AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)

ADDING VALUE TO ENGINEERING

An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

ACADEMIC COURSE STRUCTURE

AND

DETAILED SYLLABUS OF

THIRD YEAR

INFORMATION TECHNOLOGY

B.TECH 4 YEAR UG COURSE
(Applicable for the batches admitted from 2022-2023)

AISSMS INSTITUTE OF INFORMATION TECHNOLOGY
Kennedy Road, Near RTO,
Pune – 411 001, Maharashtra State, India
Email: principal@aissmsioit.org, Website:
https://www.aissmsioit.org

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BOS-INFORMATION TECHNOLOGY
AISSMS IOIT (AUTONOMOUS)
PUNE-1.

Institute Vision & Mission

Vision

To be recognized amongst top 10 private engineering colleges in Maharashtra by the year 2026 by rendering value added education through academic excellence, research, entrepreneurial attitude, and global exposure.

Mission

- To enable placement of 150 plus students in the 7 lacs plus category & ensure 100% placement of all final year students.
- To connect with 10 plus international universities, professional bodies, and organizations to provide global exposure students.
- To create conducive environment for career growth, prosperity, and happiness of 100% staff.
- To be amongst top 5 private colleges in Pune in terms of admission cut off.

Quality Policy

We commit ourselves to provide quality education & enhance our students quality through continuous improvement in our teaching and learning processes.

Department Vision & Mission

Vision

To be a leader in preparing technically competent and skillful IT Graduates to address the needs of industry and society.

Mission

- To prepare students for employment/entrepreneurship/higher studies through curricular, extracurricular and extension activities.
- To promote research and professional activities through industry involvement and professional bodies
- To instil professional ethics and lifelong learning skills with concern for society.

Program Educational Objectives (PEOs)

Graduates will
- Excel in diverse career paths with core professional skills.
- Engage in multi domain research/professional activities.
- Cater to the needs of society with IT solutions/applications.

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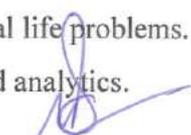BOS-INFORMATION TECHNOLOGY
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Program Outcomes (POs)

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

2. Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]

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

4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [Conduct investigations of complex problems]

5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. [Modern tool usage]

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

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

8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]

9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and team work]

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

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

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

Program Specific Outcomes (PSOs)

Graduates will be able to

1. Use database, networking and programming technologies for solving real life problems.

2. Develop applications in the field of computing, networking, security and analytics.

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A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

B. Range of credits –

A range of credits from 160 to 176 for a student to be eligible to get Undergraduate degree in Engineering.

A student will be eligible to get Undergraduate degree with Honors or additional Minor Engineering if he/she completes an additional 20 credits.

C. Credit for Undergraduate Degree in Information Technology

Sr. No.	Year	Semester	Credits
1	First Year	I	19
2		II	21
3	Second Year	III	22
4		IV	24
5	Third Year	V	23
6		VI	25
7	Final Year	VII	12
8		VIII	14
Total Credits			**160**

D. Structure of Undergraduate Engineering program

Sr. no.	Domains	Code	Credits	NEP Suggested
1	Basic Science courses	BSC	16	14-18
2	Engineering Science courses	ESC	16	12-16
3	Programme Core Courses	PCC	58	44-56
4	Programme Elective courses	PEC	18	20
5	Open Elective other than particular Programme	OEC	06	08
6	Vocational and Skill Enhancement Course	VSE	08	08
7	Humanities Social Science and Management	HSM	12	14
8	Experiential Learning Courses	ELC	22	22
9	Liberal Learning Courses	LLC	04	04
Total			**160**	**160-176**

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E. Semester wise credit details for Undergraduate Engineering program

Sr. no.	Code	Credits								Total	NEP suggested
		Semesters									
		I	II	III	IV	V	VI	VII	VIII		
1	BSC	8	8	-	-	-	-	-	-	16	14-18
2	ESC	10	6	-	-	-	-	-	-	16	16-12
3	PCC	-	-	16	16	12	12	2	-	58	44-56
4	PEC	-	-	-	-	5	5	8	-	18	20
5	OEC	-	-	3	-	3	-	-	-	06	08
6	VSE	-	2	-	3	-	3	-	-	08	08
7	HSM	-	-	3	3	3	3	-	-	12	14
8	ELC	3	3	-	-	-	-	2	14	22	22
9	LLC	-	-	-	2	-	2	-	-	04	04
Total Credits		21	19	22	24	23	25	12	14	160	160-176
Minor (Th+PR)		-	-	4	4	4	4	-	-	-	16
Total Credit including Minor		21	19	26	28	27	29	12	14	176	176
Exam Total		650	650	825	875	825	875	600	600	5900	
Total Working Hours per Week			31	33	32	35	16	28			-

F. Honors Degree : Cyber Security

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ITHDT501	Information Security and Audit Monitoring	V	3	-	-	3	40#	60*	-	-	-	100
2	ITHDT502	Information Security and Audit Monitoring Lab@@	V	-	-	4	2	-	-	25	-	25	50
3	ITHDT601	Database Security	VI	3	-	-	3	40#	60*	-	-	-	100
4	ITHDT602	Database Security Lab	VI	-	-	2	1	-	-	-	25	-	25
5	ITHDT701	Cloud Security	VII	3	-	-	3	40#	60*	-	-	-	100
6	ITHDT702	Cloud Security Lab	VII	-	-	2	1	-	-	-	25	-	25
7	ITHDT801	Cyber Crime Investigation and Digital Forensics	VIII	3	-	-	3	40#	60*	-	-	-	100
8	ITHDT802	Cyber Crime Investigation	VIII	-	-	4	2	-	-	25	-	25	50

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		and Digital Forensics Lab@@											
	Total			**12**	**-**	**12**	**18**	**160**	**240**	**50**	**50**	**50**	**550**

G. Honors Degree- with Research

								B.Tech (Honors with Research)					
Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ITHDR7R1	Research Methodology	VII	3	-	-	3	40#	60*	-	-	-	100
2	ITHDR7R2	Mathematical Modeling	VII	3	-	-	3	40#	60*	-	-	-	100
3	ITHDR7R3	Dissertation Phase I@@	VII	-	-	4	2	-	-	25	-	25	50
4	ITHDR8R4	Research Publication and Ethics	VIII	2	-	-	2	20#	30#	-	-	-	50
5	ITHDR8R5	Paper Publication	VIII	-	-	4	2	-	-	50	-	-	50
6	ITHDR8R6	Dissertation Phase II@@	VIII	-	-	12	6	-	-	100	-	50	150
	Total			**8**	**-**	**20**	**18**	**100**	**150**	**175**	**-**	**75**	**500**

H. Major Courses : Information Technology

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ITPCC302	Discrete Mathematics	III	3	-	-	3	40#	60*	-	-	-	100
2	ITPCC303	Digital Electronics & Computer Organization	III	3	-	-	3	40#	60*	-	-	-	100
3	ITPCC304	Data Structure and Algorithms	III	3	-	-	3	40#	60**	-	-	-	100
4	ITPCC305	Data Base Management System	III	3	-	-	3	40#	60*	-	-	-	100
6	ITPCC307	Digital Electronics & Computer Organization Lab@@	III	-	-	2	1	-	-	25	25	-	50
7	ITPCC308	Data Structure and Algorithms Lab@@	III	-	-	4	2	-	-	25	-	25	50
8	ITPCC309	Data Base Management System Lab@@	III	-	-	2	1	-	-	25	25	-	50
9	ITPCC402	Probability and Statistics	IV	3	-	-	3	40#	60*	-	-	-	100
10	ITPCC403	Object Oriented Programming	IV	3	-	-	3	40#	60**	-	-	-	100
11	ITPCC404	Processor Architecture and	IV	3	-	-	3	40#	60*	-	-	-	100

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Sr	Course Code	Course Name	Sem	L	T	P	Cr						Total
12	ITPCC405	Interfacing Computer Graphics and Animation	IV	3	-	-	3	40#	60*	-	-	-	100
14	ITPCC407	Object Oriented Programming Lab@@	IV	-	-	4	2	-	-	25	-	25	50
15	ITPCC408	Processor Architecture and Interfacing Lab@@	IV	-	-	2	1	-	-	25	25	-	50
16	ITPCC409	Computer Graphics and Animation Lab@@	IV	-	-	2	1	-	-	25	25	-	50
17	ITPCC502	Data Communication and Computer Network	V	3	-	-	3	40#	60*	-	-	-	100
18	ITPCC503	Theory of Computation	V	3	1	-	4	40#	60*	-	-	-	100
19	ITPCC504	Software Engineering & Project Management	V	3	-	-	3	40#	60*	-	-	-	100
20	ITPEC505	Elective-I	V	3	-	-	3	40#	60**	-	-	-	100
21	ITPCC507	Data Communication and Computer Network Lab@@	V	-	-	2	1	-	-	25	-	25	50
22	ITPCC508	Software Engineering & Project Management Lab@@	V	-	-	2	1	-	-	25	25	-	50
23	ITPEC509	Software Lab-I@@	V	-	-	4	2	-	-	25	-	25	50
24	ITPCC602	Machine Learning	VI	3	1	-	4	40#	60*	-	-	-	100
25	ITPCC603	Operating System	VI	3	-	-	3	40#	60*	-	-	-	100
26	ITPCC604	Cloud Computing	VI	3	-	-	3	40#	60*	-	-	-	100
27	ITPEC605	Elective-II	VI	3	-	-	3	40#	60**	-	-	-	100
29	ITPCC607	Operating System Lab@@	VI	-	-	2	1	-	-	25	25	-	50
30	ITPCC608	Cloud Computing Lab@@	VI	-	-	2	1	-	-	25	25	-	50
31	ITPEC609	Software Lab-II@@	VI	-	-	4	2	-	-	25	-	25	50
32	ITPCC701	Distributed Computing	VII	2	-	-	2	40#	60*	-	-	-	100
33	ITPEC702	Elective - III	VII	3	-	-	3	40#	60*	-	-	-	100
34	ITPEC703	Elective - IV	VII	3	-	-	3	40#	60*	-	-	-	100
35	ITPEC704	Software Lab-III@@	VII	-	-	2	1	-	-	25	50	-	75
36	ITPEC705	Software Lab-IV@@	VII	-	-	2	1	-	-	25	50	-	75
37	IOELC7P1	Project Stage I@@	VII	-	-	4	2	-	-	100	-	50	150
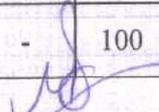
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38	IOELC801	Internship/ 2MOOCs/ Entrepreneurship/ Research Project/ Foreign University Certification Course@@	VIII	-	-	24	12	-	-	200	-	100	300
39	IOELC8P2	Project stage II@@	VIII	-	-	4	2	-	-	200	-	100	300
			Total	56	2	69	92	760	1140	850	275	375	3400

I. Minor Degree: Software Development Technologies

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme		
				L	T	P		ESE	TW	Total
1	ITMNR301	Data Structure and Algorithms	III	3	-	-	3	75	-	75
2	ITMNR302	Data Structure and Algorithms Lab	III	-	-	2	1	-	25	25
3	ITMNR401	Object Oriented Programming	IV	3	-	-	3	75	-	75
4	ITMNR402	Object Oriented Programming Lab	IV	-	-	2	1	-	25	25
5	ITMNR501	Software Engineering & Project Management	V	3	-	-	3	75	-	75
6	ITMNR502	Software Engineering & Project Management Lab	V	-	-	2	1	-	25	25
7	ITMNR601	Operating System	VI	3	-	-	3	75		75
8	ITMNR602	Operating System Lab	VI	-	-	2	1	-	25	25
			Total	12	-	8	16	300	100	400

J. Open Elective Courses

Sr. No.	Course code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ITOEC306	MOOC-Human Computer Interaction	III	3	-	-	3	40$	60$$	-	-	-	100
2	ITOEC506	MOOC-Ethical Hacking	V	3	-	-	3	40$	60$$	-	-	-	100
			Total	6	-	-	6	80	120	-	-	-	200

K. Vocational and Skill Enhancement Courses

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	ITVSC406	Web Development @@	IV	1	-	4	3	-	-	50	50	-	100

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2	ITVSC606	Software Quality Assurance and Testing@@	VI	1	-	4	3	-	-	50	50	-	100
		Total		2	-	8	6	-	-	100	100	-	200

L. Humanities Social Science and Management Courses

Sr. No.	Course code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	IOHSM301	Democracy, Election and Governance@@	III	2	-	-	2	-	-	25	-	25	50
2	IOHSM3AC	Audit course - Vedic Mathematics	III	1	-	-	1	-	-	25	-	-	25
3	ITHSM401	Management Information System@@	IV	1	1	-	2	-	-	25	-	25	50
4	IOHSM4AC	Audit course- Sustainable Development goals	IV	1	-	-	1	-	-	25	-	-	25
5	IOHSM501	Intellectual Property Rights@@	V	2	-	-	2	-	-	25	-	25	50
6	IOHSM5AC	Audit course- Foreign Language Level-I (A.German/ B. Japanese)	V	1	-	-	1	-	-	25	-	-	25
7	IOHSM601	Seminar and Technical Paper Writing	VI	1	-	2	2	-	-	50	-	-	50
8	IOHSM6AC	Audit course- Foreign Language Level-II (A. German/ B. Japanese)	VI	1	-	-	1	-	-	25	-	-	25
		Total		10	1	2	12	-	-	225	-	75	300

M. Experiential Learning Courses

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	IOELC7P1	Project Stage I@@	VII	-	-	4	2	-	-	100	-	50	150
2	IOELC801	Internship/ 2MOOCs/ Entrepreneurship/ Research Project/ Foreign University Certification Course@@	VIII	-	-	24	12	-	-	200	-	100	300
3	IOELC8P2	Project Stage II@@	VIII	-	-	4	2	-	-	200	-	100	300
Total				-	-	32	16	-	-	500	-	250	750

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N. Liberal Learning Courses

Sr. No.	Course Code	Courses Name	Sem.	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	IOLLC4L1	Lifelong Learning Skills -I	IV	-	-	-	1	-	-	25	-	-	25
2	IOLLC4L2	Lifelong Learning Skills -II	IV	-	-	-	1	-	-	25	-	-	25
3	IOLLC6L3	Lifelong Learning Skills -III	VI	-	-	-	1	-	-	25	-	-	25
4	IOLLC6L4	Lifelong Learning Skills -IV	VI	-	-	-	1	-	-	25	-	-	25
			Total	-	-	-	4	-	-	100	-	-	100

Lifelong Learning Skills courses I, II, III, IV courses introduced in 4th and 6th sem. whereall the students are required to acquire 2 credits in each semester, one each from **Extracurricular Activities** and **Co-curricular Activities** respectively which will have grades as below. Activity Certificate obtained during SY and TY B- Tech will be considered in 4th and 6th semester respectively.

