

## Faculty of Science and Technology

### NEPv23 Master of Science (M.Sc. Computer Software) Full Time Two Years Degree Programme

#### POs of PG Programme (M.Sc. Computer Software)

The post-graduate students, after successfully completing their study of postgraduate M.Sc. programme, would acquire following characteristics attributes.

At the end of the programme, students would be able to

- PO1 (Deep subject Knowledge and intellectual breadth) Apply the subject knowledge to the solution of real-world problems.
- PO2 (Professional Ethics) Apply ethical principles and commit to professional ethics and responsibilities and norms of the standard practices.
- PO3 (Creative & Critical Thinking) Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO4 (Innovation, Research and Problem Solving) Identify, formulate, review research literature, and analyze complex problems reaching substantiated and innovative conclusions.  
Design solutions for complex problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.  
Use research-based knowledge and research methods to provide valid conclusions. Demonstrate the knowledge of, and need for sustainable development.
- PO5 (Team work and Communication Skills) Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.  
Present/communicate research at national/international level, write effective articles, reports and design documentation, make effective presentations, and give and receive clear instructions.  
Communicate disciplinary knowledge to the community and broader public.
- PO6 (Professionalism and Leadership) Readiness Demonstrate personal accountability and effective work habits, e.g., punctuality, working productively with others, and time as well as workload management.  
Demonstrate integrity and ethical behavior, act responsibly with the interests of the larger community in mind, and to learn from his/her mistakes.  
Use the strengths of others to achieve common goals, and use interpersonal skills to coach and develop others.  
Assess and manage his/her emotions and those of others; use empathetic skills to guide and motivate; and organize, prioritize, and delegate work.
- PO7 (Lifelong learning) Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
- PO8 (Competence for Digital World) Prepare well for living, learning and working in a Digital Society;  
Create, select, and apply appropriate techniques, resources, and modern ICT tools to complex activities with an understanding of the limitations.  
Use existing digital technologies ethically and efficiently to solve problems, complete tasks, and accomplish goals. Demonstrate effective adaptability to new and emerging technologies.
- PO9 (Global Citizenship) Act with an informed awareness of global issues. Engage in initiatives that encourage equity and growth for all.

#### PSOs for M.Sc. Computer Software programme

The student graduating with the Degree M.Sc. Computer Software would be able to

PSO-1: Acquire subtle and detailed knowledge in computer software

PSO-2: Identify, analyse, design, optimize and implement system-solutions using appropriate algorithms of varying complexity

PSO-3: Use Basic knowledge in software methods and tools for solving real-life and R&D problems

PSO-4: Work in multidisciplinary teams in small- and large-scale projects by utilizing modern software tools and emerging technologies to develop complex products for the societal needs.

PSO-5: Become Specialist in Data mining, embedded systems, Mobile computing, distributed computing, Image processing, Pattern recognition, Virtualization techniques and Cloud Computing.

PSO-6: Become competent and complete software professional to meet the requirement of corporate world and Industry standard to provide solutions to industry, society and business.

PSO-7: Apply latest technologies for analysis and synthesis of computing systems through quantitative and qualitative techniques with a view to solve problems in the areas of Information Technology.

## Employability Potential of M.Sc. Computer Software Programs

The computer science industry is projected to grow at 22% between 2020 and 2030. According to industry experts, this rate is faster than the average of all other occupations. All technological advancements need a good amount of research into computer technology and therefore it corresponds to growth in this sector too. Computer and research scientists are also sought after in today's times because of the interdependency on technological advancements and interventions. Another area where computer experts are making a mark is cyber security. This sector is also seeing great potential for cyber experts as cyberattacks have become quite common and software engineers and analysts are required to devise ways to minimize these threats. They create new programming languages for this purpose.

**Several job opportunities:** The computer science industry has a number of excellent career opportunities that ensure a good salary and ample scope for growth. Let us look at some of the key job positions:

**Information Security Analyst** – This job entails protecting information and coming up with ways to securely deal with technological advancements.

**Computer Systems Analyst** – They design software and systems as per the requirements of individual companies. They also maintain and analyze the health of the software systems.

**Software Developer** – They develop software programmes and applications. This profile is projected to grow by over 20% in the next decade.

**Web Developer** – They design websites and web pages for new organizations and businesses. There is a constant demand for web developers because businesses are always expanding and there is a demand to revamp systems and business interfaces.

Some of the companies employing MSc graduates include:

Accenture, Alameda Technology, Solutions, Clearstream, Dell EMC, Ericsson, Erriga Inc., Firefox, IBM, VMware to mention but a few. The technology sector is going from strength to strength across all disciplines, with roles such as including Project Manager, Business Analyst, Product Manager, Java and .Net Developer, Security, Systems Administrators and Network Engineers set to continue to be popular roles in the years to come.

The market for AI/ Machine Learning professionals is forecast to become even more important as we anticipate more employers will begin advertising specialized roles in this niche area.



Sant Gadge Baba Amravati University, Amravati

FACULTY: Science &amp; Technology

Scheme of Teaching, Learning, Examination & Evaluation leading to Two Years PG Degree (Master of Computer Software) following Three Years UG Programme wef 2023-24(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry OptionM.Sc.-- (Computer Software-) First Year Semester-I

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme								
				Teaching Period Per Week				Credits				Maximum Marks					Minimum Passing			
				L	T	P	Total	L/T	Practical	Total		Theory		Practical		Total Marks	Marks Internal	Marks External	Grade	
												Theory Internal	Theory +MCQ External	Internal	External					
1.	1 Research Methodology and IPR	RM & IPR	NIMCSW1	4	-	-	4	4	-	4	3	30	70		100	12	28	P		
2.	2 Computer System Organization	DSC-I	NIMCSW2	4	-	-	4	4	-	4	3	30	70		100	12	28	P		
3.	3 Data Structure with OOP	DSC-II	NIMCSW3	4	-	-	4	4	-	4	3	30	70		100	12	28	P		
4.	4 Database Management Technologies	DSC-III	NIMCSW4	4	-	-	4	4	-	4	3	30	70		100	12	28	P		
5.	5 Compiler Construction / MOOC	DSE-I/MOOC	NIMCSW5(1)	3	-	-	3	3	-	3	3	30	70		100	12	28	P		
6.	6 Software Testing / MOOC	DSE-II/MOOC	NIMCSW5(2)																	
7.	7 Software Engineering /MOOC	DSE-I(3)/ MOOC	NIMCS5(3)																	
<b>Laboratories</b>																<b>Minimum Passing Marks</b>		<b>Grade</b>		
8.	Programming based on 2, 3 using C/ C++/ Java/ ALP	Lab-I	NIMCSW6	-	-	2	2	-	1	1	3	-	-	25	25	50	25	P		
9.	SQL/DBMS tools, MS-SQL based on 4	Lab-II	NIMCSW7	-	-	2	2	-	1	1	3	-	-	25	25	50	25	P		
10.	Lab Based on DSE I (1)/ DSE-I (2)/ DSE-I(3) /MOOC Lab**	Lab-III	NIMCSW8	-	-	2	2	-	1	1	3	-	-	25	25	50	25	P		
<b>On Job Training, Internship</b>																				
11.	# On Job Training, Internship/Apprenticeship; Field projects <b>Related to Major @ during Vacations cumulatively</b>	Related to DSC	NIMCSW9	120 Hours cumulatively during vacations of Semester I and Semester II							4*									P*
11.	Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/ Visual/Performing Arts During Semester I, II, III and IV	Generic Optional	NIMCSW10	90 Hours Cumulatively From Sem-I to Sem-IV																
<b>TOTAL</b>										22					650					

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: Prq, Theory : Th, Practical/Practicum: Pr, Faculty Specific Core: FSC, Discipline Specific Core: DSC, Discipline Specific Elective: DSE, Laboratory: Lab, OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; RM: Research Methodology; Research Project: RP, Co-curricular Courses: CC

Note : # On Job Training, Internship/ Apprenticeship; Field projects **Related to Major (During vacations of Semester I and Semester II) for duration of 120 hours mandatory to all the students, to be completed during vacations of Semester I and/or II. This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

**\*\*Students should opt MOOC Courses equivalent to given electives of 45 hours to 55 hours having minimum 3 credits . There will be no internal assessment for the MOOC theory courses whereas they should perform the practicals for the opted MOOC Courses in DSE Practicals.**

**Evaluation of MOOC Practicals will be same as that of DSE**



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(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry Option  
M.Sc. - (Computer Software) First Year Semester-II [Level6.0])**

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme								
				Teaching Period Per Week				Credits				Maximum Marks					Minimum Passing			
				L	T	P	Total	L/T	Practical	Total		Theory	Practical	Total Marks	Marks Internal	Marks External	Grade			
1.	Operating System Algorithms	DSC IV	N2MCSW1	4	-	-	4	4	-	4	3	30	70					-	-	100
2.	Graphics Application programming	DSC V	N2MCSW2	4	-	-	4	4	-	4	3	30	70	-	-	100	12	28	P	
3.	Computer Network & Wireless Technology	DSC VI	N2MCSW3	4	-	-	4	4	-	4	3	30	70	-	-	100	12	28	P	
4.	IoT /MOOC	DSE II(1)/MOOC	N2MCSW4(1)	3	-	-	3	3	-	3	3	30	70	-	-	100	12	28	P	
5.	Mobile Computing / MOOC	DSE II(2)/MOOC	N2MCSW4(2)																	
6.	6. Data Mining Data Warehouse/ MOOC	DSE II (3)/MOOC	N2MCSW4(3)																	
<b>Laboratories</b>																	<b>Minimum Passing Marks</b>			
7.	Lab IV- Programming based on 1 using C / C++ / Java	Lab-IV	N2MCSW5			2	2		1	1	3			25	25	50	25		P	
8.	Lab V- Programs on Graphics Application based on 2	Lab-V	N2MCSW6			2	2		1	1	3			25	25	50	25		P	
9.	Lab VI Based on DSE II (1)/ DSE II (2)/ DSE II (3)/MOOC Lab**	Lab-VI	N2MCSW7			2	2		1	1	3			25	25	50	25		P	
<b>On Job Training /Internship</b>																				
10.	# On Job Training, Internship/Apprenticeship;Fieldprojects Related to Major @during vacations cumulatively	<b>Related to Major</b>	N2MCSW8	120 Hours cumulatively during vacations of Semester-I And Semester-II							4*									P*
11.	Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/ Visual / Performing Arts during Semester I, II, III and IV	<b>Generic Optional</b>	N2MCSW9	90 Hours Cumulatively From Sem-I to Sem -IV																
<b>Exit Option with a PG Diploma with 4 Credits On-the-job training/internship in the respective Major subject</b> • Student has to earn Total minimum 4 Credits cumulatively during Vacations of Semester I and Semester II from internship in order to exit after First Year with PG Diploma (42-44 Credits) after Three Year UG Degree																				
<b>TOTAL</b>										18+4*						550				

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Pre-requisite Course mandatory if applicable: Prq, Theory : Th, Practical/Practicum: Pr, Faculty Specific Core: FSC, Discipline Specific Core: DSC, Discipline Specific Elective: DSE, Laboratory: Lab, OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; RM: Research Methodology; Research Project: RP, Co-curricular Courses: CC

Note : # On Job Training, Internship/ Apprenticeship; Field projects **Related to Major (During vacations of Semester I and Semester II) for duration of 120 hours mandatory to all the students, to be completed during vacations of Semester I and/or II.**

**This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

**\*\*Students should opt MOOC Courses equivalent to given electives of 45 hours to 55 hours having minimum 3 credits . There will be no internal assessment for the MOOC theory courses whereas they should perform the practicals for the opted MOOC Courses in DSE Practicals. Evaluation of MOOC Practicals will be same as that of DSE**



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**(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry Option**

**M.Sc.-- ( Computer Software) Second Year Semester-III**

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme								
				Teaching Period Per Week				Credits				Maximum Marks			Minimum Passing					
				L	T	P	Total	L/T	Practical	Total		Theory Internal	Theory+ MCQ External	Internal	External	Total Marks	Marks Internal	Marks External	Grade	
1.	Open-Source Software Technologies	DSC VII	N3MCSW1	4	-	-	4	4	-	4	3	30	70			100	12	28	P	
2.	Web Development and CMS	DSC VIII	N3MCSW2	4	-	-	4	4	-	4	3	30	70			100	12	28	P	
3.	Cyber Security and Digital Forensics	DSC IX	N3MCSW3	4	-	-	4	4	-	4	3	30	70			100	12	28	P	
4.	Distributed Systems/MOOC	DSE III(1)	N3MCSW4(1)																	
5.	Cloud Computing/MOOC	DSE III(2)	N3MCSW4(2)	3	-	-	3	3	-	3	3	30	70			100	12	28	P	
6.	OOSE/MOOC	DSE III (3)	N3MCSW4(3)																	
<b>Laboratories</b>																<b>Minimum Passing Marks</b>				
7.	Linux/Python/MySQL based on 1	Lab-VII	N3MCSW5		-	2	2	-	1	1	3			25	25	50	25		P	
8.	Web development tools/ CMS tools based on 2	Lab-VIII	N3MCSW6		-	2	2	-	1	1	3			25	25	50	25		P	
9.	Lab Based on DSE III (1)/ DSE III (2)/ DSE III (3) /MOOC Lab**	Lab-IX	N3MCSW7		-	2	2	-	1	1	3			25	25	50	25		P	
<b>On Job Training /Internship</b>																				
10.	<b>ResearchProjectPhase-I</b>	<b>Major</b>			2	4	6	2	2	4				50	--	50	25		P	
11.	Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/ Visual/Performing Arts During Semester I,II,III and IV	Generic <b>Optional</b>		<b>90 Hours Cumulatively From Sem-I to Sem-IV</b>																
<b>TOTAL</b>											22					600				

