Course and Examination Scheme
of NEP 2020 Curriculum

Bachelor of Technology in
Computer Science & Engineering
(Faculty of Science and Technology)

GONDWANA UNIVERSITY, Gadchiroli
MIDC Road Complex, Gadchiroli
PIN-442 605, (M.S.)

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Key Features of Curriculum

1. Multiple exit options after every year.
2. Provision for Open Electives (OE), Vocational and Skill Enhancement Courses (VSE), Ability Enhancement Courses (AE), Indian Knowledge System (IKS), Value Education Courses (VE), Co-Curricular Courses (CC) in addition to program core courses.
3. Mandatory internship of one semester.
4. Credits for Value education courses, Ability Enhancement Courses, Co-Curricular Curricular Activities.
5. Interdisciplinary and multidisciplinary education through minors and open electives.
6. Skill based courses.
7. Provision for learning in online mode through Swayam/NPTEL etc. courses
8. Opportunity for learner to choose courses of their interest in all disciplines.
9. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.
10. Flexibility for all types of learners i.e. Good, Normal and Exit

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Credit Distribution for each year and Exit Option

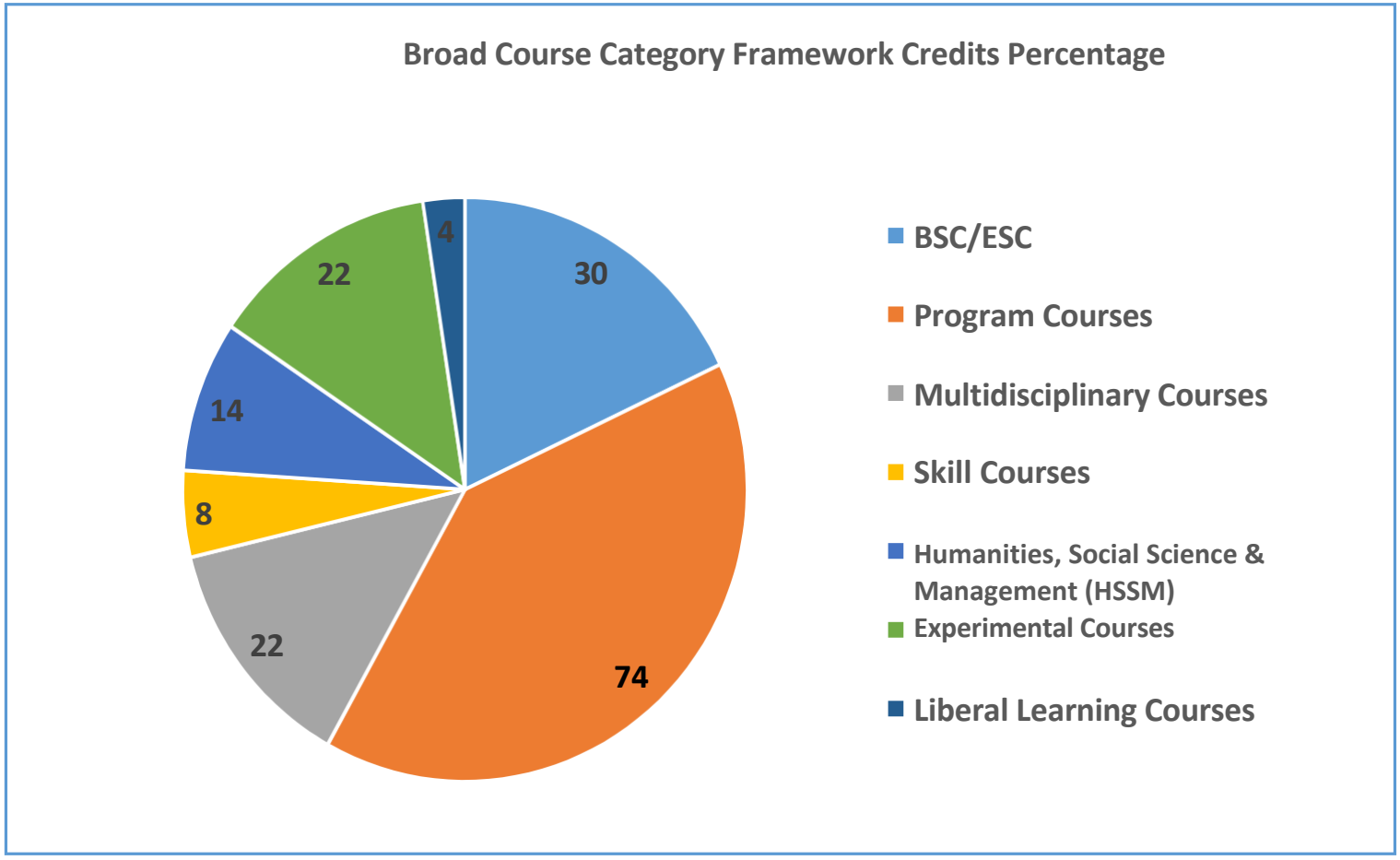
NCrF Level	Year/ Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	One Year U.G. Certificate in Engg./Tech.	44	04	48
5.0	Semester III & IV	Two Year U.G. Diploma in Engg./Tech.	88	08	96
5.5	Semester V & VI	Three Years Bachelor's Degree in Vocation (B. Voc.) Or B.Sc. (Engg./Tech.)	132	08	140
6.0	Semester VII & VIII	B. Tech. Major with Multidisciplinary Minor	174	--	174