A. Extracurricular Activities:

Sr. No.	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Sports	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O
2.	NSS/NCC	Camp	Attended	B		
		Camp + 5 Activities	Attended	B+		
		Camp + 10 Activities	Attended	A		
		Camp + 15 Activities	Attended	A+		
		Camp + 20 Activities	Attended	O		
3.	Cultural	Inter collegiate	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O
4.	Community Engagement	Certified by NGO/Authorities with report and geo-tagged photograph	1 Activity of 15 hrs.	B		
			2 Activities of 30 hrs.	B+		
			3 Activities of 45 hrs	A		
			4 Activities of 60 hrs.	A+		
			5 Activities of 75 hrs.	O		

B. Co-curricular Activities:

Sr. No	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Conference	National	Participation	B	Prize winner	A
		International	Participation	B+	Prize winner	A+
		International (Scopus indexing)	Participation	A+	Prize winner	O

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2.	Journal Publication	Non-refereed but recognized and reputed journal/ periodical, having ISSN number.	Publication	B		
		Refereed Journal - As listed by UGC	Publication	A		
		Refereed Journals- As listed by Scopus	Publication	A+		
		Refereed Journals - As listed by SCI/ SCIE	Publication	O		
3.	Hackathon		Participation	A+	Prize winner	O
4.	Professional Body	National	Membership	P	3rd Prize	A
			Activities/partici pation	B	2nd Prize	A+
			5 participations	B+	1st Prize	O
5.	Internship	1 week	Completed	C		
		2 week	Completed	B		
		3 week	Completed	B+	Sponsored Project	A+
		4 week	Completed	A	Job through internship	O
6.	Entrepreneurs hip	Awareness camp	Attended	A	Product Developed	A+
					Own Startup	O
7.	Project/Techni cal events	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O

Any activity other than listed above but having equal weightage should be considered for getting additional credit. The marks with respect to grades are as follows:

Sr. No.	Grade	Marks
1	O	25
2	A+	22
3	A	20
4	B+	18
5	B	16
6	C	13
7	P	10
8	F	0-5

O. Exit Course Structure

Sr. No.	Code	Courses Name	Hours per week			Credit	Examination Scheme					Total
			L	T	P		ISE	ESE	TW	PR	OR	
Exit course after F.Y :One year UG Certificate in Technology												
1	ITEXC101	Data Base Management SystemLab	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	25	-	25
	ITEXC102	Software Engineering & Project	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	25	-	25

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Sr	Course Code	Course Name										Total
		Management Lab										
	ITEXC103	Internship	-	-	8	4	-	-	100	-	-	100
		Total	-	-	**16**	**8**	-	-	**150**	**50**	-	**200**
		Two years UG diploma in Technology										
2	ITEXC201	Data Communication and Computer NetworkLab	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	-	25	25
	ITEXC202	Software Engineering & Project Management Lab	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	25	-	25
	ITEXC203	Internship	-	-	8	4	-	-	100	-	-	100
		Total	-	-	**16**	**8**	-	-	**150**	**25**	**25**	**200**
		Three years Bachelors Degree in Vocation(B.Voc.)or B.Sc. in Technology										
3	ITEXC301	Software Lab III	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	25	-	25
	ITEXC302	Software Lab IV	-	-	4	1	-	-	25	-	-	25
						1	-	-	-	25	-	25
	ITEXC303	Internship	-	-	8	4	-	-	100	-	-	100
		Total	-	-	**16**	**8**	-	-	**150**	**50**	-	**200**

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Information Technology- Third Year (Semester –V)

Sr. No.	Code	Course Title	L	T	P	Credits	ISE	ESE	TW	PR	OR	Total
1	IOHSM501	Intellectual Property Rights@@	2	-	-	2	-	-	25	-	25	50
2	ITPCC502	Data Communication and Computer Network	3	-	-	3	40#	60*	-	-	-	100
3	ITPCC503	Theory of Computation	3	1	-	4	40#	60*	-	-	-	100
4	ITPCC504	Software Engineering & Project Management	3	-	-	3	40#	60*	-	-	-	100
5	ITPEC505	Elective-I	3	-	-	3	40#	60**	-	-	-	100
6	ITOEC506	**MOOC**-Ethical Hacking	3	-	-	3	40$	60$$	-	-		100
7	ITPCC507	Data Communication and Computer Network Lab@@	-	-	2	1	-	-	25	-	25	50
8	ITPCC508	Software Engineering & Project Management Lab@@	-	-	2	1	-	-	25	25	-	50
9	ITPEC509	Software Lab-I@@	-	-	4	2	-	-	25	-	25	50
10	IOHSM5AC	Audit course- Foreign Language Level-I (German/ Japanese)	1	-	-	1	-	-	25	-	-	25
11	ITMNR501	Minor Course (TH)	3	-	-	3	-	75	-	-	-	75
12	ITMNR502	Minor Course (PR)	-	-	2	1	-	-	25	-	-	25
		Grand Total	21	1	10	27	200	375	150	25	75	825

*	**End Semester Examination (ESE)** based on subjective questions.
**	**Practical or Activity based Evaluation.**
#	**In Semester Evaluation I** based on Subjective Examination **In Semester Evaluation II** based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/GATE based Multiple-Choice Question (MCQ)/ Numerical based Subjective Examination
$	**For MOOCs:** Assignments marks will be converted on the scale of 40 marks.
$$	**For MOOCs:** Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.
@@	Passing is mandatory in both the examination heads to gain the respective credits.
Elective-I	A. Advanced Database Management System B. Advanced Data Structure and Algorithms C. Advanced Web Technology

MOOC: Ethical Hacking: (12 weeks) https://onlinecourses.nptel.ac.in/noc23_cs75/preview

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Information Technology - Third Year (Semester –VI)

Sr. No.	Code	Course Title	Hrs. per week			Credits	Examination Scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	IOHSM601	Seminar and Technical Paper Writing	1	-	2	2	-	-	50	-	-	50
2	ITPCC602	Machine Learning	3	1	-	4	40#	60*	-	-	-	100
3	ITPCC603	Operating System	3	-	-	3	40#	60*	-	-	-	100
4	ITPCC604	Cloud Computing	3	-	-	3	40#	60*	-	-	-	100
5	ITPEC605	Elective-II	3	-	-	3	40#	60**	-	-	-	100
6	ITVSE606	Software Quality Assurance and Testing@@	1	-	4	3	-	-	50	50	-	100
7	ITPCC607	Operating System Lab	-	-	2	1	-	-	25	25	-	50
8	ITPCC608	Cloud Computing Lab@@	-	-	2	1	-	-	25	25	-	50
9	ITPEC609	Software Lab-II@@	-	-	4	2	-	-	25	-	25	50
10	IOHSM6AC	Audit course- Foreign Language Level-II (A. German/ B.Japanese)	1	-	-	1	-	-	25	-	-	25
11	IOLLC6L3	Lifelong Learning Skills -III	-	-	-	1	-	-	25	-	-	25@
12	IOLLC6L4	Lifelong Learning Skills -IV	-	-	-	1	-	-	25	-	-	25@
13	ITMNR601	Minor Course (TH)	3	-	-	3	-	75	-	-	-	75
14	ITMNR602	Minor Course (PR)	-	-	2	1	-	-	25	-	-	25
		Grand Total	**18**	**1**	**16**	**29**	**160**	**315**	**300**	**100**	**25**	**875**

*	**End Semester Examination (ESE)** based on subjective questions.
**	**Practical or Activity based Evaluation.**
#	**In Semester Evaluation I** based on Subjective Examination
	In Semester Evaluation II based on Presentation/Group Discussion/Laboratory Work/Course Project/Home Assignment/Comprehensive Viva Voce/Blog Writing/Case Study/Survey/GATE based Multiple-Choice Question (MCQ)/ Numerical based Subjective Examination
@@	Passing is mandatory in both the examination heads to gain the respective credits.

Elective-II	A. Service Oriented Architecture B. Intelligent Process Automation C. DevOps

Software Lab-II is based on Machine Learning and Elective-II subject (whatever is opted by the student)

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Third Year Information Technology (2022 Course) Intellectual Property Rights				
Course Code:	**IOHSM501**	**Credit:**		**2**
Contact Hrs.:	**2 Hrs/week (L)**	**Type of Course:**		Lecture
Examination Scheme:	**Term-work 25 marks**	**Oral 25 marks**		

Pre-requisites:
Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives	
1	To explain the significance of Intellectual Property
2	To study various aspects of Patents
3	To understand the significance of patent information in Business development
4	To study patents documents and process for examination

Course Outcomes: Students will be able to	
501.1	Describe the significance of intellectual property
501.2	Discuss various aspects of patents
501.3	Search patent information in database
501.4	Explain patents documents and process for examination
501.5	Describe concepts related to trademarks
501.6	Differentiate copyright from patent

Topics covered:

UNIT I: INTELLECTUAL PROPERTY RIGHTS(IPR) (4 Hrs.)
IPR-Meaning, Relevance, Business Impact, Types of Intellectual Property, Protection of Intellectual Property, Competing Rationales for Protection of Intellectual Property Rights, The World Intellectual Property Organization (WIPO) and the UNESCO.

UNIT II : PATENT (4 Hrs.)
Concept of Patent, Types of Product / Process Patents & Terminology, Duration of Patents- Law and Policy Consideration ,Elements of Patentability (Novelty and Non Obviousness /Inventive Steps , Industrial Application, Non- Patentable Subject Matter), Procedure for Filing of Patent Application and types of Applications.

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UNIT III:PATENT DATABASES & PATENT INFORMATION SYSTEM (4 Hrs.) Patent Offices in India, Importance of Patent Information in Business Development, Patent search through Internet, Patent Databases.
UNIT IV: PATENT DOCUMENTS & PROCESS FOR EXAMINATION (4 Hrs.) Lab Notebooks/Logbooks/Record Books, Methods of Invention Disclosures, Patent Application and its Contents, Writing of the Patent Document, Publication of Patent Applications, Request for Examination, Process for Examination & Prosecution, Reissue & Re-examination.
UNIT V: TRADEMARKS (4 Hrs.) Definition and concept of Trademarks, The rationale of protection of trademark, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) .
UNIT VI COPYRIGHTS (4 Hrs.) Definition of Copyright, Nature of Copyright, Works in which Copyrights subsist, Author & Ownership of Copyright , Rights Conferred by Copyright , Registration of Copyrights & Appeals.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*): 1. NA.

Text Books:
1. Intellectual Property Rights-Law And Practice By Laser Typesetting

Reference Books
1. Aswani Kumar Bansal ,"Law of Trademarks in India" ,Commercial Law Publishers, 2001
2. B L Wadehra," Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications" Universal Law Publishing Co Ltd.
3. G.V.G Krishnamurthy ," The Law of Trademarks, Copyright, Patents and Design"
4. SatyawratPonkse," The Management of Intellectual Property" Bhate&Ponkshe, 1991
5. S K Roy Chaudhary& H K Saharay ,"The Law of Trademarks, Copyright, Patents and Design.Legal Aspects of Technology Transfer: A Conspectus"

E-Resources:
1. Patent act:
   https://ipindia.gov.in/writereaddata/Portal/IPOAct/1_31_1_patent-act-1970-11march2015.pdf

2. Practice and procedures:
   https://ipindia.gov.in/writereaddata/Portal/Images/pdf/Manual_for_Patent_Office_Practice_and_Procedure_.pdf

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Second Year Information Technology (2022 Course) Data Communication and Computer Network			
Course Code:	ITPCC502	Credit:	3
Contact Hrs.:	3 Hrs/week(L)	Type of Course:	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:

- **Digital Electronics and Computer Organization**

Sr. No.	Course assessment methods/tools	External/Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To understand the basics of data communication, network topologies and models.
2	To explain the protocol layering and physical level communication
3	To understand the working of Data Link Layer and Medium access control.
4	To illustrate the functions of network layer and the various routing protocols.
5	To discuss the different services provided by transport layer.
6	To understand different Application Layer protocols and its working.

Course Outcomes: Students will be able to	
502.1	Explain the basics of data communication, network topologies and models.
502.2	Identify the protocol layering and physical level communication
502.3	Explain the working of Data Link Layer and Medium access control.
502.4	Describe the functions of the network layer and compare the routing protocols.
502.5	Compare and select the services provided by the transport layer.
502.6	Analyse Application Layer protocols and it's working.

Topics covered:
UNIT-I: DATA COMMUNICATION FUNDAMENTALS AND NETWORK MODEL (6 hrs.) Data communications, transmission media, guided media, Unguided media network topologies, introduction to LAN, WAN MAN, manageable switches bridges, routers, Hubs, Repeaters, ISO OSI model and TCP /IP reference Model
UNIT-II: PHYSICAL LAYER (4 hrs.) Introduction to Physical layer, Functions and services, Physical Topologies, Modes of Transmission Medium, Physical Layer Technologies and Hardware. Network adapters, Ethernet, Repeaters, networking hubs, Connectors and interface.

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UNIT-III: DATA LINK LAYER AND MEDIUM ACCESS CONTROL (7 hrs.)   Data Link layer design issues, error detection and correction, Elementary data link protocols, sliding window protocols: Go back-N, selective repeat, The channel allocation problem, multiple access protocols, ALOHA, CSMA, Collision free protocols, wireless LAN protocols, Ethernet, Bluetooth.
UNIT-IV: NETWORK LAYER (7 hrs.)   Network layer design issues, Routing algorithms: optimality principle, Shortest path algorithm, Flooding, Distance vector routing, Link state Routing, Hierarchical routing, Routing for mobile host, Routing in Ad hoc networks, Congestion Control, Quality of service, Internetworking addressing, class-full and classless addressing
UNIT-V: TRANSPORT LAYER (6 hrs.)   The transport service, Elements of transport protocol: Addressing, Connection establishment, connection release, Error control and flow control, Congestion control, The Internet transport protocols: TCP, UDP.
UNIT-VI: APPLICATION LAYER (6hrs.)   DNS-The Domain name system, Electronic mail, World wide web,TELNET, FTP,TFTP, NFS, SMTP,SNMP.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*):   Unit-I, II, III, IV, V, VI

Text Books:

1. A. S. Tannenbaum, Computer Networks, 4th edition, Prentice Hall, 2003.

Reference Books:

1. W. Stallings, Data and Computer Communications, 6th edition, Prentice Hall, 2000.
2. F. Halsall, Data Communications, Computer Networks and Open Systems, 4th edition, Addison-Wesley, 1996.
3. Walrand and Varaiya, High Performance Communication Networks, Morgan Kaufman, 1996.
4. D. E. Comer, Internet working with TCP/IP: Principles, Protocols, Architecture, 3rd edition, Prentice Hall, 2000. 6. W. R. Stevens, TCP/IP Illustrated Vol. I, Addison Wesley, 1994

E- Books / E- Learning References:

1. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
3. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf
4. https://sureshvcetit.files.wordpress.com/2019/03/networking-notes.pdf

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Third Year Information Technology (2022 Course) Theory of Computation			
Course Code:	ITPCC503	Credit:	4
Contact Hrs.:	3 Hrs/week (L) 1 Hr./Week(T)	Type of Course:	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:
- Discrete Mathematics.
- Data Structure and Algorithms.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-SemEvaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To classify and identify finite automata and their relation with types of languages.
2	To translate regular expression to grammar.
3	To describe regular and context free grammar.
4	To apply the push down automata on CFG
5	To demonstrate the properties and computing with Turing machine.
6	To explain fundamentals of Decidability, reducibility for problem solving situations.