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: Prq, Theory : Th, Practical/Practicum: Pr, Faculty Specific Core: FSC, Discipline Specific Core: DSC, Discipline Specific Elective: DSE, Laboratory: Lab, OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; RM: Research Methodology; Research Project: RP, Co-curricular Courses: CC



Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

**\*\*Students should opt MOOC Courses equivalent to given electives of 45 hours to 55 hours having minimum 3 credits . There will be no internal assessment for the MOOC theory courses whereas they should perform the practicals for the opted MOOC Courses in DSE Practicals. Evaluation of MOOC Practicals will be same as that of DSE**

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**M.Sc.- (Computer Software) Second Year Semester-IV [Level6.5]**

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme								
				Teaching Period Per Week				Credits				Maximum Marks			Minimum Passing					
				L	T	P	Total	L/T	Practical	Total		Theory	Practical	Total Marks	Marks Internal	Marks External	Grade			
												Theory Internal	Theory+M CQ External	Internal	External					
1.	Data Mining & Data Warehousing	DSC X	N4MCSW1	4	-	-	4	4	-	4	3	30	70	-	-	100	12	28	P	
2.	Machine Learning	DSC XI	N4MCSW2	4	-	-	4	4	-	4	3	30	70	-	-	100	12	28	P	
3.	Android Programming	DSC XII	N4MCSW3	4	-	-	4	4	-	4	3	30	70	-	-	100	12	28	P	
4.	Big Data Analytics / MOOC	DSE IV(1)	N4MCSW4(1)	3	-	-	3	3	-	3	3	30	70	-	-	100	12	28	P	
5.	Software Project Management / MOOC	DSE IV(2)	N4MCSW4(2)																	
6.	Robotics / MOOC	DSE IV(3)	N4MCSW4(3)																	
<b>Laboratories</b>																	<b>Minimum PassingMarks</b>			
7.	Lab-X based on 1,2 Tools for Data mining / ML	Lab-X	N4MCS6	-	-	2	2	-	1	1	3	-	-	25	25	50	25		P	
8.	Lab-XI based on 3- Android Programming	Lab-XI	N4MCS7	-	-	2	2	-	1	1	3	-	-	25	25	50	25		P	
9.	Lab Based on DSE IV(1)/DSE IV(2)/ DSE IV(3) /MOOC Lab**	Lab-XII	N4MCS8	-	-	2	2	-	1	1	3	-	-	25	25	50	25		P	
10.	<b>Research Project Phase-II</b>	<b>Major</b>			2	8	10	2	4	6	3			75	75	150	75		P	
11.	Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I,II,III And IV	<b>Generic Optional</b>		<b>90 Hours Cumulatively From Sem-I to Sem-IV</b>																
<b>TOTAL</b>											24					700				

**L: Lecture, T: Tutorial, P: Practical/Practicum**

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT**: On Job Training: Internship/ Apprenticeship; Field projects: **FP**; **RM**: Research Methodology; Research Project: **RP**, **Co-curricular Courses: CC**

Note: **Co-curricular Courses**: In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

**\*\*Students should opt MOOC Courses equivalent to given electives of 45 hours to 55 hours having minimum 3 credits. There will be no internal assessment for the MOOC theory courses whereas they should perform the practicals for the opted MOOC Courses in DSE Practicals. Evaluation of MOOC Practicals will be same as that of DSE.**

**Table: Comprehensive Credits distribution amongst the type of Courses over Two Years (Four Semesters)  
PG Programme and Minimum Credits to be earned for PG Degree [Master inFaculty -----Major ]**

Sr. No.	Type of Course	Total Credits Offered	Minimum Credits Required
<b>1</b>	<b>MAJOR</b>		
	<b>i. DSC</b>	<b>56</b>	<b>56</b>
	<b>ii. DSE</b>	<b>16</b>	<b>16</b>
	<b>TOTAL</b>	<b>72</b>	<b>72</b>
<b>2</b>	<b>Research Methodology and IPR (FSC/DSC:Major)</b>	<b>04</b>	<b>04</b>
<b>2</b>	On Job Training, Internship/ Apprenticeship;Field projects <b>Related to Major</b>	<b>04</b>	<b>04 for 120 Hours OJT/FP cum. (Minimum 60 Hours OJT/FP is mandatory)</b>
<b>3</b>	<b>Research Project</b>	<b>10</b>	<b>10</b>
	<b>OPTIONAL</b>		
<b>4</b>	<b>Co-Curricular Courses (offline and/or online as applicable): Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts, CC also include but not limited to Academic activitieslike paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.).</b>		<b>Limited to Maximum 03 only (For 90 Hours of CC cumulatively)</b>
	<b>TOTAL</b>		
	<b>TOTAL</b>	<b>93</b>	<b>88</b>

**Table A: Comprehensive Credit Distribution for CC**

S. N.	Activities (offline/online as applicable)	Credits at Levels						Letter Grade
		College	University	State	Zone if exist	National	International if exist	
1	Health and wellness, Yoga* Competitions *If a Course (online/offline) on Yoga is completed for 60 Hours, 2credits will be awarded to the student (1 Credit = 30 Hours)	1	2	3	4	5	6	P (Pass)
2	Unnat Bharat Abhiyan [UBA]	1	2	3	4	5	6	P (Pass)
3	Sports and fitness activities (see separate <b>Table B</b> )	1	1 / 2	2 / 3	3 / 4	4 / 5	5 / 6	P (Pass)
4	Cultural activities, Fine/Applied/Visual/Performing Arts	1	2	3	4	5	6	P (Pass)
5	N.S.S. activities Camps	1	2	3	4	5	6	P (Pass)
6	Academic activities like Research Paper/Article/Poster presentations, Aavishkar, start-up, Hackathon, Quiz competitions, other curricular, co-curricular activities, students exchange programme etc.	1	2	3	4	5	6	P (Pass)
	Research Paper/Article published	--	1	2	-	4	6	P (Pass)
7	Participation in Summer school/ Winter School / Short term course	2 Credits						P (Pass)
	(not less than 30 hours 1 or 2 weeks duration)(not less than 60 hours 2 or 3 weeks duration)	4 Credits						P (Pass)
	Scientific Surveys, Societal Surveys	2 Credits						P (Pass)
	Field Visits, Study tours, Industrial Visits,	1 Credit						P (Pass)
8	NCC Activities	As given in <b>Table C</b>						

**Table B: Credit Distribution for Sports and Fitness**

Sr. No.	Particulars of Sports Status ( Individual/ Team )	Credits	Letter Grade
1	College Level Participation	1	P (Pass)
2	University Level Participation	1	P (Pass)
3	University Level Rank 1, 2, 3	2	P (Pass)
4	State Level Participation	2	P (Pass)
5	State Level Rank 1, 2, 3	3	P (Pass)
6	Zonal Level Participation	3	P (Pass)
7	Zonal Level Rank 1, 2, 3	4	P (Pass)
8	National Level Participation	4	P (Pass)
9	National Level Rank 1, 2, 3	5	P (Pass)
10	International Level Participation	5	P (Pass)
11	International Level 1,2,3	6	P (Pass)

**Table C: Credit Distribution for NCC activities**

Sr. No.	Particulars of NCC Activities	Credits	LetterGrade
1	Participation in NCC activities	1	P (Pass)
2	'B' Certificate obtained	2	P (Pass)
3	'C' Certificate obtained	3	P (Pass)
4	State Level Participation	4	P (Pass)
5	National level Participation	5	P (Pass)
6	International Level Participation	6	P (Pass)

## Appendix -D

### **N1MCS5 (1) DSE-I (1) Compiler Construction**

a. Compiler Design

By Prof. Santanu Chattopadhyay | IIT Kharagpur

Duration: 12 weeks

Credit Points : 3

Start Date : 18 Jan 2021

End Date : 09 Apr 2021

### **N1MCS5 (2) DSE-I (2) Software Testing**

a. Software testing (IIITB)

By Prof. Meenakshi D'souza | IIIT Bangalore

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

b. Software Testing (IITKGP)

Duration : 4 weeks

Credit Points : 1

Level : Undergraduate/Postgraduate

Start Date : 24 Jul 2023

End Date : 18 Aug 2023

Enrollment Ends : 31 Jul 2023

### **DSE I(3)/ N1MCS5(3) Software Engineering**

a. Software Engineering

By Dr. B. LAVANYA, Assistant Professor | University of Madras

Duration : 12 weeks

Credit Points : 4

Start Date : 30 Jan 2020

End Date : 30 Apr 2020

b. Software Engineering

By Prof.Rajib Mall | IIT Kharagpur

Duration : 12 weeks

Credit Points : 3

Start Date : 29 Jul 2019

End Date : 18 Oct 2019

**DSE II (1)/ N2MCS4(1): Internet of Things**

a. Introduction To Internet Of Things

By Prof. Sudip Misra | IIT Kharagpur

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

b. Introduction To Industry 4.0 And Industrial Internet Of Things

By Prof. Sudip Misra | IIT Kharagpur

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

**DSE II(2)/N2MCS4(2) : Mobile Computing**

a. Android Mobile Application Development

By Dr. Himanshu N. Patel | Dr. Babasaheb Ambedkar Open University (BAOU), Ahmedabad

Duration : 12 weeks

Credit Points : 4

Start Date : 31 Jul 2023

**DSE II(3)/ N2MCS4(3) : Data Mining and Data Warehousing**

a. Data Mining

By Prof. Pabitra Mitra | IIT Kharagpur

Duration : 8 weeks

Credit Points : 2

Start Date : 15 Feb 2021

End Date : 09 Apr 2021

b. Data Mining

By Mr. L. Abraham David | St.John's College, Palayamkottai Tirunelveli

Duration : 12 weeks

Credit Points : 4

Start Date : 06 Aug 2019

End Date : 10 Oct 2019

**DSE III(1) N3MCS4(1): Distributed computing**

a. Distributed Systems

By Prof. Rajiv Misra | IIT Patna

Duration : 8 weeks

Credit Points : 2

Start Date : 26 Jul 2021

End Date : 17 Sep 2021

b. Cloud Computing and Distributed Systems

By Prof. Rajiv Misra | IIT Patna

Duration : 12 weeks

Credit Points : 3

Start Date : 23 Jan 2023

End Date : 17 Mar 2023

**DSE III(2)/N3MCS4(2)- Network Security**

a. Cryptography And Network Security

By Prof. Sourav Mukhopadhyay | IIT Kharagpur

Duration : 12 weeks

Credit Points : 3

Start Date : 25 Jul 2022

End Date : 14 Oct 2022

**DSE III(3)/N3MCS4(3) - Theory of Computation**

a. Theory of Computation

By Prof. Raghunath Tewari | IIT Kanpur

Duration : 8 weeks

Credit Points : 2

Start Date : 26 Jul 2021

End Date : 17 Sep 2021

b. Theory of Computation

By Prof. Ragunath Tewari | IIT Kanpur

Duration : 8 weeks

Credit Points : 2

Start Date : 29 Jul 2019

End Date : 20 Sep 2019

**DSE IV(1)/N4MCS4(1)- Entrepreneurship Development**

a. Entrepreneurship development

By Dr. Nilam Panchal | B.K.School Of Professional And Management Studies, Gujarat University

Duration : 12 weeks

Credit Points : 4

Start Date : 31 Jul 2023

End Date : 22 Oct 2023

Enrollment Ends : 31 Aug 2023

b. Entrepreneurship

By Prof. C Bhaktavatsala Rao | IIT Madras

Duration : 12 weeks

Credit Points : 3



Start Date : 24 Jul 2023  
End Date : 13 Oct 2023  
Enrollment Ends : 31 Jul 2023  
Exam Registration Ends : 18 Aug 2023  
Exam Date : 29 Oct 2023 IST

c. Entrepreneurship And IP Strategy

By Prof. Gouri Gargate | IIT Kharagpur  
Duration : 8 weeks  
Credit Points : 2  
Start Date : 24 Jul 2023  
End Date : 15 Sep 2023  
Enrollment Ends : 31 Jul 2023  
Exam Registration Ends : 18 Aug 2023  
Exam Date : 24 Sep 2023 IST

d. Innovation, Business Models And Entrepreneurship

By Prof. Rajat Agrawal, Prof. Vinay Sharma | IIT Roorkee  
Duration : 8 weeks  
Credit Points : 2  
Start Date : 21 Aug 2023  
End Date : 13 Oct 2023  
Enrollment Ends : 21 Aug 2023  
Exam Registration Ends : 15 Sep 2023  
Exam Date : 29 Oct 2023 IST

e. Understanding Incubation And Entrepreneurship

By Prof. B.K. Chakravarthy | IIT Bombay  
Duration : 12 weeks  
Credit Points : 3  
Start Date : 24 Jul 2023  
End Date : 13 Oct 2023  
Enrollment Ends : 31 Jul 2023  
Exam Registration Ends : 18 Aug 2023  
Exam Date : 28 Oct 2023 IST