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Course Category-wise Credit Distribution

Course Category	As per NEP GR	University Credits	CC	As per NEP GR	University Credits
BSC/ESC	30	30	BSC	14-18	17
			ESC	16-12	13
Program Courses	64 -76	74	PCC	44-56	54
			PEC	20	20
Multidisciplinary Courses	22	22	MDM	14	14
			OE	8	8
Skill Courses	8	8	VSEC	8	8
Humanities, Social Science & Management (HSSM)	14	14	AEC	4	4
			EM	4	4
			IKS	2	2
			VEC	4	4
Experiential Courses	22	22	RM	4	4
			CEP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**164 – 176**	**174**		**164-176**	**174**

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Semester-wise Credit Distribution:

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	Basic Science Course (BSC)	9	8							17	14-18
2	Engineering Science Course (ESC)	7	6							13	16-12
3	Program Core Course (PCC)		2	11	13	12	8		8	54	44-56
4	Program Elective Course (PEC)					3	7	6	4	20	20
5	Multidisciplinary Minor Course (MDM)			2	2	3	3	2	2	14	14
6	Open /School Elective Course (OE)			4	2	2				8	8
7	Vocational & Skill Enhancement Course (VSEC)	2	2	1	1		2			8	8
8	Ability Enhancement Course (AEC)		2			2				4	4
9	Entrepreneurship/ Management Courses (EMC)				2		2			4	4
10	Indian Knowledge System (IKS)	2								2	2
11	Value Education Course (VEC)			2	2					4	4
12	Research Methodology (RM)								4	4	4
13	Community Engagement Activity/Field Project (CEP)			2						2	2
14	Project (PR)								4	4	4
15	Internship (IN)							12		12	12
16	Co-Curricular Course (CC)	2	2							17	4
	Total Credits	**22**	**22**	**22**	**22**	**22**	**22**	**20**	**22**	**174**	**164 - 176**

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General Instructions:

1. **Regarding Multi-Disciplinary Minor (MDM) track and subject:**

   i. The MDM subjects included in the NEP curriculum are to encourage students to gain knowledge and skills in areas beyond their core discipline and to promote flexibility, breadth of learning and innovation.

   ii. Minor subject title will appear in the **degree certificate** (e.g., B.Tech. in Computer Science & Engineering with Minor in Data Science).

   iii. In the third semester, students must select one track from the MDM basket provided in this document, that is outside the scope of their parent discipline. For example, a Computer Science and Engineering student may choose a track offered by departments like Instrumentation Engineering, Mechanical Engineering, or Civil Engineering etc., but not permitted to opt for a track provided by the Computer Science and Engineering department itself.

   iv. Once a track is selected, it cannot be changed throughout the duration of the course.

   v. An MDM track will be offered to students only if minimum 15 number of students opt for it.