Course Outcomes: Students will be able to

503.1	Construct finite state machines, their relationship with different types of languages
503.2	Write formal language into regular expression
503.3	Construct context free grammar for given language
503.4	Design push down automata and post machines for CFG
503.5	Design Turing machine for unrestricted languages.
503.6	Analyze computational complexity, reducibility for problem solving.

Topics covered:

UNIT – I: INTRODUCTION TO AUTOMATA THEORY (6 hrs.)

Basic Mathematical Objects: Sets, Logic, functions, Relations, Strings. Definition of Finite Automata (FA), Description of FA, Transition Systems, Acceptability of a String by a FA, Deterministic and Non deterministic FA, Equivalence of DFA and NFA, FA with output: Moore and Mealy machines-Definitions, Models, inter-conversion, minimization of FA. Applications of Finite Automata.

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UNIT – II: REGULAR EXPRESSIONS AND LANGUAGES(6 hrs.)

Recursive definition of regular expression, regular set, identities of regular expressions, Conversion of NFA With epsilon moves to DFA, Conversion-RE to DFA , Conversion-DFA to RE, Equivalence of R.E, Equivalence of FA, Arden's theorem, Pumping lemma for regular languages, Closure properties of regular languages, Applications of R.E

UNIT – III: CONTEXT-FREE GRAMMARS AND LANGUAGES (6 HRS.)

Context-free Grammars: Formal definition of a context-free grammar, Examples of context-free grammars, Designing context-free grammars, Ambiguity, Chomsky normal form., Equivalence with context-free grammars.

UNIT – IV: PUSHDOWN AUTOMATA, CFL AND NCFL(6 hrs.)

Pushdown Automata: Formal definition of a pushdown automata, Examples of pushdown automata, Equivalence of CFG and PDA, Pumping lemma for CFL, Non-CFL, Closure Properties of Context Free Languages,

UNIT –V: INTRODUCTION TO TURING MACHINES (6 hrs.)

The Turing Machine: The Instantaneous Descriptions for Turing Machines, Transition Diagrams for Turing Machines, Language accepted by TM,Types of Turing Machines (MultitrackTM, Two way TM, MultitapeTM, Non-deterministic TM), Computing TM, Enumerating TM, Universal TM

UNIT-VI: COMPUTABLE FUNCTIONS AND UNDECIDABILITY (6 hrs.)

Constant Functions, Primitive Recursive Functions, Regular function, Recursive and Recursive Enumerable Languages, μ-Recursive Functions, Non Recursive, Decidability, Decidable and undecidable problems, Undecidability and Reducibility, Computable and non-computable problems

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.) (*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):*GATE: Unit I, Unit II, Unit III, Unit IV, Unit V and Unit VI

Text Books

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

Reference Books

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

E-resources

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview
2. https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/

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Third Year Information Technology (2022 Course) Software Engineering & Project Management			
Course Code:	ITPCC504	**Credit:**	3
Contact Hrs.:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	**End-sem. Examination 60 Marks**	

Pre-requisites:
- Project based Learning I
- Project based Learning II

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To explain the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2	To describe methods of capturing, specifying, visualizing and analyzing software requirements
3	To apply planning, execution, tracking, audit and closure to project
4	To apply principles of agile software development, the SCRUM process and agile practices.
5	To describe project management through life cycle of the project.
6	To explain current and future trends and practices in the IT industry.

Course Outcomes : Students will be able to	
504.1	Select and Apply appropriate lifecycle model of software development
504.2	Analyze software requirements by applying various modeling techniques
504.3	Describe project planning, execution, tracking, audit and closure of project.
504.4	Explain principles of agile development, discuss the SCRUM process.
504.5	Explain software project management through life cycle of the project
504.6	Describe current and future trends and practices in the IT industry.

Topics covered:

UNIT-I: INTRODUCTION TO SOFTWARE ENGINEERING (6 hrs.)

Nature of Software, Software Process, Software Engineering Practice, Software Myths, Generic Process model, Perspective Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models, Prototyping Paradigm, Concurrent Process Model, Spiral Model, The Unified Process, Phases of the Unified Process

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UNIT -II: REQUIREMENT ANALYSIS (6 hrs.)

Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements - real life application case study.

Requirements Analysis: basics, scenario-based modeling, UML models: Use case diagram and Class diagram, data modeling, data and control flow model, behavioral modeling using State diagrams, Activity Diagram, Software Requirement Specification (SRS). Structure of SRS, writing a SRS

UNIT -III: PROJECT PLANNING (6 hrs.)

Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, **Effort estimation and scheduling:** Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule using Gantt Charts, Adding Milestones to Gantt Charts, Using Tracking Gantt Charts to Compare Planned and Actual Dates, Critical Path Method, Program Evaluation and Review Technique (PERT) with examples. Planning Cost Management, Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques

UNIT-IV: AGILE DEVELOPMENT PROCESS (6 hrs.)

Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process.

Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.

Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing

UNIT-V: SOFTWARE PROJECT MANAGEMENT (6 hrs.)

Introduction to Software Project Management: Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success, and Failure, Risk Management- Introduction, Categorizing of Risk, Framework for dealing with ,Risk Identification, Risk analysis & prioritization, Risk planning ,Risk monitoring

UNIT-VI: RECENT TRENDS IN SOFTWARE ENGINEERING AND PROJECT MANAGEMENT (6 hrs.)

Software configuration management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools).

Emerging software engineering trends: technology evolution, process trends, collaborative development, test-driven development, global software development challenges. Project Management trends: CRM, ERP: Basic concepts, Advantages and limitations, SAP, Business process reengineering, International Project Management, Case studies.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*): GATE: Unit I and IV

Text Books

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Mcgraw-Hill, ISBN: 0073375977, Seventh or Eighth Edition
2. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – FifthEdition, Tata McGraw Hill, New Delhi.
3. Joseph Phillips, IT Project Management –On Track from Start to Finish, Tata McGraw-Hill, ISBN13:978-0-07106727-0, ISBN-10: 0-07-106727-2.

Reference Books

1. PankajJalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115.
2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946.

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3. Chris Dawson with Ben Straub, Building Tools with GitHub, O'Relly, Shroff publishers, ISBN: 978-93-5213-333-8.

4. C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion,O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.

5. P.C. Tripathi, P.N. Reddy, Principles of Management, Tata McGrew Hill Education Private Limited,ISBN: 9780071333337, ISBN: 0071333339.

E-resources

1. https://www.mlsu.ac.in/econtents/16_EBOOK-7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_.pdf

2. https://resources.sei.cmu.edu/asset_files/technicalreport/1993_005_001_16214.pdf

3. https://www.cs.uct.ac.za/mit_notes/software/htmls/ch03s03.html#:~:text=Elicitation%2C%20in%20which%20the%20requirements,between%20the%20requirements%20are%20resolved.

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Third Year Information Technology (2022 Course) Elective-I(A) : Advanced Database Management System			
Course Code:	ITPEC505A	Credit:	3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	Practical/Activity Based Assignment 60 Marks	

Pre-requisites:

- **Database Management System**

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-SemEvaluation	Internal	40
2.	Practical/Activity Based Assignment	External	60

Course Objectives	
1	To discuss the basic concepts of Relational and Object-oriented databases.
2	To explain parallel database architectures and query optimization.
3	To explain distributed database and query processing.
4	To provide the knowledge of NoSQL Database.
5	To describe Data warehouse and OLAP Architectures and Applications.
6	To explain data mining architecture, software tools and applications.

Course Outcomes: Students will be able to	
505A.1	Describe the basic concepts of Relational data model.
505A.2	Classify and describe parallel database architectures and query optimization.
505A.3	Explain distributed database and query processing.
505A.4	Define the features of NO-SQL database.
505A.5	Explain Data warehouse and OLAP Architectures.
505A.6	Describe the process of data mining and tools.

Topics covered:
UNIT-I RELATIONAL DATA MODEL: A REVIEW (6hrs) Relational model concepts, Relational model constraints and relational database schemas, Update operations, anomalies, dealing with constraint violations, Types and violations.
UNIT-II: PARALLEL DATABASES (6hrs.) Introduction to Parallel Databases, Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations, Parallel query optimizations.
UNIT-III: DISTRIBUTED DATABASES (6 hrs.) Introduction to distributed databases Distributed DBMS architectures, storing data in a Distributed DBMS, Distributed catalog management, Distributed Query processing, Updating distributed data, Distributed transactions, Distributed Concurrency control and Recovery.

UNIT-IV: NOSQL DATABASES (6hrs.)
Introduction and History of NoSQL Databases, Comparison of No SQL Databases with SQL database. NoSQL Key/Value Database: MongoDB, Creating databases and collections, creating documents, Various operators used to write queries. NoSQL database Development Tools (Map Reduce) and JSON. SStudy of Column-Oriented Database: Apache Cassandra.
UNIT V: DATA WAREHOUSING (6hrs.)
Data Warehouse Architecture and components, Properties and limitations of data warehouse, Data warehouse schema: Star and Snowflake, OLAP Architecture, Introduction to decision support system, Views.
UNIT VI: DATA MINING (6hrs.)
Introduction to Data Mining, KDD seven step process, Architecture of data mining, Introduction to predictive and descriptive algorithms, Data mining software and applications.
PRACTICAL OR ACTIVITY BASED EVALUATION
1. Based on unit III toVI practical oriented problems will be assigned by teacher during End Sem Examination. 2. Three hours will be given to students for End Sem Examination. 3. From each unit two problemswill be allotted to students and student will provide solution for any one problem per unit. Within 3 hrs. student will solve 4 problems. 4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*): GATE: Unit II, III,V, and VI.

Text Books

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN-0-07-120413-X, Seventh Edition.
2. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5.

Reference Books

1. Kristina Chodorow, Michael Dirolf, MongoDB: The Definitive Guide, O'Reilly Publications.
2. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier.
3. Mario Piattini, Oscar Diaz "Advanced Database Technology and Design"- online book.
4. M. Tamer Özsu, Patrick Valduriez, "Principles of Distributed Database Systems" Prentice Hall, 1999.
5. RamezElmasri and Shamkant B. Navathe "Fundamentals of Database System"7th Edition.

E-resources

1. https://nou.edu.ng/coursewarecontent/NATIONAL%20OPEN%20UNIVERSITY%20OF%20NIGERIA.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DATABASE%20MANAGEMENT%20SYSTEMS.pdf
3. https://www.techtarget.com/searchdatamanagement/definition/database-management-system

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BOS-INFORMATION TECHNOLOGY
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Third Year Information Technology (2022 Course) Elective-1(B): Advanced Data Structure and Algorithms			
Course Code:	ITPEC505B	**Credit:**	3
Contact Hrs.:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	**Practical/Activity Based Assignment 60 Marks**	

Pre-requisites:
- Problem Solving and Programming I,II
- Data Structures and Algorithms

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	40
2.	Practical/Activity Based Assignment	External	60

Course Objectives	
1	To explain Tree for hierarchical data representation
2	To explain Graphs for non-linear data representation
3	To explain Hash tables and know their applications
4	To explain algorithms and its types
5	To apply dynamic programming to solve problems
6	To apply backtracking and branch and bound technique for problem solving

Course Outcomes: Students will be able to	
505B.1	Apply Tree Data structure for representation of Hierarchical data
505B.2	Apply Graph Data structure for representation of non-linear data
505B.3	Describe & Use Hash tables for efficient search
505B.4	Apply Divide and Conquer and Greedy method to solve problems
505B.5	Apply dynamic programming to solve problems
505B.6	Apply backtracking and branch and bound technique for problem solving

Topics covered:

UNIT-I: TREES (6 hrs.)
Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, , Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display)
Threaded binary tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, & Applications.

UNIT-II: GRAPHS (6 Hrs.)
Graph -Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, topological sorting.

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UNIT-III: HASH TABLES (6 Hrs.) **Hashing:** Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement.
UNIT-IV: ALGORITHM AND TYPES(6 hrs.) Introduction to algorithms, Types of Algorithms: Divide and conquer: General method, Binary search,QuickSort, Merge Sort, Greedy Method: General method and characteristics, Kruskal's algorithm, Prim's algorithm, Dijkstra's Algorithm, Fractional Knapsack problem
UNIT-V: DYNAMIC PROGRAMMING (6 hrs.) General method, Floyd Warshall Algorithm, Bellman–Ford Algorithm,0-1 Knapsack Problem, Travelling Salesman Problem.
UNIT-VI: BACKTRACKING AND BRANCH &BOUND(6hrs.) **Backtracking:** Introduction, The Eight queen's problem, Travelling Salesman problem **Branch and Bound:** Introduction, 0/1 Knapsack problem, Travelling Salesman problem.
PRACTICAL OR ACTIVITY BASED EVALUATION 1. Based on unit III toVI practical oriented problems will be assigned by teacher during End Sem Examination. 2. Three hours will be given to students for End Sem Examination. 3. From each unit two problemswill be allotted to students and student will provide solution for any one problem per unit. Within 3 hrs. student will solve 4 problems. 4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)*(if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit)*:**GATE:Unit-I to Unit-VI(All)**

Text Books

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", 2016 CareerMonk Publications and others. ISBN : 9788193245279
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
3. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928

Reference Books

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach using C++", Cengage Learning, 5th Edition, ISBN 978-8131504925
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++ ", Pearson Education India, 3rd edition (2007), ISBN 978-8131714744
3. Hemant Jain, "Problem Solving in Data Structures & Algorithms using C++", CreateSpace Independent Publishing Platform (2017), ISBN 978-1542396479
4. G A V PAI, "DATA STRUCTURES and Algorithms Concepts, Techniques and Applications", McGraw Hill (2017), ISBN 978-0070667266
5. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++ ", Wiley (2007), ISBN 978-8126512607

E -Resources

1. https://www.geeksforgeeks.org/advanced-data-structures/
2. https://www.javatpoint.com/advance-data-structures
3. https://www.studytonight.com/advanced-data-structures/
4. https://www.coursera.org/learn/advanced-data-structures
5. https://www.baeldung.com/cs/advanced-data-structures

CHAIRMAN
BOS-INFORMATION TECHNOLOGY
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Third Year Information Technology (2022 Course)
Elective-I(C): Advanced Web Technology

Course Code:	ITPEC505C	Credit:	3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	Practical/Activity Based Assignment 60 Marks	

Pre-requisites:
- Web Technology

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	Practical/Activity Based Assignment	External	60

Course Objectives

1	To explain best technologies for solving web client/server problems
2	To apply different styling on web page.
3	To use Java script for dynamic effects and to validate form input entry
4	To learn PHP and apply on web application.
5	To understand difference between client-side or server-side scripting
6	To develop JSP applications and connect with database.