**DSE IV(2)/N4MCS4(2) - Cyber Security**

1. Cyber Security

By Dr.G.PADMAVATHI | Avinashilingam Institute for Home Science & Higher Education for Women,Coimbatore  
Duration : 15 weeks  
Credit Points : 4  
Start Date : 31 Jul 2023  
End Date : 31 Oct 2023  
Enrollment Ends : 31 Aug 2023

a. Cyber Security Tools Techniques and Counter Measures

By Prof. Dr. Nilesh K Modi | Dr. Babasaheb Ambedkar Open University, Ahmedabad, Gujrat

Duration : 12 weeks

Credit Points : 4

Level : Certificate

b. Cyber Security and Privacy

By Prof. Saji K Mathew | IIT Madras

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

Exam Registration Ends : 18 Aug 2023

Exam Date : 28 Oct 2023 IST

c. Introduction to Cyber Security

By Dr. Jeetendra Pande | Uttarakhand Open University, Haldwani

Duration : 12 weeks

Credit Points : 4

Level : Undergraduate

Start Date : 31 Jul 2023

d. Security Analysis & Portfolio Management

By Prof. J. P. Singh | IIT Roorkee

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

Exam Registration Ends : 18 Aug 2023

Exam Date : 28 Oct 2023 IST

e. Privacy And Security In Online Social Media

By Prof. Ponnurangam Kumaraguru | IIIT Hyderabad

Duration : 12 weeks

Credit Points : 3

Start Date : 24 Jul 2023

End Date : 13 Oct 2023

Enrollment Ends : 31 Jul 2023

Exam Registration Ends : 18 Aug 2023

Exam Date : 28 Oct 2023 IST

**DSE IV (3)/N4MCS4(3) Data Science and Analytics**

a. Foundation of Data Science

By Dinesh Kumar | Indian Institute of Management Bangalore (IIMB)

Duration : 8 weeks

Credit Points : 2

Start Date : 31 Jul 2023

End Date : 31 Oct 2023

Enrollment Ends : 31 Aug 2023

b. Data Science For Engineers

By Prof. Rangunathan Rengasamy, Prof. Shankar Narasimhan | IIT Madras

Duration : 8 weeks

Credit Points : 2

Start Date : 24 Jul 2023

End Date : 15 Sep 2023

Enrollment Ends : 31 Jul 2023

Exam Registration Ends : 18 Aug 2023

**Syllabus PG Programme: M.Sc. (Computer Science)  
First Year Semester: I**

**FSC-RM/N1MCS1 Research Methodology & IPR**

**Course Outcomes:**

On completion of this course, students would be able to:

1. Study the basic concepts of research and related methodologies.
2. Identify appropriate research problem and good research designing.
3. To develop and implement the techniques of data collection, analysis of data and interpretation.
4. Describe foundational knowledge, learn, adapt and successfully apply analytical and computational approaches on changing societal and technological challenges
5. Learning research tools.
6. To study the IPR, Patent, Copyright, Design patent, and Trademark.

Unit	Contents	Periods
I	<p><b>Introduction:</b> Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research.</p> <p><b>Defining the Research Problem:</b> What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.</p>	10
II	<p><b>Reviewing the literature:</b> Place of the literature review in research, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Knowledge of IKS, Writing about the literature reviewed.</p> <p><b>Research Design:</b> Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs.</p>	10
III	<p><b>Methods of Data Collection/ Required Data Sets:</b> Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Research: methods to search required information effectively Reference Management Software like Zotero/ Mendeley.</p>	10
IV	<p><b>Processing and Analysis of Data:</b> Processing Operations, Some Problems in Processing, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association in Case of Attributes, Other Measures</p>	10
V	<p><b>Interpretation of Data and Paper Writing:</b> Publishing research papers:- Structure of a research paper, Layout of a Research Paper, Journals in Computer Science, awareness on paper publication, formats-IEEE Tran, Impact factor, h, hb, g indices, research repositories- WoS&amp; Scopus; DOI, Plagiarism and Plagiarism checking and detection tools.</p>	10
VI	<p><b>Tools used for Research and IPR: Trends</b> in research of computer science, Dataset available, Introduction to Research tools (e.g. Data Mining tool, Network Simulators, Cloud Simulators, Data analytics Tool etc.), <b>Intellectual property rights:</b> New Developments in IPR, Administration of Patent System; IPR of Computer Software, Computer hardware etc., <b>Patents:</b> Scope of Patent Rights. Licensing and transfer of technology, Copyright.</p>	10
<b>Text books:</b>		
1. Handbook of Research Methodology- Dr. Shanti Bhushan Mishra, Dr.Shashi Alok		

Edu creation Publishing. 2. A Beginners Guide to Latex Paperback – Illustrated, by <a href="#">Chetan Shirore</a> ,	
<b>Reference Books:</b> 1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition 2. Business Research Methods – Alan Bryman& Emma Bell, Oxford University Press. 3. 3. Research Methodology – C.R. Kothari	
<b>Web links:</b> 1. <a href="https://onlinecourses.swayam2.ac.in/aic21_ge02/preview">https://onlinecourses.swayam2.ac.in/aic21_ge02/preview</a> 2. <a href="https://onlinecourses.nptel.ac.in/noc23_ge36/preview">https://onlinecourses.nptel.ac.in/noc23_ge36/preview</a> 3. <a href="https://onlinecourses.swayam2.ac.in/nou23_cm06/preview">https://onlinecourses.swayam2.ac.in/nou23_cm06/preview</a> 4. <a href="https://onlinecourses.swayam2.ac.in/cec23_ge07/preview">https://onlinecourses.swayam2.ac.in/cec23_ge07/preview</a> 5. <a href="https://onlinecourses.nptel.ac.in/noc23_hs128/preview">https://onlinecourses.nptel.ac.in/noc23_hs128/preview</a> 6. <a href="https://onlinecourses.swayam2.ac.in/nou22_hs85/preview">https://onlinecourses.swayam2.ac.in/nou22_hs85/preview</a> 7. <a href="https://onlinecourses.swayam2.ac.in/nou23_hs38/preview">https://onlinecourses.swayam2.ac.in/nou23_hs38/preview</a>	

### N1MCS2/DSC1 Computer System Organization

#### Course Outcomes:

After completion of this course student will be able to:

Learn the concepts of computer organization for several engineering applications.

1. Develop the ability and confidence to use the fundamentals of computer organization as a tool in the engineering of digital systems.
2. Work and identify the different hardware of CPU and performs operation on them.
3. To identify, formulates, and solves hardware and software computer engineering problems using sound computer engineering principle.
4. To impart the knowledge on micro programming
5. To comprehend the concepts of advanced pipelining techniques.

Unit	Contents	Periods
I	Basic Functional units of Computers: Functional units, basic Operational concepts, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating point Representations. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.	10
II	Register Transfer Language and Micro Operations: RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro operations, Arithmetic logic shift unit. Basic Computer Organization and Design: Computer Registers, Computer instructions, Instruction cycle. Instruction codes, Timing and Control, Types of Instructions: Memory Reference Instructions, Input – Output and Interrupt.	10
III	Central Processing Unit organization: General Register Organization, Stack organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors Control unit design: Design approaches, Control memory, Address sequencing, micro program example, design of CU. Micro Programmed Control.	10
IV	Memory Organization: Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address map, Associative memory-Hardware organization. Match logic. Cache memory-size vs. block size, Mapping functions-Associate, Direct, Set Associative mapping. Replacement algorithms, write policies. Auxiliary memory Magnetic tapes etc.	10
V	Input –Output Organization: Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor, I/O transfers–Program controlled, Interrupt driven, and DMA, interrupts and exceptions. I/O device interfaces – SCII, USB Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism Throughput and Speedup, Pipeline hazards.	10
VI	MULTI PROCESSORS: Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. Inter Processor Communication and Synchronization Cache Coherence. Shared Memory Multiprocessors	10
<b>Text books:</b> 1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition,		

McGraw Hill. 2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI	
<b>Reference Books:</b> 1. 1.“Computer Architecture and Organization”, 3rd Edition by John P. Hayes,WCB/McGraw-Hill 2. “Computer Organization and Architecture: Designing for Performance”, 10th Edition by i. William Stallings, Pearson Education. 3. “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry ii. F. Jordan, Pearson Education. 4. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI 5. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson 6. Fundamentals or Computer Organization and Design, - SivaraamaDandamudi Springer Int. Edition. 7. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier	
<b>Web Resources: Weblinks</b> 1. <a href="http://www.youtube.com/results?search_query=computer+system+organization+weblinks+nptel">www.youtube.com/results?search_query=computer+system+organization+weblinks+nptel</a> + 2. <a href="https://youtu.be/leWKvuZVUE8">https://youtu.be/leWKvuZVUE8</a> 3. <a href="https://youtu.be/Ol8D69VKX2k">https://youtu.be/Ol8D69VKX2k</a> 4. <a href="https://youtu.be/VG9VopzV_T0">https://youtu.be/VG9VopzV_T0</a> 5. <a href="https://nptel.ac.in/courses/106105163">https://nptel.ac.in/courses/106105163</a> 6. <a href="https://archive.nptel.ac.in/courses/106/105/106105163/">https://archive.nptel.ac.in/courses/106/105/106105163/</a> 7. <a href="https://onlinecourses.nptel.ac.in/noc21_cs61/preview">https://onlinecourses.nptel.ac.in/noc21_cs61/preview</a> 8. <a href="https://nptel.ac.in/courses/106106166">https://nptel.ac.in/courses/106106166</a>	

### NIMCS3/DSC II Data Structure with OOP

#### Course Outcomes:

After completion of this course student will be able to:

1. Learn the concepts of linear data structures such as arrays, linked lists, stacks and queues.
2. Understand and use the concepts of non-linear data structures such as trees & Graph.
3. Learn and understand various data searching and sorting methods with its complexity.
4. Demonstrate operations such as insertion, deletion, searching and traversing on data structures.
5. Analyse and apply specific sorting and searching methods depending upon factors like type of data, volume of data.
6. Learn & Understand B-tree indexing, hashing, collisions processing and its applications.

Unit	Contents	Periods
I	Arrays, Matrices and Linked List, Arrays, Arrays the Abstract Data Type, Array Representation, Matrices, Special Matrices, The Linear List- Array Representation, Data Objects and Structures, The Linear List Data structure, Array Representation, Vector Representation, Multiple List in a Single Array, Linear Lists- Linked Representation, Singly Linked Lists and Chain, Circular Lists and Header Nodes, Doubly Linked Lists, Sparse Matrices and its Representation, Searching in Array & Linked List.	10
II	Stacks and Queues, Stack: Definition and Application, Array Representation, Linked Representation, Applications, Queues: Definition and Application, Array Representation, Linked Representation, Applications, Priority Queue, Definition and Application.	10
II	Trees: Terminology and Concepts, Binary and Other Trees, Trees, Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Common Binary Trees Operations, Binary Trees Traversal, The ADT Binary Trees, The Class linked Binary Trees, Application, Binary Search Trees, Definition, Abstract Data Types, Binary Search Trees Operations and Implementation, Balanced Search Trees, AVL Trees.	10
IV	Sorting: Internal Sorting, Optimal Sorting Time, Sorting Objects, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort, External Sorting: Run Generation, Sorting with Tapes, Sorting with Disks.	10
V	Graphs: Definition, Representation of Graphs, Graph Implementation, Graph Traversals, Application of Graph Traversals, Minimum Cost Spanning Trees, Shortest Path Problems, All Pair Shortest Paths.	10

VI	Indexing: Indexed Binary Search Trees, B-Trees: Indexed Sequential Access Method (ISAM), m-Way Search Trees, B-Trees of Order m, Height of a B-Tree, Searching a B-Tree, Inserting into a B-Tree, Deletion from a B-Tree, Node Structure, Hashing: Hash Function, Collision Resolution, Rehashing, Extensible Hashing.	10
<b>Text books:</b> <ol style="list-style-type: none"> <li>“Data structure algorithms and Applications in C++” : SartajSahani (Second Edition Universities Press)</li> <li>“Object Oriented Data Structures Using C++: K. S. Easwarakumar (Vikas Publishing House Pvt Ltd)</li> </ol> <b>Reference Books:</b> <ol style="list-style-type: none"> <li>“Introduction to Data Structures” - Bhagat Singh &amp; T.L. Naps.</li> <li>“Data structures using C”-Tanenbaum, Langsam, Augenstein PHI</li> <li>“Classic Data Structures”, - D. Samanta PHI</li> <li>“Data structure and Program design in C” - Kruse, Leung, Tondo (PHI)</li> <li>“Data structure” - Tenanbaum</li> <li>“Data structure and algorithm analysis in C++ “: Mark Allan Welss, Addison wesley</li> <li><a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a></li> </ol>		
<b>Weblinks:</b> <ol style="list-style-type: none"> <li><a href="https://youtu.be/8hly31xKli0">https://youtu.be/8hly31xKli0</a></li> <li><a href="https://youtu.be/hCrO_cR7kno">https://youtu.be/hCrO_cR7kno</a></li> <li><a href="https://youtu.be/6wXZ_m3SbEs">https://youtu.be/6wXZ_m3SbEs</a></li> <li><a href="https://youtu.be/odW9FU8jPRQ">https://youtu.be/odW9FU8jPRQ</a></li> </ol>		

### N1MCS4/DSC III Data Base Management Technologies

#### Course Outcomes (COs):

On completion of this course, students would be able to:

- Understand and apply the basic concepts and principles of database systems, including their purpose, structure, design, query languages, and relational operations.
- Demonstrate understanding of data manipulation, retrieval, database management concepts and apply SQL query language effectively.
- Design efficient and normalized databases using the Entity-Relationship model and will be able to achieve good relational designs and improve database by normalization techniques.
- Apply knowledge of physical storage systems, data storage structures, and indexing techniques for efficient and effective management of databases.
- Comprehend and apply the fundamental concepts and techniques related to transactions (ACID property), concurrency control & Protocols, recovery mechanisms, deadlock handling, and recovery algorithms.
- Understand recent trends in database technology and analyze different database architectures, cloud- based services, No SQL databases, and big data storage systems based on Map Reduce and Hadoop.