2. **Regarding Open Electives**

   i. Students must choose one subject from open elective basket for the respective Semester.

   ii. Students from any Program/discipline are allowed to opt for any one subject offered in the open elective basket.

   iii. An open elective course will be offered if at least 15 students opt for it.

3. **The courses to be complete through "online" mode, offered through SWAYAM/ NPTEL portal or equivalent platform which provides Evaluation mechanism with the permission of Departmental Faculty Board (DFB) of their college. In this case –**

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i. Students can register and complete these online courses during semester in which they are offered, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of respective semester in which the course is being offered.

ii. In case, if a student registers for a course in online mode but fails in the course, the student will have to register for the examination conducted by the University/institute in respective semester as per curriculum. In this case, the student will have to appear for the examinations of the course, and successfully complete the course.

4. In Seventh semester, the students have to complete mandatory internship of one semester in the company/organization approved by the DFB.

5. In addition to program specific courses, the students have to complete vocational skill courses, internship, field projects connected to major degree.

6. **Exit Option:** The exit option at the end of each year will be available to students after even semester. e. 2nd semester, 4thsemester & 6th semester and will commence from AY 2025-26 for UG Certificate, AY 2026-27 for UG Diploma, AY 2027-28 for B. Voc./B. Sc. Engineering degree.

i. Students opting for exit at any level will have to earn additional four/eight credits before exit in skill based vocational courses and internship/apprenticeship/mini-project to make them eligible to get UG certificate/UG Diploma or B.Voc./B. Sc. (Engg./Tech) degree as per eligibility.

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Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One-year UG certificate in Engineering/Technology	4	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at ITI Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation **OR** Technical Project
Exit-2	5.0	Two-year UG Diploma in Engineering/Technology	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification/Evaluation **OR** Technical Project
Exit-3	5.5	Three-year Bachelor Degree in Vocation (B.Voc) or B.Sc. (Engineering/Technology)	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification/Evaluation **OR** Technical Project

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SEMESTER–III																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science and Engineering	STMDMCSE301	Multi-disciplinary Minor-I	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
OE	Science and Humanity	STOESHC302C	Open Elective- I	4	-	-	4	3	10	10	80	100	40	--	--	--	--	4
VEC	Science and Humanity	STVECSHC303	Introduction to Constitution of India	2	-	-	2	--	30	20	--	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE304	Operating Systems	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE305	Data Structures and Program Design	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE306	Computer Architecture and Organization	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE307	Operating Systems Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE308	Data Structures and Program Design Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Computer Science and Engineering	STVSECCSE309	Software Lab-I	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
CEP	Computer Science and Engineering	STCEPCSE310	Case study on Societal issues	-	-	4	4	--	--	--	--	--	--	50	--	50	25	2
Total				**17**	**00**	**10**	**27**	**--**	**75**	**65**	**360**	**500**	**--**	**125**	**75**	**200**	**--**	**22**
Marks Grand Total				**700**														

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SEMESTER–III		
LIST OF OPEN ELECTIVE - I COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOESHC302A	Mathematical Transform and Statistical Methods
B	STOESHC302B	Engineering Applied Mathematics
C	STOESHC302C	Probability and Statistics
D	STOEINS302	Signals and Systems
E	STOECEC302	Building Constructions and Materials
F	STOEELE302	Modelling and Design of EV

Note: An open elective course will be offered if at least 15 students opt for it.

