are widely used across the SIEM deployment.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1T423.1	3	-	-	-	-	-	-	-	-	-	-	-
1T423.2	-	3	3	3	3	-	-	-	-	-	-	-
1T423.3	-	-	-	2	3	-	-	2	-	-	-	-
1T423.4	-	-	-	-	-	2	2	-	-	-	-	3

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T423.1	2	-	-	-	-	-	-
1T423.2	-	-	-	-	-	-	2
1T423.3	-	-	2	2	-	-	2
1T423.4	-	-	-	2	-	-	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✔	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**SOC basics**	**T1, T2, R1**	**7**
	1.1	Introduction to SOC, security challenges, Information assurance, risk management, security incident response, SOC generations. A modern SOC - SecOps and next-gen tech.		

	1.2	Elements of SOC-data collection and analysis, vulnerability management, threat intelligence, compliance.		
2	**Title**	**The plan phase**	**T1**	**7**
		SOC strategy – strategy element, SOC model operation, SOC services, SOC capabilities road map.		
3	**Title**	**The design phase**	**T1**	**6**
	3.1	The SOC infrastructure -design consideration, model of operation, facilities and active infrastructure.		
	3.2	Security event generation and collection -data collection, cloud security, intrusion detection and prevention system, honeypots, DNS server.		
4	**Title**	**The build and operate phase**	**T1, R2**	**8**
	4.1	The technology- network, security, system, storage, collaboration Breach detection, sandboxes.		
	4.3	Key challenges -people, process, technology. Reacting to events and incidents. maintain review and improve- reviewing and assessing the SOC, maintaining and improving SOC.		
5	**Self-study**	**User and Entity Behavioral Analytics, SIEM Analytics and Incident Response and Automation**		**6***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To do Vulnerability Scanner set-up by Configuring nessus and OpenVAS
2	Implementation of SOC using Prelude SIEM
3	Establishing baselines of files and directories with Kali Linux and Windows 7.
4	To implement event log collection and correlation
5	To conduct log analysis and cross examination for false positives
6	To generate log event reports
7	To prioritization and escalation of incidents by generating incident ticket
8	To implement containment of incidents
9	To implement eradication of incidents
10	To recover data from the incidents and Creating report of the incident

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Security Operations Center: Building, Operating, and Maintaining your SOC	First Edition	Joseph Muniz	Cisco Press	2015

2	Blue Team Handbook: A Condensed Field Guide for the Cyber Security Incident Responder: Incident Response Edition: A condensed field guide for the Cyber Security Incident Responder	First Edition	Don Murdoch	Lightning Source Inc	2014

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Modern Security Operations Center	First Edition	Joseph Muniz	Addison-Wesley Professional	2021
2	Security Operations Center - SIEM Use Cases and Cyber Threat Intelligence	First Edition	Arun E Thomas	Arun E Thomas	2018

Course (Category) Code	**Course Name**	**Teaching Scheme (Hrs/week)**					**Credits Assigned**			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
PE	**Blockchain Technology**	**2**	**0**	**2**	**5**	**10**	**3**	**0**	**1**	**3**
		Examination Scheme								
		Component		**ISE**		**MSE**		**ESE**		**Total**
1T424		**Theory**		**50**		**50**		**100**		**200**

		Laboratory	**50**	**--**	**50**	**100**

Pre-requisite Course Codes, if any.	IT206:Operating systems IT207:Computer Communications and Networks
Course Objective: To understand and use the blockchain technology	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T424.1	Explain the basic concepts of blockchain technology, Bitcoin and Ethereum.
1T424.2	Apply a smart contract on the Ethereum test network
1T424.3	Build a Decentralized Application running on a decentralized peer-to-peer network
1T424.4	Explain the General Data Protection Regulation for relevant blockchain application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
1T424.1	2	-	-	-	-	-	-	-	-	-	-	2
1T424.2	-	2	-	-	2	2	1	-	-	-	-	2
1T424.3	-	-	3	2	3	2	1	-	-	-	-	2
1T424.4	-	-	-	-	-	2	1	2	-	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	**PEO2**	**PEO3**	**PEO4**	**PSO1**	**PSO2**	**PSO3**
1T424.1	-	-	-	-	-	-	-
1T424.2	2	2	2	2	-	2	2
1T424.3	2	2	2	2	-	2	2
1T424.4	2	-	-	2	-	2	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
					✔