Unit	Contents	Periods
I	<b>Introduction to DBMS and Relational Model:</b> Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Design ,Database Engine, Database and Application Architecture, Database Users and Administrators ,Structure of Relational Databases ,Database Schema, Keys ,Schema Diagrams, Relational Query Languages, Relational Operations, The Relational Algebra.	10
II	<b>Introduction to SQL:</b> Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization, Functions and Procedures, Triggers.	10
III	<b>Database Design Using the E-R Model:</b> The Entity-Relationship Model, Attributes & its types, Mapping Cardinalities, Participation Constraints, Keys, Removing Redundant Attributes in Entity Sets, E-R Diagrams, Reducing E-R	10

	Diagrams to Relational Schemas, Entity-Relationship Design Issues. <b>Relational Database Design:</b> Features of Good Relational Designs, Decomposition Using Functional Dependencies, Normal Forms:(1NF, 2NF, 3NF, BCNF, 4NF, 5NF), Functional-Dependency Theory, Decomposition Using Multivalued Dependencies.	
IV	<b>Physical storage Systems:</b> Types of Physical Storage Media, Storage Interfaces, Magnetic Disks, Flash Memory, RAID, Disk-Block Access. <b>Data Storage Structures:</b> File Organization, Organization of Records in Files, Data - Dictionary Storage, Database Buffer. <b>Indexing:</b> Basic Concepts, Ordered Indices, B <sup>+</sup> -Tree Index Files, Hash Indices, Bitmap Indices, Hash Function, Handling Bucket overflow, Static and Dynamic Hashing.	10
V	<b>Transactions:</b> Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serialize ability, Transaction Isolation and Atomicity. <b>Concurrency Control:</b> Lock- Based Protocols, Deadlock Handling, Time stamp Based Protocols, Validation Based Protocols, and Snapshot Isolation. <b>Recovery System:</b> Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, ARIES.	10
VI	<b>Database-System Architectures:</b> Overview, Centralized Database Systems, Server System Architectures, Parallel Systems, Distributed Systems, Transaction Processing in Parallel and Distributed Systems, Cloud-Based Services. <b>Emerging Database Technologies:</b> NoSQL Databases and Big Data Storage Systems, Big Data Technologies Based on Map Reduce and Hadoop.	10
<b>Textbooks :</b>		
<ol style="list-style-type: none"> <li>1. Database System Concepts,6th edition by Abraham Silberschatz, Henry F.Korth, S. Sudarshan McGraw-Hill.(referforunit1to6).</li> <li>2. Fundamentals ofDatabaseSystems,7theditionbyElmasriR.,NavatheS.,PearsonEducation, (referforunit6)</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. S.K.Singh, "Database Systems: Concepts, Design and Application".</li> <li>2. C.J.Date,"AnIntroductiontoDatabaseSystems",Addison-Wesley,8thEdition</li> <li>3. Rab P., Coronel C. "Database Systems Design, Implementation andManagement",5th edition,ThomsonCourseTechnology,2002</li> <li>4. Ramkrishna R.,Gehrke J. "Database Management Systems",3rdedition,McGrawHill</li> <li>5. Ivan Bayross,"SQL,PL/SQL the Programming Language of Oracle", BPB Publications. Kevin Roebuck, "Storing and Managing Big Data-NoSQL, HADOOP and More".</li> </ol>		
<b>Web Link :</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc23_cs79/previewhttps://nptel.ac.in/courses/106105175">https://onlinecourses.nptel.ac.in/noc23_cs79/previewhttps://nptel.ac.in/courses/106105175</a></li> <li>2. <a href="https://youtube.com/playlist?list=PLrjkTq13jnm-CLxHftqLgkrZbM8fUt0vn">https://youtube.com/playlist?list=PLrjkTq13jnm-CLxHftqLgkrZbM8fUt0vn</a></li> <li>3. <a href="https://youtube.com/playlist?list=PLWPirh4EWFpGrpcMfZ6UcdI786QdtSxV8">https://youtube.com/playlist?list=PLWPirh4EWFpGrpcMfZ6UcdI786QdtSxV8</a></li> <li>4. <a href="https://youtube.com/playlist?list=PLdo5W4Nhv31b33kF46f9aFjoJPOkdlRc">https://youtube.com/playlist?list=PLdo5W4Nhv31b33kF46f9aFjoJPOkdlRc</a></li> <li>5. <a href="https://livesql.oracle.com/apex/f?p=590:1000">https://livesql.oracle.com/apex/f?p=590:1000</a></li> <li>6. <a href="https://freevideolectures.com/course/2668/database-management-system">https://freevideolectures.com/course/2668/database-management-system</a></li> <li>7. <a href="https://www.geeksforgeeks.org/mongodb-an-introduction/">https://www.geeksforgeeks.org/mongodb-an-introduction/</a></li> <li>8. <a href="https://www.mongodb.com/docs/manual/">https://www.mongodb.com/docs/manual/</a></li> </ol>		

### N1MCS5 (1) DSE-I (1) Compiler Construction

#### Course Outcomes:

On completion of this course, students would be able to:

1. Explore the principles, algorithms, and data structures involved in the design and construction of compilers.
2. Write the machine dependent code and learn the all table involved in compiler design phases.
3. Learn the Static and dynamic memory allocation and their tables.
4. Design the flow graph for the intermediate codes.
5. Implements the knowledge to find lexical and syntax error and compile I/O statements.
6. Design a compiler for a simple programming language



Unit	Contents	Periods
I	Introduction to Compilers: Overview, typical compiler Structure, implementation. Programming Language Grammars: Elements of formal language grammars, derivation, reduction, syntax tree, ambiguity, regular grammars and expressions. Bootstrapping, Back patching.	7
II	Scanning and Parsing Techniques: The scanner, top-down and bottom-up parsing, Shift-reduce parsing, Operator –precedence parsing, syntax directed translation, Contents of symbol table, Symbol table organization, Hash table organization, Linked List and Tree structured symbol tables, symbol table organization for structures and records.	7
III	Memory Allocation: Static and dynamic memory allocation, array allocation and access, allocation for strings, structure allocation, common and equivalence allocation.	8
IV	Compilation of expressions: Intermediate code forms, Code generation for expressions. DFA, NFA, Turing Machine, S-attribute, L-attribute, Dependency graph. Compilation of control structures: Control transfers, procedural calls, conditional execution, iteration control constructs.	8
V	Error detection, indication and recovery: Lexical and Syntax errors, semantic errors, Run time errors, Debugging Aids and options. Compilation of I/O statements: Compilation of I/O list, compilation of FORMAT list, the I/O routine, file control.	8
VI	Code optimization: Major issues, optimizing transformations, local optimizations, and program flow analysis, Global optimization, folding (constant folding). Code Generation: Problems in code generation, machine model, and simple code generator. Writing compilers, YACC (Construction tool for UNIX compiler).	7
<b>Text books:</b> 1. Compiler construction – D.M. Dhamdhere, Macmillan India Ltd.		
<b>Reference Books:</b> 1. Principles of Compiler Design – Alfred V. Aho, Jeffrey D. Ullman 2. The Theory and Practice of Compiler Writing – J.P. Trembly, P.G. Sorenson McGraw Hill Publication. 3. Engineering a compiler – K.D. Cooper and Linda Torczon, Elsevier Direct Publication		
<b>Video Links</b> 1. <a href="https://youtu.be/XUsw5igq4DM">https://youtu.be/XUsw5igq4DM</a> 2. <a href="https://youtu.be/5ZmFlxrNaN8">https://youtu.be/5ZmFlxrNaN8</a> 3. <a href="https://youtu.be/KBulg_u-b3w">https://youtu.be/KBulg_u-b3w</a> Swayam Web-Links 4. <a href="https://onlinecourses.nptel.ac.in/noc20_cs13/preview">https://onlinecourses.nptel.ac.in/noc20_cs13/preview</a>		
<b>MOOCS:</b> 1. <a href="https://onlinecourses.nptel.ac.in/noc21_cs07/preview">https://onlinecourses.nptel.ac.in/noc21_cs07/preview</a> (3 credits) 2. <a href="https://nptel.ac.in/courses/106108113">https://nptel.ac.in/courses/106108113</a> (3 credits)		

### N1MCS5 (2) DSE-I (2) Software Testing

#### Course Outcomes:

On completion of this course, students would be able to:

1. Design test cases suitable for a software development for different domains.
2. Apply various software testing techniques, such as black-box testing, white-box testing, gray-box testing, and regression testing, to identify defects and verify the functionality of software systems.
3. Prepare test planning based on the document.
4. Document test plans and test cases designed.
5. Design test cases that adequately cover different aspects of software functionality, including boundary cases, error handling, and performance scenarios.
6. Apply automated testing tools and frameworks to streamline the testing process and improve efficiency.

Unit	Contents	Periods
I	Testing: Introduction and Outline - Introduction to testing and test outline, Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization, sample application, incremental testing approach, outline approach steps, evaluation and schedule estimation.	7
II	TEST CASE DESIGN STRATEGIES: Introduction to test outline to test cases, creating test cases, documentation short cuts, Using Black Box Approach to Test Case Design -Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing Documenting test cases.	7
III	LEVELS OF TESTING The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests –systems – Usability and Accessibility test Configuration testing –Compatibility testing – Testing the documentation – Website testing. Other types of tablets, State machines, test case table with multiple inputs, decision tables, applications with complex data, managing tests, testing object-oriented software, comparison, System testing example, Unit testing of Classes	8
IV	Testing Web Applications: Introduction, sample application, functional and usability issues, configuration and compatibility testing, reliability and availability, security testing, database testing, post implementation testing.	8
V	Reducing the No. of test cases: Introduction, prioritization guidelines, priority category scheme, Risk analysis, interviewing to identify problem areas, combination schemes, tracking selected test cases.	8
VI	Creating Quality Software: Introduction, development environmental infrastructure, software testing environment, software testing tools, applying software standards to test documentation. Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.	7
<b>Text books:</b> <ol style="list-style-type: none"> <li>1. Introducing Software Testing: Louise Tamres (PE)</li> <li>2. Software Testing in the Real World by Kit – Pearson</li> <li>3. Effective methods for software testing – William E. Perry</li> <li>4. Srinivasan Desikan and Gopala swamy Ramesh, —Software Testing – Principles and Practices, Pearson Education, 2006.</li> <li>5. Ron Patton, —Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Ilene Burnstein, —Practical Software Testing, Springer International Edition, 2003.</li> <li>2. Edward Kit, Software Testing in the Real World – Improving the Process, Pearson Education, 1995.</li> <li>3. Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostrand Reinhold, New York, 1990.</li> <li>4. Aditya P. Mathur, —Foundations of Software Testing _ Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008</li> </ol>		
<b>Video Lecture</b> <ol style="list-style-type: none"> <li>1. <a href="https://youtu.be/zEgVjx85lWs">https://youtu.be/zEgVjx85lWs</a></li> <li>2. <a href="https://youtu.be/zEgVjx85lWs?t=89">https://youtu.be/zEgVjx85lWs?t=89</a></li> <li>3. <a href="https://youtu.be/OGImfxO2TEU">https://youtu.be/OGImfxO2TEU</a></li> </ol>		

<b>MOOCS</b>	
1. <a href="https://onlinecourses.nptel.ac.in/noc20_cs77/preview">https://onlinecourses.nptel.ac.in/noc20_cs77/preview</a> (3 credits)	
2. <a href="https://onlinecourses.nptel.ac.in/noc23_cs81/preview">https://onlinecourses.nptel.ac.in/noc23_cs81/preview</a> (1 credits)	
3. <a href="https://swayam.gov.in/explorer?searchText=software+testing">https://swayam.gov.in/explorer?searchText=software+testing</a> (4 credits)	
4. <a href="https://onlinecourses.nptel.ac.in/noc23_cs91/preview">https://onlinecourses.nptel.ac.in/noc23_cs91/preview</a> (3 credits)	

### DSE I(3)/ N1MCS5(3) Software Engineering

#### Course Outcomes:

1. Recognize evolving role of software project management.
2. Understand and estimate cost for software project
3. Identify & analyse aspects of managing time, process & resources effectively with quality concept.
4. Estimate software productivity using metrics and indicator & identify important issues for planning a project
5. Judge different testing techniques used to test software.
6. Apply various testing strategies for software testing and validation.