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SEMESTER–IV																	
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme									Credit
				Hours per week				Theory Marks						Practical Marks			
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Computer Science and Engineering	STMDMCSE401	Multi-disciplinary Minor-II	2	-	-	2	2	05	05	40	50	20	--	--	--	--	2
OE	Computer Science and Engineering	STOECSE402	Open Elective- II	2	-	-	2	2	05	05	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE403	Advanced Data Structures	3	1	-	4	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE404	Software Engineering	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE405	Theory of Computation	3	1	-	4	3	10	10	80	100	40	--	--	--	--	4
EMC	Computer Science and Engineering	STEMCCSE406	Professional Management Techniques	2	-	-	2	2	05	05	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE407	Advanced Data Structures Lab	-	-	2	2	-	-	-	-	-	-	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE408	Theory of Computation Lab	-	-	2	2	-	-	-	-	-	-	25	25	50	25	1
VEC	Computer Science and Engineering	STVECCSE409	Human Values and Ethics	2	-	-	2	-	30	20	-	50	20	-	-	-	25	2
VSEC	Computer Science and Engineering	STVSECCSE410	Software Lab – II	-	-	2	2	-	-	-	-	-	-	50	-	50	25	1
Total				**17**	**2**	**6**	**25**	**--**	**75**	**65**	**360**	**500**	**--**	**100**	**50**	**150**	**--**	**22**
Marks Grand Total				**650**														

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SEMESTER–IV		
LIST OF OPEN ELECTIVES - II COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOEMEC402	Industrial Management
B	STOEETC402	Digital System Design
C	STOECSE402	Design Thinking
D	STOEINS402	Optoelectronic Instrumentation
E	STOECEC402	Building Automation
F	STOEELE402	EV Design Analysis and Control

Note: An open elective course will be offered if at least 15 students opt for it.

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EXIT CRITERIA FOR U. G. DIPLOMA (AFTER SECOND YEAR)																			
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**											**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**					
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**		
PCC	Computer Science & Engineering	STEXCSE421	Android Application Development	--	--	16	16	--	--	--	--	--	--	200	--	200	100		8
OR																			
PCC	Computer Science & Engineering	STEXCSE422	Certified Software Engineer in DevOps	--	--	16	16	--	--	--	--	--	--	200	--	200	100		8
Total				**--**	**--**	**16**	**16**	--	--	--	--	--	--	**200**	**--**	**200**	**--**		**8**
Marks Grand Total				**200**															

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SEMESTER– V																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science and Engineering	STMDMCSE501	Multi-disciplinary Minor-III	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
OE	Computer Science and Engineering	STOECSE502	Open Elective- III	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE503	Design and Analysis of Algorithms	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE504	Database Management Systems	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE505	Object Oriented Programming	3	-	-	3	3	10	10	80	100	40	--	--	--	--	4
PEC	Computer Science and Engineering	STPECCSE506	PEC-I	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE507	Design and Analysis of Algorithms Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE508	Database Management Systems Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Computer Science and Engineering	STPCCCSE509	Object Oriented Programming Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
AEC	Computer Science and Engineering	STAECCSE510	Seminar/Mini-Project	-	-	4	4	--	--	--	--	--	--	25	25	50	25	1
Total				**17**	**-**	**10**	**27**	**--**	**55**	**55**	**440**	**550**	**--**	**100**	**100**	**200**	**--**	**24**
Marks Grand Total				**750**														

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SEMESTER–V						
LIST OF OPEN ELECTIVE - III COURSE			**LIST OF PROGRAM ELECTIVES - I**		**LIST OF PROGRAM ELECTIVES – I LAB**	
Sr.	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**
A	STOEMEC502	Operations Research Techniques	STPECCSE506A	Data Mining and Warehousing		
B	STOEETC502	Automotive Electronics	STPECCSE506B	Distributed Systems		
C	STOECSE502	Software Project Management	STPECCSE506C	Social Network Analytics		
D	STOEINS502	Unit Operation and Power Plant Instrumentation				
E	STOECEC502	Remote Sensing and GIS				
F	STOEELE502	Introduction to Smart Grid				

Note:

1. An open elective and Program elective course will be offered if at least 15 students opt for it.
2. If a student opts for Program Elective – I (Serial No. A), they will be eligible only for the corresponding Program Elective – I Lab (Serial No. A); the same applies for serial no. B