Course Outcomes: Students will be able to

505C.1	Use HTML,XML and XHTML technologies for design of webpages.
505C.2	Apply different styling on web page
505C.3	Use Java script for dynamic effects and to validate form input entry
505C.4	Build web application using PHP
505C.5	Use appropriate client-side or Server-side scripting in applications
505C.6	Analyze and design real time web applications.

Topics covered:

UNIT-I: INTRODUCTION TO WWW, HTML, and XHTML (6 hrs.)
Clients, Servers and Communication, Basics Internet Protocols, HTTP Request and Response Messages, Web Clients and Servers, Markup Languages Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure. Introduction to XHTML: Introduction to XML, uses of XML, XML key components, DTD and Schemas, XSL and XSLT, XHTML, Meta tags, Character entities, frames and frame sets.

UNIT-II: STYLING (6 hrs.)
Style sheets: Need for CSS, introduction to CSS, basic syntax and structure of CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning.

UNIT-III: JAVASCRIPT (6 hrs.)
Client-side scripting, what is JavaScript, how to develop JavaScript, simple JavaScript, Variables, Data Types, JavaScript Statements, Operators Literals, Functions, Objects, Arrays, Built-in Objects.

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UNIT-IV: PHP PROGRAMMING (6 hrs.)   **PHP Programming**: Introducing PHP: Creating PHP script, Running PHP script. Working with Variables and constants: Using variables, Using constants, Data types, Operators.   **Controlling program flow**: Conditional statements, Control statements, Arrays, functions. Working With forms. Connecting to MySQL using PHP, building a Web Page using PHP.
UNIT-V: AJAX, SERVLET AND JSP (6 hrs.)   **AJAX**: Introduction, AJAX with XML .   **Servlets**: Introduction to servlets, Life cycle of servlets, JSDK, The servlet API, the javax.servlet package, Reading servlet parameters and initialization parameters, The javax.servlet HTTP package, Handling Http request and responses, Using cookie, Session tracking.   **Introduction to JSP**: The problem with servlet, the anatomy of JSP page, JSP processing, JSP application design with MVC, Tomcat server and testing tomcat, Generic dynamic content, using scripting elements implicit JSP objects
UNIT-VI: JSP APPLICATION DEVELOPMENT (6 hrs.)   Running JSP Applications, Basics of JSP, JavaBeans Classes and JSP,Tag Libraries and JDBC connectivity in JSP, Studying javax.sql.* package, Accessing a database from a JSP page, Application specific database actions, Deploying JAVA beans in JSP page.
PRACTICAL OR ACTIVITY BASED EVALUATION   1. Based on unit III to VI practical oriented problems will be assigned by teacher during End Sem Examination.   2. Three hours will be given to students for End Sem Examination.   3. From each unit two problems will be allotted to students and students will provide solution for any one problem per unit. Within 3 hrs. the student will solve 4 problems.   4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*):   **1. NA.**

Textbooks
1. Web Technologies, Uttam Roy, OXFORD University press
2. Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India

Reference Books
1. Web programming Bai, Michael Ekedahl, CENAGE Learning, India edition.
2. An Introduction to Web Design Programming, Paul S.Wang, India Edition
3. Javascript Demystified, Keogh, jim, McGraw Hill
4. Beginning Javascript,Wilton,Paul,WilyIndiaWeb Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI by Ivan Bayross (BPB publication)
5. HTML5 by Mark Pilgrim O'Reilly publication

E-Resources
1. https://developer.mozilla.org/en-US/docs/Web/HTML
2. https://www.w3schools.com/html/
3. https://www.tutorialspoint.com/html/index.htm
4. https://www.manning.com/books/css-in-depth
5. https://javascript.info/
6. https://github.com/getify/You-Dont-Know-JS

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BOS–INFORMATION TECHNOLOGY
AISSMS IOIT (AUTONOMOUS),
PUNE–1.

Third Year Information Technology (2022 Course)
MOOC- Ethical Hacking

Course Code:	ITOEC506	Credit:	3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme:	40$	60$$	

Pre-requisites:

-

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	MOOCs Assignments	External	40
2.	MOOCs Examination	External	60

Course Objectives

1	To describe ethical hacking and basics of computer network
2	To simulate attacks and create secure hacking environment
3	To describe basic principles of cryptography and general cryptanalysis
4	To acquainted with the concepts of symmetric encryption and authentication
5	To make use of different tools related to cyber security

Course Outcomes: Students will be able to

506.1	Describe ethical hacking and basics of computer network
506.2	Simulate attacks and create secure hacking environment
506.3	Describe principles of cryptography and general cryptanalysis
506.4	Apply symmetric encryption and authentication
506.5	Use wireshark, burpsuit tools related to cyber security

Topics covered:

Students must register for below mentioned NPTEL MOOC:

Course Name: MOOC: Ethical Hacking: (12 weeks)

https://onlinecourses.nptel.ac.in/noc23_cs75/preview

$ For MOOCs: Assignments marks will be converted on the scale of 40 marks.
$$ For MOOCs: Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

E- Resources:

1. https://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf
2. https://www.classcentral.com/course/swayam-cryptography-and-network-security-9896
3. https://www.geeksforgeeks.org/cryptography-and-its-types/

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Second Year Information Technology (2022 Course)
Data Communication and Computer Network Lab

Course Code:	ITPCC507	Credit:		1
Contact Hrs.:	2 Hrs/week(P)	Type of Course:		Practical
Examination Scheme:	Term-work 25 Marks	Oral 25 marks		

Pre-requisites:

- **Digital Electronics and Computer Organisation**

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives	
1	To study the different application layer protocols.
2	To understand different services provided by transport layer and data link layer
3	To learn functions of the network layer and the various routing protocols.
4	To illustrate the functionalities of Packet Sniffer, NS2 and Wireshark tool

Course Outcomes: Students will be able to	
507.1	Use application layer protocols HTTP, FTP, and SMTP.
507.2	Illustrate the protocol layering and physical level communication.
507.3	Interpret the working of Data Link Layer and Medium access control.
507.4	Demonstrate the working of the routing protocol using NS2 simulator.
507.5	Use Wireshark tool for data communication.

List of Experiments:

1. Experimental study of application protocols such as HTTP, FTP, SMTP, using network packet sniffers and analyzers such as Ethereal. Small exercises in socket programming in C/C++/Java.
2. Using packet sniffers study the TCP protocol. Using OS (netstat, etc) tools to understand TCP protocol FSM, retransmission timer behavior, and congestion control behavior.
3. Introduction to NS2 (network simulator) - small simulation exercises to study TCP behavior under different scenarios.
4. Setting up a small IP network - configure interfaces, IP addresses and routing protocols to set up a small IP network. Study dynamic behavior using packet sniffers
5. Experiments with ns2 to study behavior (especially performance of) link layer protocols such as Ethernet and 802.11 wireless LAN
6. Using a Network Simulator (e.g. packet tracer) Configure
   a. Sub-netting of a given network
   b. Super-netting of a given networks.
7. Using a Network Simulator (e.g. packet tracer) Configure
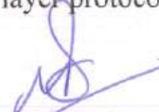
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PUNE–1.

    a. A router using router commands,

    b. Access Control lists – Standard & Extended.

8. Wireshark

    a. Investigate the working / behavior of the TCP protocol in detail

    b. Investigate the working / behavior of the IP protocol in detail

9. Design and implement a program to identify MAC address, class of given IP address, Subnet mask, first and last IP address of that block using C/C++/Java.

Textbooks

1. A. S. Tannenbaum, Computer Networks, 4th edition, Prentice Hall, 2003.

Reference Books

1. W. Stallings, Data and Computer Communications, 6th edition, Prentice Hall, 2000.
2. F. Halsall, Data Communications, Computer Networks and Open Systems, 4th edition, Addison-Wesley, 1996.
3. Walrand and Varaiya, High Performance Communication Networks, Morgan Kaufman, 1996.
4. D. E. Comer, Internet working with TCP/IP: Principles, Protocols, Architecture, 3rd edition, Prentice Hall, 2000. 6. W. R. Stevens, TCP/IP Illustrated Vol. I, Addison Wesley, 1994

E-resources

1. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
3. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf
4. https://sureshvcetit.files.wordpress.com/2019/03/networking-notes.pdf

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PUNE-1.

Third Year Information Technology (2022 Course) Software Engineering & Project Management Lab			
Course Code:	ITPCC508	Credit:	1
Contact Hrs.:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme:	Term-work 25 Marks	Practical 25 Marks	

Pre-requisites:
- Project Based Learning- I
- Project Based Learning- II

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1	Term Work	Internal	25
2	Practical	External	25

Course Objectives	
1	To explain the software lifecycle process model.
2	To analyze effective functional and non-functional requirements those are complete, correct, consistent, testable and unambiguous.
3	To analyze & design the software models using unified modeling language (UML).
4	To construct a document that outlines all risk analysis activities & estimate the software project cost.

Course Outcomes : Students will be able to	
508.1	Apply the process to be followed in the software development life-cycle models.
508.2	Analyze Software Requirement Specification.
508.3	Design the software models using unified modeling language (UML).
508.4	Construct a RMMM document that outlines all risk analysis activities & estimate the software project cost.

Practical:

Assign the case study as a detailed statement of problem to a group of 2-3 students which demonstrates the knowledge of students in software engineering. Laboratory work will be based on course syllabus with following experiments. The mentor is supposed to insist project teams to practice latest process models and software engineering principles.

The topic must be decided in consultation with a mentor.

1. Selection &application of Software Process model.
2. Preparation of Software Requirement Specification (SRS) document in IEEE format.
3. Prepare software project planning & design UML diagrams.
4. Preparation of Risk Mitigation, Monitoring& Management Plan (RMMM).
5. Use of metric to estimate the software project cost.

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PUNE–1.

AISSMS Institute of Information Technology, Pune

Textbooks

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Mcgraw-Hill, ISBN: 0073375977, Seventh or Eighth Edition.
2. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – FifthEdition, Tata McGraw Hill, New Delhi.
3. Joseph Phillips, IT Project Management –On Track from Start to Finish, Tata McGraw-Hill, ISBN13:978-0-07106727-0, ISBN-10: 0-07-106727-2.

Reference Books

1. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115.
2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946.
3. Chris Dawson with Ben Straub, Building Tools with GitHub, O'Relly, Shroff publishers, ISBN: 978-93-5213-333-8.
4. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion,O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.
5. P.C. Tripathi, P.N. Reddy, Principles of Management, Tata McGrew Hill Education Private Limited,ISBN: 9780071333337, ISBN: 0071333339

E- Books / E- Learning References

1. https://www.mlsu.ac.in/econtents/16_EBOOK-7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_.pdf
2. https://resources.sei.cmu.edu/asset_files/technicalreport/1993_005_001_16214.pdf
3. https://www.cs.uct.ac.za/mit_notes/software/htmls/ch03s03.html#:~:text=Elicitation%2C%20in%20which%20the%20requirements.between%20the%20requirements%20are%20resolved

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Third Year Information Technology (2022 Course) Software Lab- I Elective I(A): Advanced Database Management Systems			
Course Code:	ITPEC509A	Credit:	2
Contact Hrs.:	4 Hrs/week (P)	Type of Course:	Practical
Examination Scheme:	Term-work 25 Marks	Oral 25 Marks	

Pre-requisites:
- Database Management System

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives	
1	To discuss the basic concepts of Relational and Object-oriented databases.
2	To explain parallel and distributed database architectures and applications.
3	To provide the knowledge of NoSQL Database.
4	To describe Data warehouse and OLAP Architectures and Applications.
5	To explain data mining architecture, algorithms, software tools and applications.
6	To explore enhanced data models for advanced database applications.

Course Outcomes: Students will be able to	
509A.1	Use the basic concepts of Relational and Object-oriented databases.
509A.2	Demonstrate parallel and distributed database architectures.
509A.3	Use the features of NO-SQL database.
509A.4	Demonstrate Data warehouse and OLAP Architectures.
509A.5	Use the process of data mining and tools.
509A.6	Apply the features of enhanced data models for advanced database applications.

List of Experiments:
1. Install and configure client and server for Oracle/MySQL DB.
2. Install and configure client and server for MongoDB.
3. Create partitioned table (range/hash) to demonstrate parallel database operations in Oracle/MySQL DB.
4. Create distributed table in Oracle/MySQL DB and perform manipulation operations through remote clients.
5. Create a suitable collection in MongoDB and perform 10 queries to demonstrate various operations on JSON documents.
6. Implement Map-reduce and aggregation, indexing with suitable example in MongoDB. Demonstrate the Aggregation framework.
7. Design conceptual model using Star and Snowflake schema for any one database.
8. Design mini project using suitable front end with connectivity to MongoDB as backend to demonstrate CRUD operation.

Oral Evaluation
1. Student will design and develop a mini project using advanced database management concepts and present the same during OR exam

Text Books
1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN-0-07-120413-X, Seventh Edition.
2. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81-317-6092-5.

Reference Books
1. Kristina Chodorow, Michael Dirolf, MongoDB: The Definitive Guide, O'Reilly Publications.
2. M. Tamer Özsu, Patrick Valduriez, "Principles of Distributed Database Systems" Prentice Hall, 1999.
3. Kevin Loney, "Oracle 10g Complete reference", Oracle Press, McGraw Hill/Osborn Publication, 2004.

E-resources
1. https://nou.edu.ng/coursewarecontent/NATIONAL%20OPEN%20UNIVERSITY%20OF%20NIGERIA.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DATABASE%20MANAGEMENT%20SYSTEMS.pdf
3. https://www.techtarget.com/searchdatamanagement/definition/database-management-system

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Third Year Information Technology (2022 Course) Software Lab-1 Elective I(B): Advanced Data Structure and Algorithms			
Course Code:	ITPEC509B	Credit:	2
Contact Hrs.:	4 Hrs/week (P)	Type of Course:	Practical
Examination Scheme:	Term-work 25 Marks	Oral 25 Marks	

Pre-requisites:
- Problem Solvingand Programming I,II
- Data Structures and Algorithm

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives

1	To use Tree for hierarchical data representation
2	To use Graphs for non-linear data representation
3	To use Hash tables and know their applications
4	Apply Greedy method, dynamic binding, backtracking and branch and bound technique to solve problems

Course Outcomes: Students will be able to

509B.1	Implement Tree Data structure for representation of Hierarchical data
509B.2	Implement Graph Data structure for representation of non-linear data
509B.3	Use Hash tables for efficient search
509B.4	Apply Greedy method, dynamic binding, backtracking and branch and bound technique to solve problems

List of Experiments:

1. Implement binary tree and perform following operations:
   Insert (Handle insertion of duplicate entry)
   Delete
   Search
   Display tree (Traversal)
   Display - Depth of tree
2. Implement binary search tree and perform following operations:
   Display - Mirror image
   Create a copy
   Delete a specified node
   Display tree (Display tree level wise)
3. Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them, Perform BFS and DFS.
4. Represent a graph of city using adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destination.