Units	Contents	Periods
I	Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principle, critical practice.	7
II	Measures, Metrics & Indicators . Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning : Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan.	7
III	Project Scheduling :Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900L,SQA Plan. SCM process. Version control. SCM standard.	8
IV	System Engineering: Hierarchy, Business Process & Product Engineering: Overviews. Requirement engineering, System modelling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.	8
V	Software architecture :Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User- interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison Of design notation	8
VI	Software Testing Fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.	7
	<p><b>Text Books :</b></p> <ol style="list-style-type: none"> <li>1. Pressman Roger. S.: Software Engineering, A Practitioner's Approach TMH.</li> </ol> <p><b>Reference Books :</b></p> <ol style="list-style-type: none"> <li>2. Somerville: Software Engineering (Addison-Wesley)(5/e)</li> <li>3. Fairly R.: Software Engineering(McGrawHill)</li> <li>4. Davis A.: Principles of Software Development (McGrawHill)</li> </ol>	

	5. Shooman, M.L.: Software Engineering(McGraw-Hill)	
	<b>Weblinks:</b> 1. <a href="https://www.youtube.com/watch?v=Z6f9ckEElsU">https://www.youtube.com/watch?v=Z6f9ckEElsU</a> 2. <a href="https://www.youtube.com/watch?v=ykZ-_UGcYWg">https://www.youtube.com/watch?v=ykZ-_UGcYWg</a>	
	<b>MOOCS:</b> 1. <a href="https://onlinecourses.swayam2.ac.in/cec20_cs07/preview">https://onlinecourses.swayam2.ac.in/cec20_cs07/preview</a> (4credits) 2. <a href="https://onlinecourses.nptel.ac.in/noc19_cs69/preview">https://onlinecourses.nptel.ac.in/noc19_cs69/preview</a> (3 credits)	

## **Lab I: Based on CSO & DS with OOP –Lab Programming(C/C++/Java/ALP)**

### **N1MCS6 - CSO & DS with OOP Lab**

#### **Course Outcomes (COs): Computer System Organization**

1. Implementation of Computer organisation Programs using Simulators
2. Testing the working of Digital Electronics components and operations.
3. Ability to understand Input –Output Organization
4. To impart the knowledge on micro programming.
5. Implementation of Logic Gates.
6. Able to design electronic circuits.

#### **List of Practical's: Computer System Organization**

1. Implement a C/ C++ program to convert a Hexadecimal, octal, and binary number to decimal number vice versa.
2. Implement a C/ C++ program to perform Binary Addition & Subtraction.
3. Implement a C/ C++ program to perform Multiplication of two binary numbers
4. Implement a C/ C++ program to perform Multiplication of two binary numbers (signed) using Booth's Algorithms.
6. Implement a C/ C++ program to perform division of two binary numbers (Unsigned) Using restoring division algorithm.
7. Implement a C/ C++ program to perform division of two binary numbers (Unsigned) Using non-restoring division algorithm.
8. Implement Logic gates using NAND gates
9. Implement Logic gates using NOR gates
10. Design a Full adder using gates
11. Design and implement the 4:1 MUX using gates /ICs.
12. Design and implement the 8:1 MUX using gates /ICs
13. Design and Implement a 3 to 8 decoder using gates
14. Design a 4-bit comparator using gates/IC
15. Design and Implement a 4-bit shift register using Flip flops
16. Design and Implement a Decade counter
17. Write 8085 Program 8-bit addition
18. Write 8085 Program 8-bit Subtraction
19. Write 8085 Program 8bit multiplication.
20. Write 8085 Program 8 bit division

#### **Course Outcomes (COs): Data Structure with OOP**

1. Apply the basic concepts of C++/ Java programming in developing the code for various applications.
2. Individually Apply C++/Java programming concepts to design various data structures.
3. Identify and apply a suitable data structure for a given application.
4. Implement various searching techniques
5. Implement various sorting techniques
6. Implement various graph technique.

#### **List of Practical's: Data Structure with OOP**

1. Write a program to find an item using sequential search in array.
2. Write a program to find an item using binary search in array.
3. Write a program to find factorial of number using recursion.
4. Write a program to find factorial of number using iteration.
5. Write a program to insert new element in the middle of the one dimensional array.
6. Write a program to delete the element from the middle of the one dimensional array.
7. Write a program to create a linked list having n nodes.

8. Write a program to insert new node at the beginning of the linked list.
9. Write a program to create a linked list in sorted order.
10. Write a program to insert new node in the middle of the linked list.
11. Write a program to delete a node from beginning of the linked list.
12. Write a program to delete a node at the middle of the linked list.
13. Write a program to delete a node at the end of the linked list.
14. Write a program to create a singly circular linked list.
15. Write a program to create a doubly linked list.
16. Write a program to create a doubly sorted linked list.
17. Write a program to insert a new node in a doubly linked list.
18. Write a program to delete any node from the doubly linked list.
19. Write a program to find an item in a Linked List.
20. Write a program for array implementation of a Stack.
21. Write a program for linked list implementation of a Stack.
22. Write a program for circular implementation of a Queue.
23. Write a program for linked list implementation of a Queue.
24. Write a program to create a binary tree using linked representation.
25. Write a program to create a binary search tree using linked representation.
26. Write a program for Preorder traversal of binary tree using recursion.
27. Write a program for Inorder traversal of binary tree using recursion.
28. Write a program for Postorder traversal of binary tree using recursion.
29. Write a program to insert a new node in a binary search tree.
30. Write a program to delete any node from the binary search tree.
31. Write a program to create a threaded binary tree using linked representation.
32. Write a program to create a AVL tree using linked representation.
33. Write a program to store a Sparse Matrix using linked representation.
34. Write a program for Depth First Search Graph Traversal.
35. Write a program for Breadth First Search Graph Traversal.
36. Write a program for the Radix sorts of Array.
37. Write a program for the Insertion sorts of Array.
38. Write a program for the Selection sorts of Array.
39. Write a program for the Shell sorts of Array.
40. Write a program for the Quick sorts of Array.
41. Write a program for the Heap sorts of Array.
42. Write a program for the Merge sorts of Array.
43. Write a program for Hashing Function.

**Lab II: Based on Database Management Technologies -  
Lab SQL/DBMS tools, MS Sql, My Sql**

**N1MCS7- DBMT Lab**

**Course Outcomes (COs): DBMT**

On completion of this course, students would be able to:

1. Install and configure database systems proficiently.
2. Analyze and assess database models and entity relationship models.
3. Design and implement a database schema for a specific problem domain.
4. Acquire thorough understanding of relational database systems.
5. Execute effective data population and querying using SQLDDL, DML, and DCL commands.
6. Develop a back end database for an organization based on case study.

**List of Laboratory Practical's: DBMT**

Write PL/Sql Block/Sql queries/Sql triggers/Sql functions/ Sql procedures for:

1. Installing and configuring a database management system.
2. Creating and manipulating database tables using SQLDDL commands.
3. Inserting and retrieving data from database able using SQLDML commands.

4. Implementing primary key and foreign key constraints in database tables.
5. Performing basic CRUD operations (Create, Read, Update, Delete) on database records.
6. Writing SQL queries to filter and sort data from single table.
7. Joining multiple tables using various types of joins (inner join, outer join, etc.).
8. Implement in aggregation functions(e.g., SUM,COUNT, AVG) on data base records.
9. Creating views to provide a customized view of the database.
10. Implementing transactions to ensure data integrity and consistency.((use BEGINTRANSACTION/STARTTRANSACTION,COMMIT,ROLLBACK along with other sql queries)
11. Applying databasenormalizationtechniquestoeliminateredundancyandimprovedataintegrity.
12. Designing and implementing a database schema for a specific problem domain.
13. Creating and managing index estooptimize database per for mance.
14. Implementing database security measures(e.g., user authentication, access control).
15. Writing stored procedures and triggers to automate database operations.
16. Handling database exceptions and error conditions.
17. Backup and restore operations for database recovery.
18. Implementing concurrency control mechanisms to handle multiple simultaneous transactions.
19. Designing and implementing a database for an e-commerce application.
20. Implementing database replication for high availability and fault to clearance.
21. Performing data import and export operations between databases.
22. Implementing full-text search functionality in a database.
23. Designing and implementing a data warehouse for analytics and reporting.
24. Implementing datamining techniques to discover patterns and trends in large datasets.
25. Working with No SQL databases and performing CRUD operations.
26. Implementing distributed database systems and handling data partitioning.
27. Utilizing cloud-based database services for scalability and flexibility.
28. Working with in-memory databases for high-performance data processing.
29. Implementing graph databases for managing and querying graph-like data structures.
30. Exploring big data processing technologies and performing data analytics on large datasets.
31. Create a database with suitable example using Mongo DB and implement Inserting and saving document, Removing document, Updating document
32. Execute at least 10 queries on any suitable Mongo DB database that demonstrates following querying techniques: find and find One, Query criteria, Type-specific queries.
33. Draw ER Diagram for any information system application.

**Sample Problem domain/ Information systems / Schemas for implementing above practical's:**

1. **E-commerce:** (Product Name (varchar(100)), Product Description(text), Price(decimal(10, 2)), Category (varchar(50)),Manufacturer (varchar(50)), Quantity in Stock(integer), Image URL(varchar(255)),Date Added(date), Rating(decimal(3,2)))
2. **Hospital Management:** (PatientID (varchar(10)), Patient Name (varchar (100)), Date of Birth(date), Gender (varchar(10)),Address (varchar(255)), Contact Number (varchar(20)), Blood Group (varchar(5)),Medical History(text), Doctor Name (varchar(100)))
3. **Library Management:**( BookID (varchar(10)),Book Title (varchar(100)), Author (varchar(100)), Publication Year(integer), ISBN (varchar(20)), Category (varchar (50)),Available Copies(integer),Borrower ID (varchar(10)),Due Date(date))
4. **Human Resources:**(Employee ID(varchar(10)), Employee Name(varchar(100)) ,Date of Birth(date), Gender (varchar(10)), Address(varchar(255)), Contact Number (varchar(20)), Position (varchar(50)), Salary (decimal(10, 2)),Joining Date(date))
5. **Inventory Management:**(Product ID (varchar(10)), Product Name (varchar(100)), Description (text), Category (varchar(50)), Manufacturer (varchar(50)), Quantity in Stock (integer), Cost Price (decimal (10,2)), Selling Price (decimal(10,2)), Supplier ID(varchar(10)))

6. **Social Networking:** (User ID (varchar(10)), Username(varchar(50)), Email (varchar(100)), Password (varchar (50)), Date of Birth (date), Gender (varchar (10)), Profile Picture URL(varchar (255)), Bio (text), Friends Count(integer))
7. **Event Management:**(Event ID (varchar(10)), Event Name (varchar (100)), Date (date), Time (time), Location (varchar (255)), Organizer Name (varchar (100)), Description (text), Attendee Count (integer), Registration Deadline(date))
8. **Banking System:**(Account Number (varchar (20)), Account Holder Name (varchar (100)), Account Type (varchar (50)), Balance (decimal(10, 2)), Opening Date (date), Branch Code (varchar(10)), Address (varchar (255)), Contact Number (varchar (20)), Transaction History (text))
9. **Hotel Reservation:**(ReservationID(varchar(10)),GuestName(varchar(100)),Check-in Date (date), Check-outDate(date), Room Type(varchar(50)), Number of Guests(integer), Contact Number(varchar(20)), Total Amount (decimal(10,2)), Reservation Status (varchar(20)))
10. **Student Information System:** (Student ID(varchar(10)), Student Name (varchar(100)), Date of Birth (date), Gender (varchar(10)), Address (varchar (255)), Contact Number (varchar(20)), Course (varchar(50)), Year (integer), GPA (decimal(3,2)))

**Lab III:Lab Based on DSE I (1)/ DSE-I (2)/ DSE-I(3)  
1MCS8**

**N1MCS8 -DSE-I(1): Compiler Construction Lab**

**Course Outcomes (COs):**

1. Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc.
2. Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
3. Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
4. Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.
5. Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.

**Practical List: Compiler Construction**

Perform the following with the help of C/C++/Python.