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SEMESTER– VI																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science and Engineering	STMDMCSEC601	Multi-disciplinary Minor-IV	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Computer Science and Engineering	STPCCCSE602	Computer Networks	3	1	-	4	3	10	10	80	100	40	--	--	--	--	4
PCC	Computer Science and Engineering	STPCCCSE603	Compiler Design	3	-	-	3	2	10	10	80	100	40	--	--	--	--	3
PEC	Computer Science and Engineering	STPECCSE604	PEC-2	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Computer Science and Engineering	STPECCSE605	PEC-3	3	-	-	3	3	10	10	80	100	40	--	--	--	--	3
EMC	Computer Science and Engineering	STEMCCSE606	Enterprise Resource Planning	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Computer Science and Engineering	STPCCCSE607	Computer Networks Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Computer Science and Engineering	STPECCSE608	PEC-2 Lab	-	-	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Computer Science and Engineering	STVSECCSE609	Soft Skills	-	1	2	3	--	--	--	--	--	--	25	25	50	25	
Total				**17**	**2**	**6**	**25**	**--**	**55**	**55**	**440**	**550**	**--**	**75**	**75**	**150**	**--**	**20**
Marks Grand Total				**750**														

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SEMESTER–VI			
LIST OF PROGRAM ELECTIVES - II		**LIST OF PROGRAM ELECTIVES – II LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECCSE604A	**Deep Learning**	**STPECCSE608A**	**Deep Learning**
STPECCSE604B	**Real Time Operating System**	**STPECCSE608B**	**Real Time Operating System**
STPECCSE604C	**Digital Forensics**	**STPECCSE608C**	**Digital Forensics**

LIST OF PROGRAM ELECTIVES - III		**LIST OF PROGRAM ELECTIVES – III LAB**	
Course Code	**Name of the course**	**Course Code**	**Name of the course**
STPECCSE605A	**Natural Language Processing**		
STPECCSE605B	**Big Data Analytics**		
STPECCSE605C	**Information Retrieval**		

Note:

1. A Program elective course will be offered if at least 15 students opt for it.
2. If a student opts for Program Elective – II or III (Serial No. A), they will be eligible only for the corresponding Program Elective – II or III Lab (Serial No. A); the same applies for serial no. B

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EXIT CRITERIA FOR BACHELOR DEGREE IN VOCATION (AFTER THIRD YEAR)																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
PCC	Computer Science & Engineering	STEXCSE412	Certified Network Engineer (CISCO, CCNA)	--	--	16	16	--	--	--	--	--	--	200	--	200	100	8
OR																		
PCC	Computer Science & Engineering	STEXCSE413	Certified Cloud Engineer (AWS, AZURE)	--	--	16	16	--	--	--	--	--	--	200	--	200	100	8
Total				**--**	**--**	**16**	**16**	--	--	--	--	--	--	**200**	**--**	**200**	**--**	**8**
Marks Grand Total				**200**														

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SEMESTER– VII																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science & Engineering	STMDMCSE701	Multi-disciplinary Minor-V	*2	--	--	2	--	--	50	--	50	20	--	--	--	--	2
PEC	Computer Science & Engineering	STPECCSE702	Program Elective – IV	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
PEC	Computer Science & Engineering	STPECCSE703	Program Elective – V	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
ELC	Computer Science & Engineering	STINCSE704	Internship / OJT	--	--	24	24	--	--	--	--	--	--	100	200	300	150	12
Total				**8**	**--**	**24**	**32**	**--**	**--**	**250**	**--**	**250**	**--**	**100**	**200**	**300**	**--**	**20**
Marks Grand Total				**550**														

Note: Program Elective-IV and V is 12-week online certificate courses conducted by NPTEL / SWAYAM / MOOC / OTHERS in the area approved by DFB