5. Using Array create Hash Table and demonstrate chaining with and without probing(define insert, and search operations)
6. Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.
7. Write a program to implement Fractional knapsack using Greedy algorithm and 0/1 knapsack using dynamic programming. Show that Greedy strategy does not necessarily yield an optimal solution over a dynamic programming approach.
8. Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity
9. Write a recursive program to find the solution of placing n queens on the chessboard so that no two queens attack each other using Backtracking.
10. Write a program to solve the traveling salesman problem and to print the path and the cost using LC Branch and Bound.

Oral Evaluation
1. Student will design and develop a mini project using advanced data structure and algorithms concepts and present the same during OR exam

Text Books
1. Narasimha Karumanchi, "Data Structures And Algorithms Made Easy", 2016 CareerMonk Publications and others. ISBN : 9788193245279
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
3. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928

Reference Books
1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach using C++", Cengage Learning, 5th Edition, ISBN 978-8131504925
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++ ", Pearson Education India, 3rd edition (2007), ISBN 978-8131714744
3. Hemant Jain, "Problem Solving in Data Structures & Algorithms using C++", CreateSpace Independent Publishing Platform (2017), ISBN 978-1542396479
4. G A V PAI, "DATA STRUCTURES and Algorithms Concepts, Techniques and Applications", McGraw Hill (2017), ISBN 978-0070667266
5. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++ ", Wiley (2007), ISBN 978-8126512607
6. Algorithms on strings, trees, and sequences: computer science and computational biology - Gusfield, D, Cambridge University Press, 1997. ISBN: 0521585198

E -Resources
1. https://www.geeksforgeeks.org/advanced-data-structures/
2. https://www.javatpoint.com/advance-data-structures
3. https://www.studytonight.com/advanced-data-structures/
4. https://www.coursera.org/learn/advanced-data-structures
5. https://www.baeldung.com/cs/advanced-data-structures
6. https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Module4_DAA.pdf
7. https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Module5_DAA.pdf

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Third Year Information Technology (2022 Course)
Software Lab-1
Elective I(C): Advanced Web Technology

Course Code:	ITPEC509C	Credit:		2
Contact Hrs.:	4 Hrs/Week(p)	Type of Course:		Lecture/Practical
Examination Scheme:	Term-work 25 Marks	Oral 25 Marks		

Pre-requisites:
- Web Technology

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives	
1	To explain best technologies for solving web client/server problems
2	To apply different styling on web page.
3	To use Java script for dynamic effects and to validate form input entry
4	To learn PHP and apply on web application.
5	To understand difference between client-side or server-side scripting
6	To develop JSP applications and connect with database.

Course Outcomes: Students will be able to	
509C.1	Develop web page using HTML.
509C.2	Design web page using CSS styling.
509C.3	Develop an application and validate from using Javascript.
509C.4	Build web application using PHP and JSP.

List of Experiments:
1. Design web pages for your college containing a description of the courses, departments, faculties, library etc,
2. Create a web page using frames. Divide the page into two parts with Navigation links on the left hand side of the page (width=20%) and the content page on the right hand side of page (width = 80%). On clicking the navigation Links corresponding content must be shown on the right hand side
3. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
4. Develop simple calculator for addition, subtraction, multiplication and division operation using JavaScript
5. Create HTML Page that contains form with fields Name, Email, Mobile No , Gender , Favorite Color and a button now write a JavaScript code to combine and display the information in textbox when the button is clicked

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6. Create XML file to store student information like Enrollment Number, Name , Mobile Number , Email Id

7. Write a php program to check if a number is prime or not.

8. Write a PHP Script for login authentication. Design an html form which takes username and password from user and validates against stored username and password in file.

9. Write PHP Script for storing and retrieving user information from MySql table. 1. Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php) 2. Store this data in Mysql database / text file. 3. Next page display all user in html table using PHP (display.php)

10. Using ajax fetch information from a database with AJAX.

11. Write a servlet to connect to the database, Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration.

12. Write a JSP to connect to the database, Insert the details of the student academic information with student academic info page.

Oral Evaluation

1. Student will design and develop a mini project using advanced web technology concepts and present the same during OR exam

Textbooks

1. Web Technologies, Uttam Roy, OXFORD University press
2. Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India

Reference Books

1. Web programming Bai, Michael Ekedahl, CENAGE Learning, India edition.
2. An Introduction to Web Design Programming, Paul S.Wang, India Edition
3. JavascriptDemystified, Keogh, jim, McGraw Hill
4. Beginning Javascript,Wilton,Paul,WilyIndiaWeb Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI by Ivan Bayross (bpb publication)
5. HTML5 by Mark Pilgrim O'Reilly publication

E-Resources

1. https://developer.mozilla.org/en-US/docs/Web/HTML
2. https://www.w3schools.com/html/
3. https://www.tutorialspoint.com/html/index.htm
4. https://developer.mozilla.org/en-US/docs/Web/CSS
5. https://www.manning.com/books/css-in-depth
6. https://www.w3schools.com/css/
7. https://www.tutorialspoint.com/css/index.htm

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BOS-INFORMATION TECHNOLOGY
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PUNE-1.

Third Year Information Technology (2022 Course)			
AUDIT COURSE – FOREIGN LANGUAGE LEVEL-I (GERMAN)			
Course Code:	IOHSM5AC	Credit:	1
Contact Hrs.:	1 Hr/week (L)	Type of Course:	Lecture
Examination Scheme:	Term-work 25 Marks		

Pre-requisites:
-

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/Internal	Marks
1.	Term-work	Internal	25

Course Objectives	
1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever-growing German industry with respect to language support.

Course Outcomes: Students will be able to	
5AC.1	Use German language for basic communication.
5AC.2	Apply the knowledge of German script.
5AC.3	Read, write, and improve their listening skills.
5AC.4	Develop interest to pursue profession in Indo-German Industry.
5AC.5	Grasp the basic sentence structure and build a good foundational vocabulary.

Unit 01	:	Introduction to the German Language-I	(04 Hrs)

Introduction of German Alphabets,
- Spell the names
- Addresses
- Numbers,
- Telephone numbers
- Ordinal Numbers
- Pin code Numbers
- Dates
- Birthdates
- Age
- days of the week
- Months

Unit 02	:	Introduction to the German Language-II	(04 Hrs)

- Basic Greetings
- Personal Pronouns
- Possessive Pronouns

Unit 03	:	Introduction to the German Language-II	(04 Hrs)

- Self-Introduction
- Introducing other people, about family, friends, course mates
- Introduction to seasons, and seasons in Germany and in neighboring countries.

Text Books:

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1. Netzwerk A-1 (Deutsch alsFremdsprache) " Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Tipps und Uebungen A1

E Resources:
1. Practice Material like Listening Module, reading Texts
2. NPTEL Course On German -I LANGUAGE
3. Online German-English Dictionary www.leo.org

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Third Year Information Technology (2022 Course)
AUDIT COURSE – FOREIGN LANGUAGE LEVEL-1 (JAPANESE)

Course Code:	IOHSM5AC	Credit		1
Contact Hours:	01Hr/Week	Type of Course:		Lecture
Examination scheme:	Term-work 25 marks			

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Mar ks
1.	Term Work	Internal	25

Course Objectives

1	To meet the needs of an ever growing industry with respect to language support.
2	To get introduced to Japanese society and culture through language.

Course Outcomes: Students will be able to

5AC.1	Demonstrate basic communication skills.
5AC.2	Show knowledge of Japanese script.
5AC.3	Apply skills to reading , writing and listening
5AC.4	Develop interest to pursue professional Japanese Language courses.

Topics covered:

UNIT I Introduction to Japanese Language (2 hrs.)
Introduction to Japanese Language.Hiragana basic Script, colors, Days of the week.

UNIT II: Hiragana (2 hrs.)
Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo Long vowels, Greetings and expressions.

UNIT III: Personal Essentials of Japanese Language (2 hrs.)
Self-Introduction, Introducing another person, Numbers, Months, Dates, Telephone numbers, Stating one's age.

UNIT IV: Katakana Basic (2 hrs.)
Katakana basic Script, Denoting things (nominal & prenominal demonstratives) Purchasing at the Market / in a shop / mall (asking & stating price).

UNIT V: Katakana (2 hrs.)
Katakana: Modified kana, double consonant, letters with ya, yu, yo, Long vowels Describing time, describing starting & finishing time (kara ~ made) Point in time (denoting the time when any action or the movement occurs)

UNIT VI: Travel Essentials (2 hrs.)
Means of transport (Vehicles), Places, Countries,Starting Birth date, Indicating movement to a certain place by a vehicle.

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Guidelines for Assessment (Any one of following but not limited to)
- Written Test
- Presentation
- Report

Text Books:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Textbook 1-1
   (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. George Trombley, Yukari Takenaka "Japanese from Zero!" Learn From Zero Publisher

MOOC/NPTEL courses

1. NPTEL Course on "**JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi)** "
   Link of the Course: **https://onlinecourses.nptel.ac.in/noc23_hs76/preview**
2. **NPTEL Course on**" Introduction to Japanese Language and Culture"
   Link of the Course :https://onlinecourses.nptel.ac.in/noc19_hs52/preview

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Third Year Information Technology (2022 Course) Seminar & Technical Report Writing			
Course Code:	**ITHSM601**	**Credit:**	**2**
Contact Hrs.:	1 Hr/week (L) 2 Hrs/Week(P)	**Type of Course:**	**Lecture/Practical**
Examination Scheme:	**Term-work 50 Marks**		

Pre-requisites:
-

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term-work	Internal	50

Course Objectives

1	To prepare students to communicate effectively as professionals.
2	To train students to use visual aids effectively.
3	To implant technical writing skills.
4	To develop presentation and technical writing skill.

Course Outcomes : Students will be able to

601.1	Analyze communication-related problems and improve communication skill
601.2	Use various types of technical communication as per need.
601.3	Write proposals and reports
601.4	Develop key skills in research, dissemination and documentation.

Topics covered:

UNIT I:TECHNICAL COMMUNICATION: ORAL (6 hrs.) Basics of Technical Communication, different forms of communication and advanced communication skills, dynamics of professional presentations , group discussions, etiquettes and mannerisms, job interviews (online/offline mode), public speaking, oral presentation.

UNIT II: TECHNICAL COMMUNICATION: WRITTEN (6 hrs.)
Technical proposal, technical writing: efficient process to create a report, research paper, report writing and documentation style-LaTex, use of visual aids, ethics in writing using plagiarism tools, resume writing.

Note: The assessment for the subject shall be based on presentation and report submission.

List of Assignments / Activities :
Any eight of the following
1. Introduction to technical communication
2. Group Discussion
3. Official/Public Speaking
4. Communication ethics
5. Conversational skills for job interviews
6. Theme based seminar/ oral presentation /poster presentation
7. Writing ethics-letter of application, resume e-mails.
8. Develop proposal in LaTex for selected research project

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9. Publication process: How to write and submit paper for conference, journal, the evaluation process, how to communicate with the editors, copyright, plagiarism.

Text Books:

1. Sunita Mishra, "Communication Skills for Engineers" Pearson Education
2. Prof. K. R. Laxminarayanan and Dr. T. Murugavel "Communication Skills for Engineers" SCITECH.
3. Sharon J Gerson and Steven Gerson "Technical Writing – Process& Product", Pearson
4. Education.
5. Danial Riordan, Steven E. Pauley Technical Report Writing Today
6. Krishna Mohan, Meera Banerji "Developing Communication skills", Laxmi Publications.
7. Meenakshi Raman and Sangeeta Sharma," Technical Communication Principles and Practice", Oxford University Press.

Reference Books:

2. Sanjay Kumar and Pushp Lata, "Communication Skills" Oxford University Press.
3. Davies J.W. "Communication for engineering students", Longman
4. Eisenberg, "Effective Technical Communication", Mc. Graw Hill.
5. Robert A. Day, "How To Write and Publish a Scientific Paper", Fifth Edition, Oryx Press, Phoenix, AZ, 1998.

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Third Year Information Technology (2022 Course) Machine Learning			
Course Code:	ITPCC602	Credit:	4
Contact Hrs.:	3 Hrs/week (L) 1 Hr./week(T)	Type of Course:	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:
- Probability and Statistics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To understand the basic concepts of machine learning.
2	To discuss regression techniques for making predictions in different applications
3	To understand and apply the classification algorithms to classify the data with appropriate labels
4	To learn and apply the various clustering algorithms to divide the unlabeled data into the similar groups
5	To introduce and integrate models in the form of advanced ensembles
6	To explain reinforcement learning and its algorithms

Course Outcomes: Students will be able to

602.1	Explain the basic concepts of machine learning.
602.2	Design ML models to make predictions by using appropriate regression techniques.
602.3	Implement classification models for two class problems and multiclass problems.
602.4	Identify and Implement clustering models for unlabeled data as per need of application.
602.5	Integrate multiple machine learning algorithms in the form of ensemble learning.
602.6	Apply reinforcement learning and its algorithms for different applications.

Topics covered:

UNIT-I: - INTRODUCTION (6 Hrs.)
Introduction: What is Machine Learning, Definitions and Real-life applications, Comparison of Machine learning with traditional programming, ML vs AI vs Data Science.
Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning.
Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models.
Features: Kinds of features, features transformation, features construction and selection: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA)

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UNIT II: -REGRESSION (6 Hrs.)

Introduction: Regression, Need of Regression, Difference between Regression and Correlation, Types of Regression: Univariate vs. Multivariate, Linear vs. Nonlinear, Simple Linear vs. Multiple Linear, Bias-Variance tradeoff, Overfitting and Underfitting.

Regression Techniques - Linear Regression, Polynomial Regression, Stepwise Regression, Decision Tree Regression, Random Forest Regression, Support Vector Regression, Bayesian Linear Regression.

Evaluation Metrics: Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), R-squared

UNIT III: -CLASSIFICATION (6 Hrs.)

Introduction: Need of Classification, Types of Classification (Binary and Multiclass), Binary-vs-Multiclass Classification, Balanced and Imbalanced Classification Problems.

Binary Classification: Linear Classification model,

Multiclass Classification: One-vs-One and One-vs-All classification techniques, Performance Evaluation- Confusion Matrix, Per Class Precision, Per Class Recall.

Classification Algorithms: Naive Bayes Classifier, Decision Tree, K Nearest Neighbor, Linear Support Vector Machines (SVM), RandomForest.