1. Understand the different phases of the compilation process, including lexical analysis, parsing, semantic analysis, code generation, and optimization.
2. Implement a lexical analyzer (lexer) to tokenize input programs based on specified language rules.
3. Design and implement a parser for a given grammar using top-down or bottom-up parsing techniques.
4. Develop symbol table management techniques to store and retrieve information about program symbols.
5. Explore different methods of handling lexical, syntax, and semantic errors in the compilation process.
6. Apply optimization techniques to improve the generated intermediate code, such as constant folding or dead code elimination.
7. Develop semantic analysis routines to perform type checking, scope resolution, and other semantic checks.
8. Experiment with different code generation strategies for translating high-level language constructs into target machine code.
9. Understand the role of optimization in improving the performance and efficiency of compiled programs.



10. Analyse the impact of various compiler optimizations on the generated code and measure their effectiveness.
11. Investigate error recovery techniques to handle syntax errors gracefully and provide helpful error messages.
12. Design and implement a complete compiler for a subset of a programming language, incorporating multiple stages and components.

### **N1MCS8-DSE-I(2): Software Testing Lab**

#### **Course Outcomes(COs):**

1. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
2. To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
3. To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
4. To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
5. To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.
6. To understand software test automation problems and solutions.

#### **Practical List: Software Testing**

1. Understand The Automation Testing Approach (Theory Concept).
2. Install Selenium IDE. Write a test suite containing minimum 4 test cases.
3. Understanding Test Automation. Using Selenium write a simple test script to validate each field of the registration page ( Eg: Facebook Registration Page)
4. Install Selenium server and demonstrate it using a script in Java/PHP.
5. Conduct a test suite for any two web sites.
6. Write and test a program to login a specific web page.
7. Write test cases to validate a mobile number using one time pin identification(OTP)
8. Write and Test a program to find out list of employees having salary greater than Rs 50,000 and age between 30 to 40 years.
9. Write and test a program to update 10 student records into table into Excel file.
10. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).
11. Write and test a program to provide total number of objects present / available on the page.
12. Write and test a program to get the number of list items in a list / combo box.
13. Write and test a program to count number of items present on a desktop.
14. Understanding the use of bug tracking and testing tool Bugzilla.
15. Demonstrate any one open source tool for software other than that used in lab exercises
16. Prepare test cases for any software application like Admission form, Shopping cart, Travel Booking, Hotel Booking, Utility Bill Payment..

### **N1MCS8- DSE-I (3) : Software Engineering Lab**

#### **Course Outcomes (COs):**

Upon completion of this course successfully, students would be able to:

1. Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship.
2. Draw a class diagram after identifying classes and association among them.
3. Graphically represent various UML diagrams and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially.

4. Use modern tools for demonstrating the complete Software life cycle activities (specification, design, implementation and testing) from requirements analysis to maintenance using the modern tools and techniques.
5. Translate end-user requirements into system and software requirements
6. Apply standard data mining methods and techniques such as association rules, data clustering and classification.

#### **Practical List: Software Engineering**

1. Analysis and Identification of the suitable process models
2. To prepare PROBLEM STATEMENT for any project.
3. Identifying the Requirements from Problem Statements.
4. Estimation of Project Metrics.
5. Work Break-down Structure (Process Based, Product Based, Geographic Based and Role Based) and Estimations
6. Estimation of Test Coverage Metrics and Structural Complexity
7. Designing Test Suites.
8. An introduction to software engineering.
9. Requirement modelling using Entity Relationship Diagram(Structural Modeling) for any project
10. Requirement modelling using Context flow diagram, DFD ( Functional Modeling) for any project
11. Requirement modelling using State Transition Diagram ( Behavioral Modeling) for any project
12. Development of DFD, data dictionary, E-R diagram, structured chart for the project.
13. To study and draw various UML diagrams.
14. To illustrate the use of class diagrams.
15. To draw an activity diagram and use case diagram.(for eg. ATM and Library Management System)
16. Draw Object Diagram (For eg. ATM System)
17. Development of OO design — Use case Model, Class Model
18. Development of OO design — Interaction Models
19. Development of OO design — Package, Component and deployment models
20. Development of State Transition Diagram.
21. Draw ER Diagram for Hospital Management System
22. Design and demonstration of test cases. Functional Testing and Non- Functional Testing (using any open source tools)
23. Design of Story Boarding and User Interface design Modeling.

**Syllabus PG Programme: M.Sc. (Computer Science)  
First Year Semester: II**

**DSC IV/ N2MCS1: Operating System Algorithms**

**Course Outcomes:**

On completion of this course, students would be able to:

1. To make aware of different types of Operating System and their services.
2. Know basic components of an operating system.
3. Comprehend how an operating system virtualises CPU and memory.
4. Discuss various scheduling and swapping policies.
5. Explain how a simple file system organizes data in the hard disk.
6. get to know how an operating system protects the computer system.

Units	Contents	Total Lectures
I	Introduction: Services, Types, Operating System Interface: Command Interpreter, Graphical User Interface, System Calls, System Programs, Operating System Structure: Simple, Layered Approach; Micro-kernels, Modules, Virtual Machine, System Boot.	10
II	Process Management: Process Concept, Process States, Process Control Block, Process Scheduling: Schedulers, Context Switch; Operations on Process: Creation, Termination, Inter Process Communication; Threads: Concept, Benefits; CPU Scheduling: Burst Cycle, Types of Scheduling, Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, Priority Scheduling, Round-Robin,[multiple processor scheduling]	10
III	Process Synchronization and Deadlocks: Critical Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlock: System Model, Deadlock Characterization, And Resource Allocation Graph, Methods for handling Deadlock: Prevention, Avoidance and Detection; Recovery from Deadlock: Process Termination, Resource Pre-emption.	10
IV	Memory Management: [Basic Hardware, Address Binding]; Logical and Physical Address Space, Swapping, Contiguous Allocation, Dynamic Storage Allocation: First-fit, Best-Fit, Worst-fit; Fragmentation; Paging; Segmentation. Virtual Memory: Introduction, Virtual Address Space, Demand Paging, Copy-on-write, Page Replacement: Concept, Page Replacement Algorithms: FIFO, Optimal Page Replacement, LRU, Second-Chance Page Replacement; Thrashing, I/O Interlock	10
V	File System: File: Concept, Attributes, Operations; File Organization and Access: Sequential, Index Sequential, Indexed, Direct or Hash File. Directory: Operations, Structures. Protection: Access Control and Permissions. File System Structure, Allocation Methods, Free Space Management. Disk Structure, Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK. [Disk Management, Swap Space Management], RAID: Concept. I/O Systems: I/O Hardware, Interrupts, DMA, Application I/O Interface, Kernel I/O Subsystem.	10
VI	Distributed File System: Concept, Naming and Transparency, Remote File Access, Stateful Vs Stateless Service, File Replication, Remote Login, Remote File Transfer, Data Migration, Computation Migration, Process Migration. Embedded Operating Systems: Embedded Systems: Definition, Requirements and Constraints, Organization of Embedded System; Characteristics of Embedded Operating Systems. Case Studies: Linux and Mobile Operating Systems	10
<b>Books:</b>		
<ol style="list-style-type: none"> <li>1. Operating System Concepts–Seventh Edition: Abraham Silberschatz, Peter Galvin, Greg Gagne (John Wiley &amp; Sons)</li> <li>2. Operating Systems: William Stallings (Pearson)</li> <li>3. Modern Operating System: Andrew S.Tanenbaum</li> <li>4. Distributed Operating Systems, Prentice Hall M. Singhal &amp; N. Shivaratri,</li> <li>5. Advanced Concepts in Operating Systems, McGraw Hill</li> <li>6. Understanding theLinuxKernel,2nd Edition By Daniel P. Bovet, Oreilly</li> <li>7. The Design of Unix Operating System Maurice Bach,Pearson</li> </ol>		

**Weblinks :**

1. <https://youtu.be/vBURt97EkA>
2. <https://www.youtube.com/watch?v=WJ-UaAaum>
3. <https://youtu.be/RozoeWzT7IM>

**DSC V/ N2MCS2: Graphics Application Programming****Course Outcomes:**

On completion of this course, students would be able to:

1. Able to understand the mathematical modelling of graphical objects to be drawn/used in different kind of applications.
2. Learn and understand the concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in 2 D&3D.
3. Learn and understand the algorithms to generate line segments, polygon and its transformations, windowing and clipping.
4. Demonstrate operations such as various Transformation and Projection.
5. Demonstrate various algorithms for scan conversion and filling of basic objects and their comparative analysis.
6. Get the knowledge of display control, 3D geometry, primitives and conversions, algorithms for hidden surfaces and lines, concepts of shading and curves.

Unit	Content	Total Lectures
I	Geometry and line generation: Introduction, Points and Lines, Planes and Coordinates, Line segments, Perpendicular line segments, Vectors, Pixels and Frame Buffers, Vector generation, Character generation, Displaying the frame buffer. Graphics primitive: Introduction, Display devices, Primitive operations, The Display-FileInterpreter, Normalized device coordinates, Display-file structure, Display control.	10
II	Polygon: Introduction, Polygon, Polygon representation, Entering polygon, An inside test, Filling polygon, Antialiasing. Transformations: Introduction, matrices, scaling transformations, sin and cos, Sum of angles, identifiers, rotation, homogeneous coordinates and translation, rotation about an arbitrary point, other transformations, and display procedures.	10
III	Segments: Introduction, the segment table, segment creation, closing a segment, deleting a segment, renaming a segment, visibility, image transformations, saving and showing segments, other display file structures, Some Raster techniques, Windowing and clipping: Introduction, view in transformation, implementation, clipping, clipping the polygon, Adding Clipping to the system, Generalized Clipping.	10
IV	Interaction: Introduction, hardware, Input devices-handling Algorithm, Event handling, Sample devices, The detectability attributes, Simulating a Locator with a Pick and Pick with a Locator, Echoing, Interactive Techniques. Three dimensions: Introduction, 3D Geometry, Primitives and Transformations, Rotation about an arbitrary axis, Parallel projection, Perspective projection, Viewing parameters, Conversion to View Plane Coordinates, The 3D Viewing Transformation.	10
V	Hidden Surfaces and Lines: Introduction, Back face removal & algorithm, ZBuffers, Scan-Line algorithm, The Painter's algorithm, Comparison Techniques, Warnock's algorithm, Franklin algorithm, Hidden Line method, Binary Space Partition, An Application.	10
VI	Shading: Introduction, diffusion, illumination, point source illumination, specular reflection, transparency and shadows. Curves: Introduction, curve generation, implementation, interpolating polygons, E-splines, B-Splines and Curves.	10
	<b>Text Books :</b> 1. "Computer Graphics A Programming approach"- Steven Harrington. Reference	

	Books: 2. “Computer Graphics, C Version”-Donald Hearn, M.Pauline Baker-(Prentice Hall Press) 3. “Interactive Computer Graphics”-Newmann andSproul 4. “Computer Graphics”-Rogers.	
<b>Weblinks:</b> 1. <a href="https://youtu.be/uTBKa1PSyf8">https://youtu.be/uTBKa1PSyf8</a> 2. <a href="https://youtu.be/NmMky9Pg8Yc">https://youtu.be/NmMky9Pg8Yc</a> 3. <a href="https://youtu.be/UiDinO0lzOg">https://youtu.be/UiDinO0lzOg</a>		

### DSC VI N2MCS3: Computer Networks and Wireless Technology

#### Course Outcome

After successful completion of the course, the students would be able to :

1. Understand the basics of data communication and computer networking
2. Compare and describe the structure and working of various reference models for networking
3. Infer the process of communication in client server model
4. Develop knowledge about design of various protocols used in communication
5. Anticipate various anomalies that may occur during network communication
6. Build knowledge about wireless technology

Units	Contents	Total Lectures
I	<b>Data Communication:</b> Types: Analog & Digital; <b>Modulation:</b> Amplitude, Frequency, Phase Shift, PAM, PCM; <b>Multiplexing:</b> FDM, WDM, TDM; <b>Switching:</b> Circuit, Message, Packet; Delays in Packet Switched Network, Packet Loss; <b>Network Reference Models:</b> ISO-OSI model, TCP/IP model	10
II	<b>Application Layer:</b> Services; <b>Principles of Network Applications:</b> Client-Server Architecture, Client and Server Processes, Socket Interface; Transport Services Available to Applications; <b>HTTP:</b> Introduction, RTT, HTTP Handshake, types of HTTP Connections, HTTP Messages, Cookies; Electronic Mail, SMTP; <b>DNS:</b> Services, working	10
III	<b>Transport Layer:</b> Services; Multiplexing and Demultiplexing in Transport Layer; Connectionless Transport – UDP; Principles of Reliable of Data Transfer (RDT): RDT 1.0, 2.0, 2.1, 2.2 and 3.0; Stop-and-wait and Pipelined protocols; Go-Back-N (GBN) and Selective Repeat (SR) protocols; Connection Oriented Transport: TCP Connection, Flow Control; Principles of Congestion Control; Approaches to Congestion Control; TCP Congestion Control	10
IV	<b>Network Layer:</b> Services; Network Service Model: Datagram, Virtual Circuit; Internet Protocol: IP Addressing, IPv4 datagram format, IPv6 datagram format; Routing Principles; Routing Algorithms: Classifications, RIP, OSPF, BGP; Hierarchical Routing; DHCP; ICMP: Overview and message types; SNMP: overview.	10
V	<b>Data Link Layer:</b> Services; Error Detection and Correction Techniques; Multiple Access Protocols: Polling, ALOHA, CSMA/CD; MAC Addresses and ARP; Switches; Point-to-Point Protocol.	10
VI	<b>Wireless Technology:</b> Advantages, Applications; <b>Signals:</b> Characteristics, Propagation, Fading, Multipath Propagation; Frequency Reuse Principle, Cellular System; Wireless LAN: Advantages, Disadvantages, Infra-red and radio transmission, infrastructure and ad-hoc wireless networks; Bluetooth.	10
<b>Text Books:</b>		