***Courses to be mentored and assessed by faculty members**

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SEMESTER– VIII																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Computer Science & Engineering	STMDMCSE801	Multi-disciplinary Minor-VI	2	-	-	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Computer Science & Engineering	STPCCCSE802	Cryptography and Network Security	3	1	-	4	3	10	10	80	100	40	---	---	---	---	4
PCC	Computer Science & Engineering	STPCCCSE803	Cloud Computing	3	-	-	3	3	10	10	80	100	40	---	---	---	---	3
PEC	Computer Science & Engineering	STPECCSE804	PEC-VI	3	-	-	3	3	10	10	80	100	40	---	---	---	---	3
RM	Computer Science & Engineering	STRMCSE805	Research Methodology	3	1	-	4	3	10	10	80	100	40	---	---	---	---	4
PCC	Computer Science & Engineering	STPCCCSE806	Cryptography and Network Security Lab	-	-	2	2	---	---	---	---	---	---	25	25	50	25	1
PCC	Computer Science & Engineering	STPCCCSE807	Cloud Computing Lab	-	-	2	2	---	---	---	---	---	---	25	25	50	25	1
PEC	Computer Science & Engineering	STPECCSE808	Project	-	-	8	8	---	---	---	---	---	---	75	75	150	75	4
Total				**14**	**2**	**12**	**28**	**--**	**45**	**45**	**360**	**450**	**--**	**125**	**125**	**250**	**--**	**22**
Marks Grand Total				**700**														

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Semester - VIII	
LIST OF PROGRAM ELECTIVES - VI	
Course Code	**Name of the course**
STPECCSE804A	**Reinforcement Learning**
STPECCSE804B	**Software Testing & Quality Assurance**
STPECCSE804C	**Parallel Computing**

Note:

1. A Program elective course will be offered if at least 15 students opt for it.

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LIST OF OPEN ELECTIVE COURSE (BASKET OF OPEN ELECTIVE)			
	OPEN ELECTIVE-I	**OPEN ELECTIVE -II**	**OPEN ELECTIVE -III**
A	STOESHC302A Mathematical Transform and Statistical Methods	STOEMEC402 Industrial Management	STOEMEC502 Operations Research Techniques
B	STOESHC302B Engineering Applied Mathematics	STOEETC402 Digital System Design	STOEETC502 Automotive Electronics
C	STOECSE302 Probability and Statistics	STOECSE402 Design Thinking	STOECSE502 Software Project Management
D	STOEINS302 Signals and Systems	STOEINS402 Optoelectronic Instrumentation	STOEINS502 Unit Operation and Power Plant Instrumentation
E	STOECEC302 Building Constructions and Materials	STOECEC402 Building Automation	STOECEC502 Remote Sensing and GIS
F	STOEELE302 Modelling and Design of EV	STOEELE402 EV Design Analysis and Control	STOEELE502 Introduction to Smart Grid

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LIST OF PROGRAM ELECTIVES						
Name of course	**Program Elective - I**	**Program Elective - II**	**Program Elective - III**	**Program Elective - IV**	**Program Elective - V**	**Program Elective – VI**
Code	**STPECMEC506**	**STPECCSE604**	**STPECCSE605**	**STPECCSE702**	**STPECCSE703**	**STPECCSE804**
A	Data Mining and Warehousing	Deep Learning	Natural Language Processing	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Reinforcement Learning
B	Distributed Systems	Real Time Operating System	Big Data Analytics	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Software Testing & Quality Assurance
C	Social Network Analytics	Digital Forensics	Information Retrieval	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Parallel Computing

SWAYAM/NPTEL etc. portal Courses should be approved by DFB and **at least of 12 weeks** including tutorials.

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Name of course	**Program Elective – II Lab**
Code	**STPECCSE608**
A	Deep Learning
B	Real Time Operating System
C	Digital Forensics

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LIST OF MULTI DICIPLINARY MINOR COURSE TRACK (MDM BASKET)

Sr. No.	Offering Department	Name of Minor Course (Track)	Students from Department Who can register
1	Civil Engineering (CEC)	Environmental Engineering	All branches except Civil Engineering
2	Computer Science & Engineering (CSE)	Data Science	All branches except Computer Science & Engineering
3	Electrical Engineering (ELE)	Power System Engineering	All branches except Electrical Engineering
4	Electronics and Telecommunication Engg.(ETC)	IoT and Drone Technology	All branches except Electronics and Telecommunication Engineering
5	Instrumentation Engineering (INS)	Industrial Automation	All branches except Instrumentation Engineering
6	Mechanical Engineering (MEC)	Industry IoT and Smart Manufacturing	All branches except Mechanical Engineering