Evaluation Metrics: Accuracy, Precision, Recall, F-score, Cross-validation, Micro Average.

UNIT IV: -CLUSTERING (6 Hrs.)

Introduction: What is clustering, Need of Clustering, Types of Clustering

Hierarchical clustering algorithms: Agglomerative Hierarchical Clustering (AHC) algorithm, Divisive Hierarchical Clustering (DHC) algorithm.

Clustering algorithms: K-Means clustering algorithm, Elbow method, K-Medoids, K-Prototype.

Density-based clustering algorithms: DBSCAN algorithm.

Distribution-based clustering algorithms: Gaussian mixture model.

Evaluation metrics: elbow method, extrinsic and intrinsic methods.

UNIT V: - ENSEMBLE LEARNING (6 Hrs.)

Ensemble Learning: Introduction to Ensemble Learning, Homogeneous and Heterogeneous ensemble methods, Applications of Ensemble Learning, Basic Ensemble Learning **Techniques:** Voting Ensemble, Typesof Voting: Max Voting, Averaging, Weighted Average.

Advanced Ensemble Learning Techniques: Bagging: Bootstrapping, Aggregation, Boosting: Adaptive Boosting (AdaBoost), Gradient Boosting, XGBoost, Random Forest Ensemble, Stack Generalization.

UNIT VI: - REINFORCEMENT LEARNING(6 Hrs.)

Reinforcement learning: Introduction to Reinforcement Learning, Supervised vs Unsupervised vs Reinforcement Learning, Types of Reinforcement, Elements of Reinforcement Learning, Applications of Reinforcement learning.

Markovas Decision process: Markov property, Markov Chain/Process, Markov reward process (MRP), Markov decision process (MDP). Q Learning: Introduction of Q-Learning, Important terms in Q learning, Q table, Q functions, Q learning algorithm.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*):
NA.

Text Books:

1. Bishop, Christopher M., and Nasser M. Nasrabadi, —Pattern recognition and machine learning‖,Vol. 4.No. 4. New York: springer, 2006
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition",CRC Press, 2014.

Reference Books:
1. Tom Mitchell, — Machine learning‖, McGraw-Hill series in Computer Science, 1997
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016
4. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021. SebastainRaschka, VahidMirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019.

E-Resources:
1. Python Machine Learning http://www.ru.ac.bd/wpcontent/uploads/sites/25/2019/03/207_05_01_Rajchka_Using-Python-for-machinelearning-2015.pdf
2. Foundation of Machine Learning:https://cs.nyu.edu/~mohri/mlbook/
3. A brief introduction to machine learning for Engineers: https://arxiv.org/pdf/1709.02840.pdf
4. Feature selection:https://dl.acm.org/doi/pdf/10.5555/944919.944968
5. Introductory Machine Learning Nodes : http://lcsl.mit.edu/courses/ml/1718/MLNotes.pdf

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BOS-INFORMATION TECHNOLOGY
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Third Year Information Technology (2022 Course) Operating System			
Course Code:	ITPCC603	**Credit:**	3
Contact Hrs.:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites:
- Digital Electronics and Computer Organization
- Data Structures and Algorithms

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To explain objectives and functions of operating system and design consideration for different operating systems.
2	To explain concept of process, threads and scheduling algorithm.
3	To describe how resources are scheduled and managed.
4	To discuss various memory management techniques.
5	To explain the concept of I/O management.
6	To discuss file management in detail.

Course Outcomes: Students will be able to	
603.1	Explain functions and design consideration of operating systems.
603.2	Solve problems related to concept of process, threads and scheduling algorithm.
603.3	Detect and Recover deadlock conditions using algorithms.
603.4	Describe various memory management techniques.
603.5	Explain the concept of I/O management.
603.6	Describe the concept of file management.

Topics covered:

UNIT I: INTRODUCTION TO OPERATING SYSTEM (6 Hrs.)
Basics of Operating Systems: Definition, Generations of Operating systems, Types of Operating Systems, OS Service, System Calls, OS structure: Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine

UNIT II: PROCESS MANAGEMENT AND SCHEDULING (6 Hrs.)
Process Management Processes: Definition, Process Relationship, Process states , Process State transitions , Process Control Block ,Context switching, Threads, Concept of multi threads , Benefits of threads , Types of threads, Process Scheduling: Definition, Scheduling objectives

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Types of Schedulers ,Scheduling criteria : CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only) , Scheduling algorithms : Pre-emptive and Non-preemptive ,FCFS ,SJF ,RR , Multiprocessor scheduling : Types , Performance evaluation of the scheduling.

UNIT III: PROCESS SYNCHRONIZATION & CONCURRENCY CONTROL (6 Hrs.)

Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance :banker's algorithm, Deadlock detection and Recovery Inter-process Communication Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation , Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem.

UNIT IV: MEMORY MANAGEMENT (6 Hrs.)

Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction,Paging: Principle of operation – Page allocation – Hardware support for paging –, Protection and sharing – Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies: Optimal (OPT) , First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU)

UNIT V: I/O MANAGEMENT (6 Hrs.)

Principles of I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers , Device drivers , Device independent I/O software , Secondary-Storage Structure: Disk structure ,Disk scheduling algorithm

UNIT VI: FILE MANAGEMENT (6 Hrs.)

File Management: File concept, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous,linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table),efficiency & performance, Linux file system,Android file system.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit*):
GATE:Unit 1 to Unit 6

Text Books

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY,ISBN 978-1-118-06333-0 , 9th Edition

Reference Books

1. Andrew S. Tanenbaum& Herbert Bos, Modern Operating System, Pearson, ISBN-13:
2. 9780133592221, 4th Edition
3. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278.
4. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8.

E Resource

1. https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf
2. https://nptel.ac.in/courses/106/102/106102132/#
3. https://nptel.ac.in/courses/106/106/106106144/

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Third Year Information Technology (2022 Course)
Cloud Computing

Course Code:	ITPCC604	Credit:		3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:		Lecture/Practical
Examination Scheme:	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks		

Pre-requisites:
- Data Communication and Computer Network

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To become familiar with fundamental ideas behind Cloud Computing and its eco system
2	To discuss the components of cloud computing and learn importance of virtualization
3	To give technical overview of cloud programming and services
4	To describe Container, Docker and Kubernetes
5	To describe in-depth security mechanism of Cloud Computing.
6	To use Cloud Simulators and green cloud

Course Outcomes : Students will be able to	
604.1	Explain the core concepts of the cloud computing paradigm
604.2	Define system, network and storage virtualization and outline their role in enabling the cloud computing system model.
604.3	Apply various cloud programming models to build and deploy cloud applications that are resilient, elastic and cost-efficient.
604.4	Design application using Docker and Kubernetes
604.5	Analyze various cloud security mechanism and apply them to solve problems on the cloud.
604.6	Illustrate the Cloud Simulators and green cloud

Topics covered:

UNIT I: INTRODUCTION TO CLOUD COMPUTING (6 Hrs.)
Cloud computing, motivation and evolution, Characteristics of cloud computing, desired features of cloud, Challenges and risk, difference between cloud and traditional architecture, cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds.
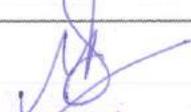
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UNIT II: COMPONENTS OF CLOUD COMPUTING (6 Hrs.) components of a cloud computing such as virtualization virtual machines, levels of virtualization, load balancing and virtualization, understanding hypervisors, Types of hypervisor, virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Centre Automation.
UNIT III: CLOUD PLATFORMS AND APPLICATION (6 Hrs.) Features of Cloud and Grid Platforms, Amazon EC2, programming support of Google App Engine, programming on Amazon AWS and Microsoft Azure, software productivity in cloud, Economics of scale: Public Vs. Private cloud **Applications:** Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Salesforce.com, Dev 2.0 platform
UNIT IV: DOCKER AND KUBERNETE (6 Hrs.) Introduction to Containers w/ Docker, Kubernetes&OpenShift,Benefits of Containers, Difference between containers and virtual machines, importance of containers in cloud computing and emerging ecosystem, getting started with Docker, Kubernetes Architecture, scaling with Kubernetes, Cloud using OpenShift. Managing Applications with Kubernetes
UNIT V: CLOUD SECURITY AND ISSUES (6 Hrs.) Cloud information security objectives, cloud security services, cloud security design principles, secure cloud software requirement, cloud security policy implementation and decomposition, secure cloud software testing. **Cloud Issues:** Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability
UNIT VI: CLOUD SIMULATORS (6 Hrs.) Introduction to Simulator, Cloud Simulators- CloudSim and GreenCloud, Understanding CloudSim simulator, CloudSimArchitecture (User code,CloudSim, GridSim, SimJava) Understanding GreenCloud simulator,Comparison between Cloud Sim and Green Cloud.
Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(*if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):NA*

Text Books

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
3. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
4. Gautham Shroff, Enterprise Cloud Computing, Cambridge, ISBN: 9781107648890.

Reference Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.

E-Resources

1 https://onlinecourses.nptel.ac.in/noc21_cs14/preview

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Third Year Information Technology (2022 Course) Elective-II (A): Service Oriented Architecture			
Course Code:	ITPEC605A	**Credit:**	3
Contact Hrs.:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	Practical/Activity based Evaluation 60 Marks	

Pre-requisites:
- Web Development

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	Practical/Activity based Evaluation	External	60

Course Objectives	
1	To Explain concepts of Distributed Computing & Web services.
2	To Describe the Principles of Service-Oriented Architecture.
3	To Describe Web Service Standards.
4	To Explain Web Service Specifications
5	To Explain the principles of Service-Oriented Computing
6	To Describe SOA platforms.

Course Outcomes : Students will be able to	
605A.1	Describe concepts of Distributed Computing & Web services.
605A.2	Explain the principles of Service-Oriented Architecture.
605A.3	Explain Web Service Standards.
605A.4	Describe Web Service Specifications.
605A.5	Describe the principles of Service-Oriented Computing.
605A.6	Explain SOA platforms.

Topics covered:

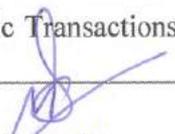**UNIT-I: INTRODUCTION TO SERVICE ORIENTED ARCHITECTURE (6 Hrs.)**
Concepts of Distributed Computing, XML, Fundamental of SOA, evolution of SOA, Web Services Fundamental and Standard: Web Services: Definition, Architectures and Standards.

UNIT-II: PRINCIPLES OF SERVICE-ORIENTED ARCHITECTURE (6 Hrs.)
Directory services, SOAP, REST WSDL, UDDI. Principles of Service-Oriented Architecture-Service- orientation and object- orientation, SOA Standards Stack, SOA with Web Services, Key Principles of SOA.

UNIT-III: WS PROTOCOLS (6 Hrs.)
SOA and WS-* Extension: Message Exchange Pattern, Coordination, Atomic Transactions, Business Activities, Orchestration, Choreography, WS-Addressing

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UNIT-IV: TYPES OF WS POLICIES (6 Hrs.)

WS- Reliable Messaging, WS-Policy (including WS-Policy Attachments and WS-Policy Assertions), WS-Metadata Exchange, WS-Security (including XML-Encryption, XML-Signature, and SAML)

UNIT-V: SERVICE LIFE CYCLE AND DEPLOYMENT (6 Hrs.)

Principles of Service-Oriented Computing: RPC versus Document Orientation, Service Life Cycle, Service Creation, Service Design and Build, Service Deployment, Publish Web service using UDDI.

UNIT VI: SOA AND JAVA (6 Hrs.)

SOA Platforms: SOA support in J2EE – Java API for XML- based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- SOA support in .NET

PRACTICAL OR ACTIVITY BASED EVALUATION

1. Based on unit III to VI practical oriented problems will be assigned by teacher during End Sem Examination.
2. Three hours will be given to students for End Sem Examination.
3. From each unit two problems will be allotted to students and student will provide solution for any one problem per unit. Within 3 hrs. student will solve 4 problems.
4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.):
All Units.

Text Books

1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson education.
2. Service-Oriented Computing: Semantics, Processes, Agents, Munindar P. Singh and Michael N. Huhns, John Wiley & Sons, Ltd., 2005

Reference Books

1. SOA Using Java™ Web Services by Mark D. Hansen
2. SOA Design Pattern By Thomas Erl PHI
3. Web service contract Design & Versioning for SOA by Thomas Erl PHI
4. SOA with .NET by Rajbalasubhramaniam Prentice Hall

E-Resources:

1. https://www.tutorialspoint.com/soa/index.htm
2. https://learn.oracle.com/ols/home/oracle-soa-suite-learning-subscription/38584
3. https://onlineitguru.com/oracle-soa-online-training-placement.html

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Third Year Information Technology (2022 Course)
Elective-II (B) Intelligent Process Automation

Course Code:	ITPEC605B	Credit:		3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:		Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	Practical/Activity based Evaluation 60 Marks		

Pre-requisites:
- Data Structures and Algorithms
- Object Oriented Programming

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem Evaluation	Internal	40
2.	Practical/Activity based Evaluation	External	60

Course Objectives	
1	To explain the basics of robotic process automation.
2	To discuss variables, control flow options and data manipulation.
3	To explain automation for various types of data.
4	To describe mechanism to handle user events in RPA.
5	To explain the types of exceptions and strategies.
6	To explain the steps of deployment of robot and its integration.

| Course Outcomes : Students will be able to	
605B.1	Describe the basics of robotic process automation.
605B.2	Explain types of variables, Control Flow and data manipulation techniques.
605B.3	Describe Image, Text and Data Tables Automation.
605B.4	Explain the process of handling the User Events.
605B.5	Describe various types of Exceptions and strategies.
605B.6	Deploy and maintain the RPA application

Topics covered:
UNIT-I: INTRODUCTION TO ROBOTIC PROCESS AUTOMATION (6Hrs.)   Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation, Benefits of RPA , Application areas of RPA, Components of RPA, RPA Platforms.
UNIT-II: RPA TOOLS (6 Hrs.)   Introduction to RPA Tool, The User Interface, Variables, Managing Arguments, Namespaces Control Flow, Activity, Data Manipulation, Gathering and Assembling Data
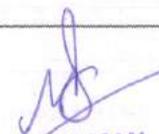
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UNIT-III: APP INTEGRATION, RECORDING AND SCRAPING (6Hrs.)

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT-IV: HANDLING USER EVENTS & ASSISTANT BOTS (6Hrs.)

What are assistant bots? Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking, Launching an assistant bot on a keyboard event.

UNIT-V: EXCEPTION HANDLING (6Hrs.)

Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

UNIT-VI: DEPLOYMENT AND MAINTENANCE (6Hrs.)

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors – Open Source RPA, Future of RPA.