Theory Component

Module No.	**Unit No.**	**Topics**	**Ref.**	**Hrs.**

1	**Title**	**Introduction to Blockchain**	**T1, T2, R1**	**6**
	1.1	The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model		
	1.2	Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).		
2	**Title**	**Consensus**	**T1, T2**	**8**
	2.1	Bitcoin - Wallet - Blocks – Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.		
	2.2	Permissioned Blockchain: Basics, Distributed consensus, RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance.		
3	**Title**	**Hyperledger Fabric**	**T1, T2**	**8**
	3.1	Transaction Flow. Hyperledger Fabric Details, Fabric - Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demo on IBM Blockchain Cloud.		
	3.2	Hyperledger Composer - Application Development. Hyperledger Composer - Network Administration, Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Blockchain: Enterprise use cases.		
4	**Title**	**Data Protection and applications of blockchain**	**T1, T2, T3, R2**	**6**
	4.1	General Data Protection Regulation (GDPR) and its relevance for Indian businesses, Internal Policy on management and sharing data, GDPR compliance between multiple organizations. Liability and indemnity under GDPR, GDPR for Entrepreneurs.		
	4.2	Applications of blockchain - Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and smart cities, smart industries, anomaly detections, FinTech, Shaping the Financial World, IoT.		
6	**Self-study**	Scaling the blockchain: payment channels and state channels Scaling the blockchain using optimism and using SNARK Privacy in public blockchain: deanonymizing the blockchain and mixing.	**R1, R2**	**6***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment

1	Implementation of symmetric key cryptosystems – I
2	Implementation of asymmetric key cryptosystems – I
3	To implement Merkle Tree and genesis block
4	Demonstration of Bootstrapping
5	Demonstration of Hyperledger Fabric
6	Demonstration of Hyperledger Fabric – Ethereum
7	Implementation of Bitcoin
8	To implement the application: Land Registration
9	To implement the application: Smart Contract
10	To implement the application: FinTech

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Illustrated	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder	Princeton University Press	2016
2	Blockchain: Blueprint for a New Economy	First Edition	Melanie Swa	O′Reilly	2015
3	Building-Blocks of a Data Protection Revolution: The Uneasy Case for Blockchain Technology to Secure Privacy and Identity	First Edition	Shraddha Kulhari	Nomos	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Bitcoin Standard: The Decentralized Alternative to Central Banking	First Edition	Saifedean Ammous	Wiley	2018
2	Blockchain For Dummies	Second Edition	Tiana Laurence	Wiley	2019

Course(Category)	Course Name	Teaching Scheme (Hrs/week)	Credits Assigned

Code		L	T	P	O	E	L	T	P	Total
PE	Digital Image Processing	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
1T433		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To Evaluate the techniques for image processing to analyze Images.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T433.1	Evaluate the techniques for enhancing and segmenting Images.
1T433.2	Analyze images using various transforms.
1T433.3	Categorize various compression techniques and standards for Images and Videos.
1T433.4	Apply image processing algorithms in practical applications.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
1T433.1	3	2	2	-	2	-	-	-	-	-	-	-
1T433.2	3	2	-	-	2	-	-	-	-	-	-	-
1T433.3	3	2	2	-	2	-	-	-	-	-	-	-
1T433.4	2	1	-	-	1	-	-	-	2	2	-	-

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T433.1	2	-	-	-	-	-	-
1T433.2	2	-	-	-	-	-	-
1T433.3	2	-	-	-	-	-	-
1T433.4	2	2	-	1	2	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
			✔		

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Fundamentals of Image Processing**		03
	1.1	Structure of the Human Eye, Light, Brightness adaption and discrimination, Pixels, Coordinate conventions	T1	
	1.2	Imaging Geometry, Image acquisition, Sampling and Quantization, image resolution, basic relationship between pixels, color images, RGB, HSI models	T1	
2		**Image Enhancement and Segmentation**		07
	2.1	Point Processing, Histogram processing, Smoothing and Sharpening Filters.	T1	
	2.2	Detection of discontinuities, Edge linking and Boundary detection, Hough transform, Thresholding, Region oriented segmentation.	T1	
3		**Image Transform and Morphology**		06
	3.1	Discrete Fourier Transforms, Hadamard-Walsh Transform, Discrete Cosine Transform, Discrete Wavelet Transform.	T1	
	3.2	Image Morphology: Structuring Element, Erosion & Dilation, Opening & Closing, Region filling.	T1	
4	Title	**Video Processing**		05
	4.1	Digital Video Sampling, Video Frame classifications, Moving picture types, Macroblock, Motion Compensation.	R1	
	4.2	Motion Models, 2D Apparent-Motion Estimation, 3D Motion and Structure Estimation.	T2	
5	Title	**Image and Video Compression**		07
	5.1	Redundancies, Lossy and Lossless Compression	T1	
	5.2	RLE, Huffman Coding, Arithmetic Coding, LZW, JPEG, Predictive Coding	T1	
	5.3	H.261, MPEG	R1	
6	Self Study	Object Representation and Object Recognition, Image Restoration, Applications of Image Processing	T1	6*
Total				28

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Image Enhancement using Point Processing Operations.
2	Smoothing and Sharpening of Images.
3	To enhance Image using Histogram equalization.
4	To segment Image using Image Segmentation.
5	To perform morphological operations on Image
6	To perform Region Filling in the Image
7	To implement transform on the Image.
8	To implement compression of the Image.
9	To detect object in the Video.