<ol style="list-style-type: none"> <li>1. Data Communications and Networking, 4/e - Behrouz A. Forouzan (McGraw Hill Education)</li> <li>2. Computer Networking: A Top-Down Approach - James Kurose &amp; Keith Ross (Pearson Education) 6<sup>th</sup>/7<sup>th</sup> edition</li> <li>3. Mobile Communications – Jochen Schiller (Pearson Education)</li> </ol>	
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Computer Network &amp; Internet - Douglas E. Comer (Pearson)</li> <li>2. Data and Computer Communication – William Stallings (Pearson)</li> <li>3. Computer Networks - Andrew S. Tanenbaum (PHI)</li> </ol>	
<b>Weblinks:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=I2PKJslPObM">https://www.youtube.com/watch?v=I2PKJslPObM</a></li> <li>2. <a href="https://www.youtube.com/watch?v=8kICGfKCA1o">https://www.youtube.com/watch?v=8kICGfKCA1o</a></li> <li>3. <a href="https://www.youtube.com/watch?v=ut-EMl-uHXY">https://www.youtube.com/watch?v=ut-EMl-uHXY</a></li> </ol>	

### DSE II (1)/ N2MCS4(1): Internet of Things

#### Course Outcome:

##### On completion of this course, students would be able to:

1. Understood what Internet of Things are.
2. Identify the use of IOT from the global market.
3. Able to control home appliances from anywhere in the world.
4. Analyze the IOT enabling technologies.
5. Design applications using IOT.
6. Determine the real-world problems and challenges in IOT.

Unit	Contents	Total Lectures
I	<b>Introduction and Concepts:</b> Definition and Characteristics of Introduction to IoT, Physical design of IoT, Things in IoT, IoT protocols, Logical Design of IoT, IoT functional blocks, IoT communication Model, IoT Communication API, IoT Enabled Technologies.	7
II	<b>Developing IoT:</b> IoT platform and design methodology-Purpose & requirement specification, process specification, Domain Model specification, Information Model Specification, service specification, IoT level specification, functional view specification, Operational view specification, Device & Component Integration, Application Development.	7
III	IoT Physical Device Endpoints-Basic building blocks of an IoT Device, Exemplary Device Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python.	8
IV	IoT and M2M-Machine 2 Machine, Difference between IoT and M2M, Web of Things, Applications-- Remote Monitoring and Sensing, Remote Controlling, Performance Analysis. Security aspects of IoT.	8
V	Application of IoT with Domain Specific tools: Case studies on Intrusion Detection, Smart Parking, Smart Roads, Surveillance, and Emergency response, Air/Noise Pollution Monitoring Systems, Prognostics, Smart Irrigation, Green House Controls and Wearable Electronics.	8
VI	Data analytics for IOT: MapReduce Programming Model, Ozie workflow for IOT data analysis, setting up a strong, cluster, REST –based approach web socket-based approach, case studies	7
<b>Text books:</b> <ol style="list-style-type: none"> <li>1. Internet of Things (A Hands on Approach), Vijay Madiseti, Arshdeep Bahga</li> <li>2. Getting Started with Internet of Things: Connecting Sensors and Microcontrollers to the cloud by Cuno Pfister, O'ReillyPublications</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler VlasiosTsiatsis Catherine Mulligan Stefan Aves &amp; Stamatis Kamouskos</li> </ol>		

<ol style="list-style-type: none"> <li>2. Getting Started with the Internet of Things by Cuno Pfister.</li> <li>3. The Internet of Things: Connecting Objects by Hakima Chaouchi.</li> <li>4. Francisda Costa. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", I Edition, A press Publications, 2013.</li> <li>5. Raj Kamal" Internet of Things", 1<sup>st</sup> edition 2016,McGraw-Hill</li> </ol>	
<b>Weblinks:</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=LlhmzVL5bm8">https://www.youtube.com/watch?v=LlhmzVL5bm8</a></li> <li>2. <a href="https://www.youtube.com/watch?v=APH6Nrar27w">https://www.youtube.com/watch?v=APH6Nrar27w</a></li> <li>3. <a href="https://www.youtube.com/watch?v=Fi02iTrWUx0">https://www.youtube.com/watch?v=Fi02iTrWUx0</a></li> </ol>	
<b>MOOCS :</b> <ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc23_cs89/preview">https://onlinecourses.nptel.ac.in/noc23_cs89/preview</a> (3 Credit)</li> <li>2. <a href="https://onlinecourses.nptel.ac.in/noc23_cs90/preview">https://onlinecourses.nptel.ac.in/noc23_cs90/preview</a> (2 Credit)</li> <li>3. <a href="https://onlinecourses.nptel.ac.in/noc21_cs14/preview">https://onlinecourses.nptel.ac.in/noc21_cs14/preview</a> (2 Credit)</li> <li>4. <a href="https://archive.nptel.ac.in/courses/106/105/106105167">https://archive.nptel.ac.in/courses/106/105/106105167</a> (4 Credit)</li> </ol>	

### DSE II(2)/N2MCS4(2) : Mobile Computing

#### Course Outcome:

On completion of this course, students would be able to:

1. Study and aware of fundamentals of mobile computing
2. Study and analyse wireless networking protocols, applications and environment.
3. Understand various data management issues in mobile computing.
4. Analyse different type of security issues in mobile computing environment.
5. Data synchronisation used in mobile computing.
6. Learn Android application development, Mobile OS, XML

Unit	Contents	Periods
I	<b>Introduction to Mobile Computing:</b> Evolution of mobile computing, Architecture for Mobile Computing, Three tier Architecture, Mobile Devices and Mobile-Enabled Applications. <b>Mobile Devices and Systems:</b> Mobile Phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices: Operating System, Smart Systems, Limitations of Mobile Devices, Automotive Systems	7
II	<b>GSM-Services and Similar Architecture:</b> GSM-Services and System Architecture, Radio Interfaces, Protocols, Radio Interfaces , Localization, Calling Handover, Security, Short message services, Mobile computing over SMS, Value added services through SMS, Accessing the SMS bearer. <b>Wireless Medium Access Control and CDMA-based Communication</b> Medium Access Control Introduction to CDMA-based Systems, Spread Spectrum in CDMA Systems, Coding Methods in CDMA IST, IS-105 cdma One System, IMT-2000, i-mode, OFDM.	8
III	<b>Mobile IP Network Layer:</b> IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol. <b>Mobile Transport Layer</b> Conventional TCP/IP Transport Layer Protocols , Indirect TCP , Snooping TCP Mobile TCP, Other Methods of TCP-layer Transmission for Mobile, Networks TCP Over 2.5G/3G Mobile Networks.	8
IV	<b>Databases</b> Database Hoarding Techniques, Data Caching, Client-Server Computing and Adaptation ,Transactional Models, Query Processing, Data Recovery Process Issues relating to Quality of Service <b>Data Dissemination and Broadcasting Systems</b> Communication Asymmetry, Classification of Data-Delivery Mechanisms, Data Dissemination Broadcast Models ,Selective Tuning and Indexing Techniques, Digital Audio Broadcasting.	8
V	<b>Data Synchronization in Mobile Computing System,</b> Synchronization Software for Mobile Devices, Synchronization Protocols, SyncML-Synchronization Language for Mobile Computing Sync4J (Funambol) ,Synchronized Multimedia Markup Language (SMIL) Mobile Devices: Server and Management Mobile Agent , Application Server, Gateways ,Portals ,Service Discovery , Device Management, Mobile File Systems, Security.	7
VI	<b>Introduction to Android Operating System &amp; Programming:</b> Overview and evolution of Android, Features of Android, Android architecture, Components of an Android Application, Manifest file, Android Activity and Service Lifecycle,	7

	UI Designing (layout designig) All components (e.g Button , Slider, Image view, Toast) Event Handling –Introduction to XML, <b>Mobile Operating Systems:</b> iOS, PalmOS, WindowsCE, Symbian OS, Linux for Mobile Devices.	
<b>Text books:</b>	1. Mobile Computing: Raj Kamal (Oxford) 2. Jochen Schiller, Mobile communications, Addison wisely , Pearson Education	
<b>Reference Books:</b>	1. Mobile Communication: Jochen Schiller (PE) 2. Principles of mobile communication: Gordon L. Stuber (Springer) 3. Wireless Communications: Principles and Practice: Theodore S. Rappaport (Pearson) 4. 4) Beginning Android 3 by Mark Murphy APress , ISBN 9788132203568	
<b>Weblinks:</b>	1. <a href="https://www.youtube.com/watch?v=GT-tYP8RGIs&amp;list=PLV8vIYTIIdSnZMKQTQSTxWbx4NGNfxyZq_N">https://www.youtube.com/watch?v=GT-tYP8RGIs&amp;list=PLV8vIYTIIdSnZMKQTQSTxWbx4NGNfxyZq_N</a> 2. <a href="https://www.youtube.com/watch?v=hIEJR4XYepg&amp;list=PLPIwNooIb9vj5gQ64BL7iVpFtymBt9A22">https://www.youtube.com/watch?v=hIEJR4XYepg&amp;list=PLPIwNooIb9vj5gQ64BL7iVpFtymBt9A22</a> 3. <a href="https://www.youtube.com/watch?v=6yHOrDT7Ct0&amp;list=PLYwpaL_SFmcAjqrKO-b9UMa2AaAlzZY7D">https://www.youtube.com/watch?v=6yHOrDT7Ct0&amp;list=PLYwpaL_SFmcAjqrKO-b9UMa2AaAlzZY7D</a>	
<b>MOOCs:</b>	1. <a href="https://onlinecourses.nptel.ac.in/noc23_ge36/preview">https://onlinecourses.nptel.ac.in/noc23_ge36/preview</a> (2 Credit) 2. <a href="https://onlinecourses.swayam2.ac.in/nou23_cm06/preview">https://onlinecourses.swayam2.ac.in/nou23_cm06/preview</a> (6 Credit) 3. <a href="https://onlinecourses.swayam2.ac.in/nou22_cm14/preview">https://onlinecourses.swayam2.ac.in/nou22_cm14/preview</a> (6 Credit) 4. <a href="https://onlinecourses.swayam2.ac.in/cec23_ge07/preview">https://onlinecourses.swayam2.ac.in/cec23_ge07/preview</a> (4 Credit) 5. <a href="https://onlinecourses.swayam2.ac.in/nou22_ge57/preview">https://onlinecourses.swayam2.ac.in/nou22_ge57/preview</a> (4 Credit)	

### DSE II(3)/ N2MCS4(3) : Data Mining and Data Warehousing

#### Course Outcomes:

Upon completion of this course successfully, students would be able to

1. Use basic concepts and techniques of Data Mining
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop experience of doing in dependent study and research.
4. Study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.
5. Develop and apply critical thinking, problem-solving, and decision- making skills.