PRACTICAL OR ACTIVITY BASED EVALUATION

1. Based on unit III to VI practical oriented problems will be assigned by teacher during End Sem Examination.
2. Three hours will be given to students for End Sem Examination.
3. From each unit two problems will be allotted to students and student will provide solution for any one problem per unit. Within 3 hrs. student will solve 4 problems.
4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)
NA

Text Books

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

Reference Books

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

E-Resources

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

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Third Year Information Technology (2022 Course)
Elective-II (C) DevOps

Course Code:	ITPEC605C	Credit:		3
Contact Hrs.:	3 Hrs/week (L)	Type of Course:		Lecture
Examination Scheme:	In-sem. Evaluation 40 Marks	Practical/Activity based Evaluation. 60 Marks		

Pre-requisites:
  1. Software Engineering and Project Management

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1	In-Sem Evaluation	Internal	40
2	Practical/Activity based Evaluation	External	60

Course Objectives

1	To Explain the need of DevOps as a software engineering practice.
2	To Explain the background of DevOps Evolution.
3	To Discuss the concept of Continuous Integration Continuous Delivery (CICD).
4	To Discuss the concept of continuous deployment and test strategies
5	To Explain the monitoring system and reliability engineering.
6	To explore the emerging tools used in the DevOps lifecycle

Course Outcomes: Students will be able to

605C.1	Explain the fundamental concepts of DevOps.
605C.2	Describe how to link DevOps with other technologies
605C.3	Explain the concept of continuous integration and continuous delivery.
605C.4	Compare various stages of continuous deployment and test strategies
605C.5	Explain the monitoring system and reliability engineering in DevOps
605C.6	Explain the latest tools in DevOps.

Topics covered:

UNIT-I: INTRODUCTION TO DEVOPS:(6 Hrs.)
What is DevOps? Role of DevOps Engineer, Developer responsibility, Introduction to Continuous Integration and Continuous Delivery Policies, DevOps Culture: Dilution of barriers in IT departments, Process automation, Agile Practices, Reason for adopting DevOps, What and Who Are Involved in DevOps? Changing the Coordination, Introduction to DevOps pipeline phases, Defining the Development Pipeline, Centralizing the Building Server, Monitoring Best Practices, Best Practices for Operations.

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UNIT-II: MICROSERVICES ARCHITECTURE AND CLOUD NATIVE DEVELOPMENT (6 Hrs.)

Monolithic applications, Introduction to microservice architecture, Implementing a microservices Architecture, Pros and Cons of a microservice Architecture, Characteristics of microservice architecture, Monolithic applications and microservices compared, microservices best practices, Deployment strategies, Introduction to cloud computing, cloud computing deployment models, service models, why to use cloud, Principle of container based application design, Introduction to Docker, Serverless computing, orchestration, Difference between orchestration and automation

UNIT-III: CONTINUOUS INTEGRATION AND TEST-DRIVEN DEVELOPMENT (6 Hrs.)

Introduction to continuous integration, time to market and quality, Build in a Continuous Integration Scenario, Code Repository Server, Continuous Integration Server, Introduction to Continuous Delivery and chain, Differentiate Continuous Integration and Continuous Delivery, Strategies for Continuous Delivery, Benefits of Continuous Integration and Continuous Delivery, Designing a CI and CD System, Building Continuous Integration and Continuous Delivery Pipelines, Continuous Database Integration, Preparing the Build for Release, Identifying the Code in the Repository, Creating Build Reports, Putting the Build in a Shared Location, Releasing the Build

UNIT-IV: CONTINUOUS DEPLOYMENT AND ORCHESTRATION(6 Hrs.)

Implementing a testing Strategy: Types of Tests, Integration testing, managing defect backlogs, what is Continuous Deployment? Changes moving through the deployment pipeline, Trade-offs in the deployment pipeline, Basic Deployment pipeline, Deployment pipeline practices & Commit stage, Automated Acceptance Test Gate, Subsequent test stages, preparing to release, Implementing a deployment pipeline.

UNIT-V: CONTINUOUS MONITORING AND SITE RELIABILITY (6 Hrs.)

What is a monitoring system? Factors involved in monitoring systems, why monitoring is important, white-box and black-box monitoring, building a monitoring system, monitoring infrastructure and applications, collecting data, logging, creating dashboard, behavior driven monitoring, what is site reliability engineering? SRE and DevOps, roles, and responsibilities of SRE, common tools used by SREs.

UNIT-VI: DEVOPS TOOLING AND CASE STUDIES (6 Hrs.)

Continuous Development/ Version Control: Git, Serverless orchestration: Kubernetes, Container Technology: Docker, Continuous Integration: Jenkins, Continuous delivery: Jenkins, Continuous Deployment: Ansible, Continuous Testing: Selenium, Monitoring: Prometheus, Bug tracking tool: Jira, elk stack. Case study: Spotify: Using Docker, Bank of New Zealand, EtSy.

PRACTICAL OR ACTIVITY BASED EVALUATION

1. Based on unit III to VI practical oriented problems will be assigned by teacher during End Sem Examination.
2. Three hours will be given to students for End Sem Examination.
3. From each unit two problems will be allotted to students and student will provide solution for any one problem per unit. Within 3 hrs. student will solve 4 problems.
4. Evaluation of each problem carries 15 marks where 10 marks is for successful execution and 5 marks is for QA.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.) NA

Text Books:
1. Pierluigi Riti, "Pro DevOps with Google Cloud Platform", Apress, ISBN: 978-1-4842-3896-7.
2. Katrina Clokie, "A Practical Guide to Testing in DevOps", Lean Publishing published on 2017-08-01

3. Jez Humble and David Farley, "Continuous Delivery", Pearson Education, Inc, ISBN: 978–0–321–60191–9

Reference Books:

1. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices"
2. Jennifer Davis and Katherine Daniels, "Effective DevOps: Building a Culture of Collaboration, Anity, and Tooling at Scale", O'Reilly Media, Inc., ISBN: 978-1-491-92630-7
3. Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", John Wiley & Sons, Inc., 2nd IBM Limited Edition, ISBN: 978-1-119-04705-6

E-resources:

1. htttps://www.redhat.com/en/resources/cloud-native-container-design-whitepaper
2. https://www.redhat.com/en/topics/cloud-native-apps/what-is-serverless
3. https://www.redhat.com/en/topics/automation/what-is-orchestration
4. https://www.atlassian.com/continuous-delivery/continuous-integration
5. https://www.flagship.io/glossary/site-reliability-engineer/
6. https://docs.microsoft.com/en-us/learn/paths/intro-to-vc-git/
7. https://www.javatpoint.com/kubernetes
8. https://www.javatpoint.com/docker-tutorial
9. https://www.javatpoint.com/jenkins
10. https://prometheus.io/docs/introduction/overview/
11. https://www.javatpoint.com/jira-tutorial

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Third Year Information Technology (2022 Course)			
Software Quality Assurance and Testing			
Course Code:	ITVSE606	**Credit:**	3
Contact Hrs.:	1 Hr./week (L) 4 hrs/week (P)	**Type of Course:**	Lecture/Practical
Examination Scheme:	Term-work 50 Marks	Practical 50 Marks	

Pre-requisites:
- Software Engineering and Project Management

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1	Term-work	Internal	50
2	Practical	External	50

Course Objectives	
1	Introduce basic concepts of software testing.
2	Explain manual testing techniques
3	Explain automation testing techniques
4	Explore automation testing tools for automation testing.

Course Outcomes: Students will be able to	
606.1	Describe fundamental concepts of software quality assurance and testing
606.2	Design and Develop project test plan, design test cases, test data, and conduct test operations.
606.3	Describe the need of automation testing
606.4	Apply automation tool for testing different scenarios

Topics covered:
UNIT-I: INTRODUCTION TO SOFTWARE TESTING (2Hrs.) Basic Software quality parameters and its metrics, Quality management models: ISO, SPICE, IEEE, CMM, Introduction to testing, Error, bug, defect, and failure, Verification versus validation, Types of Applications, Probabilities of getting an error in an application, Difference between Test case, Use case and Scenario. Prepare test plan and strategy, Prepare a test case template.
UNIT-II: MANUAL TESTING(4Hrs.) Test Case Design Technique : Boundary Value Analysis , Equivalence Partitioning , Decision Table , State Transition Diagram , Use Case Testing, Bug Life cycle, Prepare the Bug template, Bug Tracking tool , Types of Testing , Difference between Static and Dynamic testing, Difference between Functional and Non-functional testing, Black box testing and its Types, White box testing and its types, System Integration vs User Acceptance Testing,

Entry Criteria and Exit Criteria, Test Environment and Test data preparation, Flow graph notations : Statement coverage, Branch Coverage, path coverage, Cyclometric Complexity, Integration testing, Big Bang Integration, Incremental Approach – Top-Down, Bottom-up, and Hybrid Requirement traceability matrix.

UNIT-III: AUTOMATION TESTING (4Hrs.)

What is Automation Testing, Advantages of Automation Testing, Fundamentals of test automation, ROI in Automation, Automation framework, Various tools and comparison with Selenium, Selenium, Components of Selenium Suite, Advantages of Selenium, Limitations of Selenium , Selenium WebDriver, Advantages of Selenium , What is the difference between Selenium and QTP.

UNIT-IV: SELENIUM WEB DRIVER 3.0 (2Hrs.)   What is a driver? Why Selenium Web Driver?, Automation Setup for Selenium Web Driver, Configuration of Selenium Jar using Eclipse ,Setup for Firebug, Fire path for Mozilla Firefox browser, Web Driver Interface Methods, Different locators available in Selenium, Miscellaneous Selenium scenarios.

List of Experiments:

1. Write TEST Scenario for Gmail Login Page and test it
2. Conduct a test suite for any two web sites.
3. Write Test cases in excel sheet for Social Media application or website
4. Create Defect Report for Any application or web application
5. Install Selenium server and demonstrate it using a script in Java/PHP
6. Using Selenium IDE, Write a test suite containing minimum 4 test
7. Write and test a program to update 10 student records into table into Excel file
8. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).
9. Write and test a program to provide total number of objects present/ available on the page
10. Write and test a program to get the number of list items in a list / combo box.
11. Write and test a program to count number of check boxes on the page checked and unchecked count.
12. Demonstrate the use of bug tracking and testing tool Bugzilla and Jira

Textbooks

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903
2. SrinivasanDesikan, GopalSwamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

Reference Books

1. NareshChauhan, "Software Testing Principles and Practices", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

E Resources

1. https://www.softwaretestinggenius.com/download/staqtpsn.pdf
2. https://ebooks.lpude.in/computer_application/mca/term_3/DCAP503_SOFTWARE_TESTING_AND_QUALITY_ASSURANCE.pdf
3. https://students.cs.byu.edu/~cs340ta/winter2019/notes/rodham/15-QA-Testing/IntroToTesting.pdf

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Third Year Information Technology (2022 Course) Operating System Lab			
Course Code:	ITPCC607	Credit:	1
Contact Hrs.:	2Hrs/week (P)	Type of Course:	Practical
Examination Scheme:	Term-work 25 Marks	Practical 25 Marks	

Pre-requisites:
- Digital Electronics and Computer Organization
- Data Structures and Algorithms

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Practical	External	25

Course Objectives	
1	To learn shell programming concepts and applications.
2	To demonstrate the functioning of OS basic building blocks like processes, threads.
3	To demonstrate the functioning of OS concepts in user space like concurrency control with the help of classical problems.
4	To demonstrate the functioning of Inter Process Communication.

Course Outcomes: Students will be able to	
607.1	Build shell scripts for various applications.
607.2	Implement basic building blocks like processes, threads.
607.3	Develop various system programs for the functioning of OS concepts in user space like concurrency control with the help of classical problems.
607.4	Develop system programs for Inter Process Communication.

List of Experiments:

1. Shell programming to handle library database.
2. Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states.
   I. Implement the C program in which main program accepts the integers to be sorted. Main program uses the FORK system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.
   II. Implement the C program in which main program accepts an integer array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an integer array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program that uses this sorted array for performing the binary search to search the particular item in the array.
3. Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.
4. Thread synchronization and mutual exclusion using mutex. Application to demonstrate:

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Reader-Writer problem with reader priority.

5. Deadlock Avoidance Using Semaphores: Implement the deadlock-free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.

6. Inter process communication in Linux using following.

a. Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.

b. FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.

Textbooks
1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY,ISBN 978-1-118-06333-0 , 9th Edition

Reference Books
1. Andrew S. Tanenbaum& Herbert Bos, Modern Operating System, Pearson, ISBN-13:9780133592221, 4th Edition
2. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526.
3. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project.

E-Resources
1. https://nptel.ac.in/courses/106/102/106102132/#
2. https://nptel.ac.in/courses/106/106/106106144/
3. https://opensource.com/resources/linux

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Third Year Information Technology (2022 Course) Cloud Computing Lab			
Course Code:	**ITPCC608**	**Credit:**	**1**
Contact Hrs.:	**2 Hrs/week (P)**	**Type of Course:**	**Practical**
Examination Scheme:	**Term-work 25 Marks**	**Practical 25 Marks**	

Pre-requisites:
* Data Communication and Computer Network

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Practical	External	25

Course Objectives	
1	To develop web applications in cloud.
2	To learn the design and development process involved in creating a cloud based application.

Course Outcomes: Students will be able to	
608.1	Demonstrate Linux commands, shell scripting and explain networking concepts
608.2	Demonstrate how to use public cloud to solve deploy applications
608.3	Design and develop cloud-based applications
608.4	Design and deploy web applications in cloud environment.

List of Experiments:

1. Linux commands for Cloud &Devops
2. Install and use a generic cloud environment that can be used as a private cloud.
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Deploy Web application on AWS Cloud (or any cloud) (PHP/Python/Node js any application).
5. Use GAE launcher to launch the web applications.
6. Deploy Web Application using S3 Bucket
7. Write IaC using terraform to create EC2 machine on AWS or Azure or Google cloud. (Compulsory to use Input and output variable files)
8. Write an ansible-playbook to install nginx on target servers
9. Deploy static website using Dockers
10. Find a procedure to transfer the files from one virtual machine to another virtual machine.
11. Find a procedure to transfer the files from one virtual machine to another virtual machine.

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12. Design and develop custom Application (Mini Project) using Salesforce Cloud.

Text Books

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
3. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
4. Gautham Shroff, Enterprise Cloud Computing, Cambridge, ISBN: 9781107648890.

Reference Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology &Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.