10	To Implement an application of Image Processing

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Image Processing	Third Edition	Rafael C. Gonzalez and Richard E. Woods	Pearson Education	2010
2	Digital Video Processing	Second Edition	Murat Tekalp	Pearson Education	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Multimedia Systems Design	--	Prabhat K Andleigh / Kiran Thakrar	Pearson	2015
2	Handbook on Image and Video Processing	--	A.I.Bovik	Academic Press	2009

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
PE	Project Management	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
1T434		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	IT 302: Software Engineering
Course Objective: To study the fundamentals of Project Management	
Course Outcomes (CO): ***At the End of the course students will be able to***	
1T434.1	Align the project to the organization's strategic plans and business justification throughout its lifecycle
1T434.2	Manage the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders
1T434.3	Identify Project constraints and justify resource utilization.
1T434.4	Adapt projects in response to issues that arise internally and externally
1T434.5	Analyze the failed projects

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
1T434.1	-	-	2	-	-	-	-	-	2	2	-	-
1T434.2	-	-	2	-	-	-	-	-	2	2	3	-
1T434.3	-	-	-	-	-	-	2	1	2	2	3	-
1T434.4	-	-	-	2		1	2	1	2	2	-	-
1T434.5	-	-	-	2	1	1	2	1	2	2	3	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
1T434.1	3	-	-	-	2	-	-
1T434.2	3	-	-	-	2	-	-
1T434.3	-	1	-	-	-	-	-
1T434.4	-	-	2	-	-	-	1

1T434.5	-	-	2	-	-	-	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
				✔	

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**		**04**
	1.1	Project Attributes, Project Characteristics, The Framework of Project Management	**T1,T2, T3**	
	1.2	The Project Life Cycle, Overview of Scrum Project Management		
2		**Project Initiation and Planning**		**08**
	2.1	Project Initiation, Project Charter	**T1,T2, T3**	
	2.2	Project Scope , Work Breakdown Structure, Project Schedule and Time Management, Project Costs , Make/buy/outsource decision		
3		**Software Project Status Monitoring**		**06**
	3.1	Network Scheduling technique, Earned Value Analysis, Schedule & Cost slippage, Critical chain project management , Goldratt's critical chain	**T1,T2, T3**	
	3.2	Resource Loading and Leveling, Techniques for Managing Resources		
4		**Change Management**		**06**
	4.1	Change management plan , Dealing with resistance and conflicts.	**T1,T2, T3**	
	4.2	Project Risk Management		
	4.3	Techniques for Quality management		
5		**Project Implementation & Closure**		**04**
	5.1	Project Implementation methods	**T1,T2, T3**	
	5.2	Administrative closure , Project evaluations		
	5.3	Project audit ,Post production review		
6	**Self Study**	**Case studies, Co- located and Distributed Projects, Project failures, Challenges and tools.**		**8**
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To design Business Case for given case study
2	Define Scope and WBS
3	To use decision making tools for Project make- buy decision
4	Project planning using MS Project or using similar tools
5	Project status reporting EVA
6	Risk assessment/ Quality Management Tools
7	Project communication Using JIRA
8	Software Contracts
9	Resource Loading and Leveling
10	Case study on conflict Management using Meyers Briggs Model

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Project Management For Engineering Business And Technology	2021 Edition	John M. Nicholas and Herman Steyn	Taylor and Francis	August 2020
2	Project Management	--	Adrienne Watt	Creative Commons-ShareAlike 4.0 International License	2015
3	Information Technology Project Management	Fourth Edition	Jack T. Marchewka	4th edition, Wiley India	2014

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Managing Information Technology Project	Fourth Edition	Kathy Schwalbe	Cengage Learning publication	September 2010
2	Effective Software Project Management	--	Robert K.Wysocki	Wiley Publication	September 2010
3	Project Management in Distributed Projects	--	Thomas Gollubits	VDM Verlag Dr. Mueller E.K	May 2008

SEMESTER VIII