Units	Contents	Total Lectures
I	Introduction, Data Mining Functionalities, Data Preprocessing: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.	7
II	Data Warehouse and OLAP Technology: Overview, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Data Generalization and Concept Description.	7
III	Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint- Based Association Mining.	8
IV	Classification and Prediction: Issues, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation. Prediction: Linear Regression, Nonlinear Regression, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor.	8
V	Cluster Analysis: Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-	8



	Dimensional Data. Mining Time-Series Data, Mining Sequence Patterns in Biological Data.	
VI	Graph Mining, Social Network Analysis and Multi-relational Data Mining. Mining Object, Spatial, Multimedia, Text, and Web Data, Data Mining Applications, Trends in Data Mining.	7
<b>Text Books:</b> Data Mining: Concepts and Techniques - J. Han, M. Kamber		
<b>Reference Books:</b> 1. Data Mining: Introductory and Advanced Topics – Margaret H. Dunham, Pearson Education 2. Data Warehousing in the real world - Sam Anahory, Dennis Murry, Pearson Education 3. Principles of Data Mining - David Hand, Heikki Manila, Padhraic Smyth, PHI 4. Data Warehousing, Data Mining & OLAP, Alex Bezon, Stephen J. Smith McGraw-Hill Edition 5. Data Warehousing Fundamentals, Paulraj Ponniah, Wiley-Interscience Publication		
<b>Weblinks:</b> 1. <a href="https://youtu.be/T_D2tDTmrWE">https://youtu.be/T_D2tDTmrWE</a> 2. <a href="https://youtu.be/cLI_bllq-oU">https://youtu.be/cLI_bllq-oU</a> 3. <a href="https://youtu.be/KgjUsie50WQ">https://youtu.be/KgjUsie50WQ</a> 4. <a href="https://youtu.be/ykZ-UGcYWg">https://youtu.be/ykZ-UGcYWg</a> 5. <a href="https://youtu.be/jzDZZ-msoQc">https://youtu.be/jzDZZ-msoQc</a> 6. <a href="https://youtu.be/m-aKj5ovDfg">https://youtu.be/m-aKj5ovDfg</a>		
<b>MOOCS:</b> 1. <a href="https://onlinecourses.nptel.ac.in/noc21_cs06/preview">https://onlinecourses.nptel.ac.in/noc21_cs06/preview</a> (2 Credit) 2. <a href="https://onlinecourses.swayam2.ac.in/cec19_cs01/preview">https://onlinecourses.swayam2.ac.in/cec19_cs01/preview</a> (4 Credit)		

**Lab IV: Based on Operating System Algorithm - Lab Programming (C/C++/Java)**  
**N2MCS5**

**Course Outcomes (COs): Operating System Algorithm**

1. Able to learn various CPU scheduling algorithms.
2. Able to learn memory management techniques.
3. Able to learn disk scheduling algorithms.
4. Able to learn memory allocation algorithms.
5. Able to learn the various page replacement algorithms.

**Practical List: Operating System Algorithm**

1. Write a program to demonstrate the use of FCFS CPU Scheduling algorithm.
2. Write a program to demonstrate the use of SJF CPU Scheduling algorithm.
3. Write a program to demonstrate the use of Priority CPU Scheduling algorithm.
4. Write a program to demonstrate the use of Round Robin CPU Scheduling algorithm.
5. Write a program to demonstrate the use of resource allocation to identify whether the system is in safe state.
6. Write a program to demonstrate the use of resource allocation to identify cycle in the system.
7. Write a program to demonstrate the use of dynamic memory allocation.
8. Write a program to demonstrate the use of First fit/Best Fit / Worst Fit memory allocation algorithms.
9. Write a program to demonstrate the use of FIFO Page Replacement algorithm.
10. Write a program to demonstrate the use of LRU Page Replacement algorithm.
11. Write a program to demonstrate the use of Optimal Page Replacement algorithm.
12. Write a program to demonstrate the use of FCFS Disk Scheduling algorithm.
13. Write a program to demonstrate the use of SSTF Disk Scheduling algorithm.
14. Write a program to demonstrate the use of SCAN Disk Scheduling algorithm.
15. Write a program to demonstrate the use of CSCAN Disk Scheduling algorithm.
16. Write a program to demonstrate the use of LOOK Disk Scheduling algorithm.

**Lab V: Lab Based on Graphics Application Programming**  
**N2MCS6**

**Course Outcomes (COs): Graphics Application Programming**

1. Apply the basic concepts of C programming in developing the code for various Graphics applications.
2. Individually Apply C programming concepts to do the Program in Computer Graphics.
3. Identify and apply a suitable transformation for a given application.

**List of Practical: Graphics Application Programming**

1. Write a program to draw a line using Bresenham's line drawing algorithm.
2. Write a program to draw a line using DDA line drawing algorithm.
3. Write a program to draw a circle using ARCDDA algorithm.
4. Write a program to draw a rectangle.
5. Write a program to draw an ellipse using ARCDDA algorithm.
6. Write a program to rotate an object about origin.
7. Write a program to rotate an object about any arbitrary point.
8. Write a program to implement 2D Scaling Transformation.
9. Write a program to implement 3D Scaling Transformation.

10. Write a program to implement 2D Translation Transformation.
11. Write a program to implement 3D Translation Transformation.
12. Write a program to move an image (ball) on the screen.
13. Write a program to generate a Cubic Bezier Curve.
14. Write a program to draw a Polygon using Absolute and Relative commands.
15. Write a program to clip user defined area of a screen.
16. Write a program to clip line segment.
17. Write a program to clip polygon.
18. Write a program to demonstrate rotation of point.
19. Write a program to fill area by given pattern.
20. Write a program to fill the closed area using flood fill method.
21. Write a program to fill the closed area using Scan line method.

**Lab-VI: Lab Based on DSE II (1)/ DSE II (2)/ DSE II (3)**  
**2MCS7**  
**N2MCS7- DSE II (1)- Internet of Things**

**Course Outcomes (COs): Internet of Things**

1. To be able to design hardware for IoT on different platforms for devices that can be connected to internet
2. To recognize the functionality of micro controller, latest version processor and its application
3. Acquire thinking and designing capability, to solve real world engineering problem, and analyses results.
4. To be able to design a components with realistic constraints, for IOT nodes and systems.

**List of Practical: Internet of Things**

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.
3. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings
4. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
5. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
6. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. To interface Bluetooth with Arduino Raspberry Pi and write o program to turn LED ON/OFF when 170 is received from smartphone using Bluetooth
9. To insert MySQL database on Raspberry Pi and perform RC basic SQL queries
10. Write a program on Arduino Raspberry Pi to publish temperature data to MOTT Broker

**Lab VI- Lab Based on DSE II (1)/ DSE II (2)/ DSE II (3)**  
**N2MCS7 - DSE II (2)-Mobile Computing**

**DSE II (2): Mobile Computing**

**Course Outcomes(COs): Mobile Computing**

1. To understand the basic concepts of mobile computing.
2. To learn the basics of mobile telecommunication system .
3. To be familiar with the network layer protocols and Ad-Hoc networks.

4. To know the basis of transport and application layer protocols.
5. To gain knowledge about different mobile platforms and application.

### **List of Practical's: Mobile Computing**

1. Study the three tier architecture of Mobile Computing
2. Study GSM services and System Architecture
3. Study of WMAC and CDMA communication.
4. Study of Packet Delivery and Handover Management,
5. Study of IP and Mobile IP Network Layers.
6. Study of Classification of Data-Delivery Mechanisms
7. Study of Selective Tuning and Indexing Techniques
8. Study of Mobile File Systems
9. Study of Data Synchronization System.
10. Script writing using Synchronized Multimedia Markup Language (SMIL)
11. Study of UI in Android
12. Study of Activity Life Cycle
13. Study of Indent in Android
14. Develop an application that uses GUI components, Font and Colours
15. Study of Adapters and View
16. Design an android application Using Radio buttons
17. Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)
18. Develop an application that uses Layout Managers and event listeners.
19. Write an application that draws basic graphical primitives on the screen.
20. Develop an application that makes use of databases.
21. Create a user registration application that stores the user details in a database table.

### **Lab VI- Lab Based on DSE II (1)/ DSE II (2)/ DSE II (3) N2MCS7 -DSE II (3) - Data Mining Data Warehousing**

#### **Course Outcomes (COs): Data Mining Data Warehousing**

1. Be familiar with mathematical foundations of data mining tools.
1. Understand and implement classical models and algorithms in data warehouses and data mining
2. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
3. Master data mining techniques in various applications like social, scientific and environmental context.
4. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

#### **List of Practical: Data Mining Data Warehousing**

##### **Data mining Tools used: Weka / Rapid miner**

1. **Create an Employee Table with the help of Data Mining Tool. Description:** We need to create an Employee Table with training data set which includes attributes like name, id, salary, experience, gender, phone number.

2. **Create a Weather Table with the help of Data Mining Tool. Description:** We need to create a Weather table with training data set which includes attributes like outlook, temperature, humidity, windy, play.
3. **Apply Pre-Processing techniques to the training data set of Weather Table Description:** Real world databases are highly influenced to noise, missing and inconsistency due to their queue size so the data can be pre- processed to improve the quality of data and missing results and it also improves the efficiency. There are 3 pre-processing techniques they are:
  - 1) Add
  - 2) Remove
  - 3) Normalization
4. **Apply Pre-Processing techniques to the training data set of Employee Table Description:** Real world databases are highly influenced to noise, missing and inconsistency due to their queue size so the data can be pre- processed to improve the quality of data and missing results and it also improves the efficiency. There are 3 pre-processing techniques they are:
  - 1) Add
  - 2) Remove
  - 3) Normalization
5. **Normalize Weather Table data using Knowledge Flow. Description:** The knowledge flow provides an alternative way to the explorer as a graphical front end to WEKA's algorithm. Knowledge flow is a working progress. So, some of the functionality from explorer is not yet available. So, on the other hand there are the things that can be done in knowledge flow, but not in explorer. Knowledge flow presents a dataflow interface to WEKA. The user can select WEKA components from a toolbar placed them on a layout campus and connect them together in order to form a knowledge flow for processing and analyzing the data.
6. **Normalize Employee Table data using Knowledge Flow. Description:** The knowledge flow provides an alternative way to the explorer as a graphical front end to WEKA's algorithm. Knowledge flow is a working progress. So, some of the functionality from explorer is not yet available. So, on the other hand there are the things that can be done in knowledge flow, but not in explorer. Knowledge flow presents a dataflow interface to WEKA. The user can select WEKA components from a toolbar placed them on a layout campus and connect them together in order to form a knowledge flow for processing and analyzing the data.
7. **Finding Association Rules for Buying data. Description:** In data mining, association rule learning is a popular and well researched method for discovering interesting relations between variables in large databases. It can be described as analyzing and presenting strong rules discovered in databases using different measures of interestingness. In market basket analysis association rules are used and they are also employed in many application areas including Web usage mining, intrusion detection and bioinformatics.
8. **Finding Association Rules for Banking data. Description:** In data mining, association rule learning is a popular and well researched method for discovering interesting relations between variables in large databases. It can be described as analyzing and presenting strong rules discovered in databases using different measures of interestingness. In market basket analysis association rules are used and they are also employed in many application areas including Web usage mining, intrusion detection and bioinformatics.
9. **Finding Association Rules for Employee data. Description:** In data mining, association rule learning is a popular and well researched method for discovering interesting relations between variables in large databases. It can be described as analyzing and presenting strong rules discovered in databases using different measures of interestingness. In market basket analysis association rules are

used and they are also employed in many application areas including Web usage mining, intrusion detection and bioinformatics.

**10. To Construct Decision Tree for Weather data and classify it.**

**Description:**

1. **Classification & Prediction:** Classification is the process for finding a model that describes the data values and concepts for the purpose of Prediction.
2. **Decision Tree:** A decision Tree is a classification scheme to generate a tree consisting of root node, internal nodes and external nodes. Root nodes representing the attributes. Internal nodes are also the attributes. External nodes are the classes and each branch represents the values of the attributes Decision Tree also contains set of rules for a given data set; there are two subsets in Decision Tree. One is a Training dataset and second one is a Testing data set. Training data set is previously classified data. Testing data set is newly generated data.

**11. To Construct Decision Tree for Customer data and classify it.**

**Description:**

1. **Classification & Prediction:** Classification is the process for finding a model that describes the data values and concepts for the purpose of Prediction.
2. **Decision Tree:** A decision Tree is a classification scheme to generate a tree consisting of root node, internal nodes and external nodes. Root nodes representing the attributes. Internal nodes are also the attributes. External nodes are the classes and each branch represents the values of the attributes Decision Tree also contains set of rules for a given data set; there are two subsets in Decision Tree. One is a Training dataset and second one is a Testing data set. Training data set is previously classified data. Testing data set is newly generated data.

**12. To Construct Decision Tree for Location data and classify it.**

**Description:**

1. **Classification & Prediction:** Classification is the process for finding a model that describes the data values and concepts for the purpose of Prediction.
2. **Decision Tree:** A decision Tree is a classification scheme to generate a tree consisting of root node, internal nodes and external nodes. Root nodes representing the attributes. Internal nodes are also the attributes. External nodes are the classes and each branch represents the values of the attributes Decision Tree also contains set of rules for a given data set; there are two subsets in Decision Tree. One is a Training dataset and second one is a Testing data set. Training data set is previously classified data. Testing data set is newly generated data.

**13. Write a procedure for Visualization for Weather Table.**

**Description:** This program calculates and has comparisons on the data set selection of attributes and methods of manipulations have been chosen. The Visualization can be shown in a 2-D representation of the information.

**14. Write a procedure for Visualization of Banking Table.**

**Description:** This program calculates and has comparisons on the data set selection of attributes and methods of manipulations have been chosen. The Visualization can be shown in a 2-D representation of the information.

**15. Write a procedure for cross-validation using J48 Algorithm for weather table.**

**Description:** Cross-validation, sometimes called rotation estimation, is a technique for assessing how the results of a statistical analysis will generalize to an independent data set. It is mainly used in settings where the goal is prediction, and one wants to estimate how accurately a predictive model will perform in practice. One round of cross-validation involves partitioning a sample of data into complementary subsets, performing the analysis on one subset (called the training set), and validating the analysis on the other subset (called the validation set or testing set).