E-Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

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Third Year Information Technology (2022 Course) Software Lab II				
Course Code:	ITPEC609		Credit:	2
Contact Hrs.:	4Hrs/week (P)		Type of Course:	Practical
Examination Scheme	Term-work 25 Marks		Oral 25 Marks	

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

PART A
MACHINE LEARNING

Pre-requisites:
- Probability and Statistics

| Course Objectives	
1	To understand and apply the regression techniques for making predictions in different applications
2	To understand supervised learning algorithm to classify the data with appropriate labels.
3	To learn principles and significance of unsupervised learning algorithms.
4	To understand the ensemble or reinforcement learning algorithm

Course Outcomes: Students will be able to	
609.1	Design and develop ML models to make predictions by using appropriate regression techniques.
609.2	Identify and Implement classification models for two class problems and multiclass problems.
609.3	Apply unsupervised learning algorithms to diverse datasets for pattern discovery and data exploration.
609.4	Develop the Machine learning model for real world application using the ensemble or reinforcement learning algorithm

List of Experiments:
1. Implement linear regression using python
2. Implement **Naïve Bayes** theorem to classify the English text
3. Implement Support vector Machine classification for spam Email detection(Normal and Abnormal State) Dataset link: https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of kmeans clustering with 3 means (i.e., 3 centroids) experiments

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
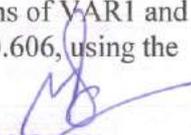
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0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. Implement Random Forest Classifier model to predict the safety of the car.
   Dataset link:https://www.kaggle.com/datasets/elikplim/car-evaluation-data- set

6. Use different voting mechanism and Apply AdaBoost (Adaptive Boosting), Gradient, Tree Boosting (GBM), XGBoost classification on Iris dataset and compare the performance of three models using different evaluation measures.
   Dataset Link:https://www.kaggle.com/datasets/uciml/iris

7. Solve the Taxi problem using reinforcement learning where the agent acts as a taxi driver to pick up a passenger at one location and then drop the passenger off at their destination.

8. Build a Tic-Tac-Toe game using reinforcement learning in Python by using following tasks
   a. Setting up the environment
   b. Defining the Tic-Tac-Toe game
   c. Building the reinforcement learning model
   d. Training the model
   e. Testing the model

Text Books

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition",CRC Press, 2014.

Reference Books
1. Ian H Witten, Eibe Frank, Mark A Hall, "Data Mining, Practical Machine Learning Tools and Techniques", 3rd edition, Elsevier

E Resources
1. Reinforcement Learning
   https://www.cs.toronto.edu/~urtasun/courses/CSC411_Fall16/19_rl.pdf
2. An Introduction to Statistical Learning by Gareth James
   https://www.ime.unicamp.br/~dias/Intoduction%20to%20Statistical%20Learning.pdf
3. Python Machine Learning
   http://www.ru.ac.bd/wpcontent/uploads/sites/25/2019/03/207_05_01_Rajchka_Using-Python-for-machinelearning-2015.pdf Python Data Science Handbook by Jake VanderPlas
   https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf
4. Elements of Statistical Learning: data mining, inference, and prediction.
   https://hastie.su.domains/ElemStatLearn/index.html

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PART-B
Elective-II (B): Service Oriented Architecture

Pre-requisites:
- Web Development

Course Objectives

1	To explain Integration of HTML and XML
2	To demonstrate creation of services and clients

Course Outcomes: Students will be able to

609.5	Integrate HTML and XML
609.6	Demonstrate creation of services and clients

List of Experiments (ANY SIX)
1. Create DTD file for student information and create a valid well-formed XMLdocument to store student information against this DTD file
2. Create XML schema for student information and create a valid well-formed XML document to store student information against this XMS schema file.
3. Using XSL display student information in tabular format.
4. Create web calculator service in .NET and create client to consume this service.
5. Create java client to consume web service created in .NET
6. Create .NET client to consume web service created in JAVA.
7. Create java client to consume existing web service hosted in the internet
8. Create a RESTFUL web-services in Net beans
9. Using JAXP SAX echo given xml file on console.
10. Using JAXP DOM echo given xml file on console.
11. Using AXIS 2 framework and TOMCAT create a simple calculator web serviceand also create a java client to consume this web service.

Oral Evaluation:
1. Student will design and develop a mini project using Machine Learning and Service Oriented Architecture concepts and present the same during OR exam

Text Books
1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson education.
2. Service-Oriented Computing: Semantics, Processes, Agents, Munindar P. Singh and Michael N. Huhns, John Wiley & Sons, Ltd., 2005

Reference Books
1. SOA Using Java™ Web Services by Mark D. Hansen
2. SOA Design Pattern By Thomas Erl PHI
3. Web service contract Design & Versioning for SOA by Thomas Erl PHI 4. SOA with .NET by Rajbalasubhramaniam Prentice Hall
4.

E-Resources
1. https://www.tutorialspoint.com/soa/index.htm
2. https://learn.oracle.com/ols/home/oracle-soa-suite-learning-subscription/38584
3. https://onlineitguru.com/oracle-soa-online-training-placement.html

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PART-B
Elective II(B): Intelligent Process Automation

Pre-requisite:
- Data Structures and Algorithms
- Object Oriented Programming

Course Objectives	
1	To explain the basics of robotic process automation.
2	To describe mechanism to handle user events in RPA.

Course Outcomes: Students will be able to	
609.5	Apply the basics of robotic process automation.
609.6	Demonstrate the process of handling of User Events.

List of Experiments(ANY SIX)
1. Write a Programming in C or Python to implement fuzzy logic application for autonomous robot system.
2. Write a Program in C or Python to solve traveling salesman problem.
3. Write program using Visual Prolog to create an expert system
4. Write program for obstacle avoidance in mobile robots using any one algorithm.
5. Implement A* algorithm to Solve 8-puzzle problem using. Assume any initial configuration and define goal configuration clearly
6. Perform the case study on the operators for controlling domestic robot.
7. Solving real time planning and scheduling problems using software like Witness/Pro-model

Oral Evaluation:
1. Student will design and develop a mini project using Machine Learning and Intelligent Process Automation concepts and present the same during OR exam

Text Books:
1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

Reference Books:
1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. SrikanthMerianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

E-Resources:
1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

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PART-B
Elective II(C): DevOps

Pre-requisite:
1. Software Engineering & Project Management

Course Objectives	
1	To explain the version control using Git and GitHub.
2	To discuss the concept of Continuous Integration Continuous Delivery (CICD).
3	To explain the Docker tool in DevOps.
4	To discuss Selenium for automatic testing

Course Outcomes: Students will be able to	
609.5	Use Git, GitHub, selenium tools for software version control and automation
609.6	Apply the concept of Continuous Integration Continuous Delivery (CICD) and dockers

List of Experiments (ANY SIX)
1. Write code for a simple user registration form for an event using Flask and Docker in DevOps
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code written in experiment no.1
4. Jenkins installation and setup explore the environment for. Continuous Integration and Continuous Deployment (CI/CD) in software development.
5. Develop an application to demonstrate continuous integration and development using Jenkins.
6. Develop an application to demonstrate Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Develop an application to demonstrate Integration of Kubernetes and Docker.
9. Develop an application to automate the process of running containerized application developed in exercise 7 using Kubernetes
10. Installation of Selenium and using it for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using Selenium.

Oral Evaluation:
1. Student will design and develop a mini project using Machine Learning and DevOps concepts and present the same during OR exam

Text Books:
1. PierluigiRiti, "Pro DevOps with Google Cloud Platform", Apress, ISBN: 978-1-4842-3896-7.
2. Katrina Clokie, "A Practical Guide to Testing in DevOps", Lean Publishing published on 2017-08-01
3. Jez Humble and David Farley, "Continuous Delivery", Pearson Education, Inc, ISBN: 978–0–321–60191–9

Reference Books:
1. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices"

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2. Jennifer Davis and Katherine Daniels, "Effective DevOps: Building a Culture of Collaboration, Anity, and Tooling at Scale", O'Reilly Media, Inc., ISBN: 978-1-491-92630-7

3. Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", John Wiley & Sons, Inc., 2nd IBM Limited Edition, ISBN: 978-1-119-04705-6

E-resources:

1. https://www.redhat.com/en/resources/cloud-native-container-design-whitepaper
2. https://www.redhat.com/en/topics/cloud-native-apps/what-is-serverless
3. https://www.redhat.com/en/topics/automation/what-is-orchestration
4. https://www.atlassian.com/continuous-delivery/continuous-integration
5. https://www.flagship.io/glossary/site-reliability-engineer/
6. https://docs.microsoft.com/en-us/learn/paths/intro-to-vc-git/
7. https://www.javatpoint.com/kubernetes
8. https://www.javatpoint.com/docker-tutorial
9. https://www.javatpoint.com/jenkins
10. https://prometheus.io/docs/introduction/overview/
11. https://www.javatpoint.com/jira-tutorial

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Third Year Information Technology (2022 Course) AUDIT COURSE – FOREIGN LANGUAGE LEVEL-II –(GERMAN)			
Course Code:	IOHSM6AC	Credit:	1
Contact Hrs.:	1 Hr/week (L)	Type of Course:	Lecture
Examination Scheme:	Term-work 25 Marks		

Pre-requisites:

-

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term-work	Internal	25

Course Objectives	
1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever growing German industry with respect to language support.

Course Outcomes: Students will be able to	
6AC.1	Communicate using advanced level of German Language.
6AC.2	Develop reading, writing and listening skills.
6AC.3	Use tenses in German Language.
6AC.4	Develop interest to pursue a German language course.
6AC.5	Get comprehensive understanding of basic German Language and build a good enough vocabulary to articulate themselves in any given daily life situation.

Unit 01	:	Introduction of Cases	(04 Hrs)
Introduction of Cases: Nominative, Akkusative, Dative. Personal & Possessive Pronouns in Nominative, Akkusative, Dative			
Unit 02	:	Prepositions	(04 Hrs)
Prepositions:- Akkusative& Dative			
Unit 03	:	Tenses	(04 Hrs)
Tenses:- Past tense of sein &haben Verbs, Perfect tense			

Text Books:
1. Netzwerk A-1 (Deutsch alsFremdsprache) , Goyal Publishers & Distributors Pvt. Ltd

Reference Books:
2. Tipps und Uebungen A1

Online Resources:
1. Practice Material like online Worksheets regarding the Grammar.
2. NPTEL COURSE ON GERMAN -II LANGUAGE
3. ONLINE GERMAN-ENGLISH DICTIONARY www.leo.org

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Audit Course
AUDIT COURSE – FOREIGN LANGUAGE LEVEL-II –(JAPANESE)

Course Code:	IOHSM6AC	Credit	1
Contact Hours:	01Hr/Week	Type of Course:	Lecture
Examination scheme:	Term-work 25 marks		

Pre-requisites:
Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To understand the basics of the Japanese writing system, including Kanji characters.
2	To indicate an action or motion in progress, describe habitual actions, and express permission and prohibition.

Course Outcomes: Students will be able to

6AC.1	Demonstrate basic communication skills.
6AC.2	Describe their daily routines in Japanese.
6AC.3	Describe things, people, and places using appropriate adjectives.
6AC.4	Express the existence or presence of a thing or a person in different contexts.

Topics covered:

UNIT I: Kanji (2 hrs.)
Introduction to Kanji Script, Describing one's daily routine. To ask what someone does. Expressions of Giving & Receiving.

UNIT II: Adjectives (2 hrs.)
Adjectives (Types of adjectives) Asking for an impression or an opinion about a thing / person / place that the listener, Has experienced, visited, or met , Describing things / person / places with the help of the adjectives.

UNIT III: Comparative Expressions (2 hrs.)
Expressions of Like & Dislikes. Expressing one's ability, hobby Comparison between objects, persons & cities.

UNIT IV: Spatial Basics (2 hrs.)
Stating existence or a presence of thing (s), person (s) Relative positions, Counters.

UNIT V: Action Directives (2 hrs.)
Expressing one's Desire & wants Verb groups, Asking, Instructing a person to do something.

UNIT VI: Progressive Phrases (2 hrs.)
Indicating an action or motion is in progress. Describing habitual action Describing a certain continuing state which resulted from a certain action in the past. Express permission & prohibition.

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Guidelines for Assessment (Any one of following but not limited to)
- Written Test
- Presentation

- Report

Text Books:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Textbook 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. George Trombley, Yukari Takenaka "Japanese from Zero!" Learn From Zero Publisher

MOOC/NPTEL courses

1. NPTEL Course on "JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi) " Link of the Course: https://onlinecourses.nptel.ac.in/noc23_hs76/preview
2. **NPTEL Course on**" Introduction to Japanese Language and Culture"
3. Link of the Course :https://onlinecourses.nptel.ac.in/noc19_hs52/preview

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Third Year Information Technology (2022 Course)
Lifelong Learning Skill-III

Course Code:	IOLLC6L3	Credit:		1
Examination Scheme	Term-work 25 Marks			

Lifelong Learning Skills courses introduced for holistic development of students where all the students are required to acquire 1 credit in 4th semester from **Extracurricular Activities** which will have grades as below. Activity Certificate obtained either in 3rd sem or 4th sem from below mentioned activities will be considered for grading in 4th sem.

Extracurricular Activities:

Sr. No.	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Sports	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O
2.	NSS/NCC	Camp	Attended	B		
		Camp + 5 Activities	Attended	B+		
		Camp + 10 Activities	Attended	A		
		Camp + 15 Activities	Attended	A+		
		Camp + 20 Activities	Attended	O		
3.	Cultural	Inter collegiate	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O
4.	Community Engagement	Certified by NGO/Authorities with report and geo-tagged photograph	1 Activity	B		
			2 Activities	B+		
			3 Activities	A		
			4 Activities	A+		
			5 Activities	O		

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Third Year Information Technology (2022 Course) Lifelong Learning Skill -IV				
Course Code:	**IOLLC6L4**	**Credit:**		**1**
Examination Scheme	Term-work 25 Marks			

Lifelong Learning Skills courses introduced for holistic development of students where all the students are required to acquire 1 credit in 4th semester from **Co-curricular Activities** which will have grades as below. Activity Certificate obtained either in 3rd sem or 4th sem from below mentioned activities will be considered for grading in 4th sem.

Co-curricular Activities:

Sr. No	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Conference	National	Participation	B	Prize winner	A
		International	Participation	B+	Prize winner	A+
		International (Scopus indexing)	Participation	A+	Prize winner	O
2.	Journal Publication	Non-refereed but recognized and reputed journal/ periodical, having ISSN number.	Publication	B		
		Refereed Journal - As listed by UGC	Publication	A		
		Refereed Journals- As listed by Scopus	Publication	A+		
		Refereed Journals - As listed by SCI/ SCIE	Publication	O		
3.	Hackathon		Participation	A+	Prize winner	O
4.	Professional Body	National	Membership	P	3rd Prize	A
			Activities/participation	B	2nd Prize	A+
			5 participations	B+	1st Prize	O
5.	Internship	1 week	Completed	C		
		2 week	Completed	B		
		3 week	Completed	B+	Sponsored Project	A+
		4 week	Completed	A	Job through internship	O
6.	Entrepreneurship	Awareness camp	Attended	A	Product Developed	A+
					Own Startup	O
7.	Project/Technical events	Inter collegiate	Participation	P	Prize winner	C
		University	Participation	C	Prize winner	B
		Zonal	Participation	B	Prize winner	B+
		State	Participation	B+	Prize winner	A
		National	Participation	A	Prize winner	A+
		International	Participation	A+	Prize winner	O

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