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LIST OF MULTI DICIPLINARY MINOR COURSES (MDM BASKET)

Name of Minor Course	Civil Engineering	Computer Science and Engineering	Electrical Engineering	Electronics & Telecommunication Engineering	Instrumentation Engineering	Computer Science & Engineering
	TRACK-I Environmental Engineering	**TRACK-I** Data Science	**TRACK-I** Power System Engineering	**TRACK-I IoT and Drone Technology**	**TRACK-I Industrial Automation**	**TRACK-I Industry IoT and Smart Manufacturing**
Multi-disciplinary Minor -I	STMDMCEC301 Basics of Environmental Engineering	STMDMCSE301 Introduction to Data Science	STMDMELE301 DC Machines and Transformer	STMDMETC301 IoT Sensors and Actuators	STMDMINS301 Industrial Measurements	STMDMMEC301 Additive Manufacturing
Multi-disciplinary Minor -II	STMDMCEC401 Drinking Water Quality and Water Pollution	STMDMCSE401 Tools for Data Science	STMDMELE401 AC Machines	STMDMETC401 Basics of Drone Technology	STMDMINS401 Control System Components	STMDMMEC401 PLC and Automation
Multi-disciplinary Minor -III	STMDMCEC501 Air Pollution	STMDMCSE501 Data Visualisation and Data Analytics	STMDMELE501 Electrical Drives	STMDMETC501 IoT Architecture and Protocol	STMDMINS501 Control System Engineering	STMDMMEC601 Industrial Robotics
Multi-disciplinary Minor -IV	STMDMCEC601 Soil, Sound and Solid Waste Pollution	STMDMCSE601 Machine Learning	STMDMELE601 Power System Protection	STMDMETC601 Interfacing Programming of IoT and Drone	STMDMINS601 Process Automation	STMDMMEC601 Mechatronics Systems
Multi-disciplinary Minor -V	STMDMCEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column	STMDCSEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column	STMDMELE701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column	STMDMETC701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column	STMDMINS701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column	STMDMMEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to vertical column
Multi-disciplinary Minor -VI	STMDMCEC801 Advance Air Pollution and Solid waste Management	STMDMCSE801 Data Science in Practice	STMDMELE801 Digital Signal Processing	STMDMETC801 IoT and Drones Application	STMDMINS801 Process Control	STMDMMEC801 IoT in Automotive Engineering

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STVECSHC303

Title of Course: Introduction to Constitution of India

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

Course outcomes:

After completing the course, the students will be able;

CO1 Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO2 Understand the functioning of three wings of the government i.e., legislative, executive and judiciary.

CO3 Understand the decentralization of power between central, state and local self-government.

CO4 Understand the functioning of urban and rural administration in India.

Unit	Content	Hours
I	**Constitution: Meaning and Importance** Introduction to the Constitution of India, history, social, political, economic, and spiritual influences in the development of the constitution, Nature and special features: Equality and social justice- various kinds of freedoms-social control, Citizenship, Preamble, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy (Article 41 to 47)	8
II	**The Central Government of India** The levels of government, Indian Federation, Center-state relationship: Legislative, Administrative and Financial, Roles and positions of President, PM, Council of union ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	8
III	**The State Government** Roles and positions of Governor, CM, and Council of ministers of states: Legislative, and Executive Control, Secretariat and Directorates: organization, structure, and functions, District Administration and the role of District Collector: Legislative, and Executive Control. The Supreme Court and High Court: Powers and Functions.	7
IV	**Urban and Rural Administration** Role and importance of District's administrative head, the role of Mayor and elected representative, Role and functioning of the Municipal Corporation and Municipalities, Zila Panchayat, Gram Panchayat, Block level governance, democracy at the grass root level, The Election Commission of India: Introduction to the role and functioning of the Election Commission of India, Overview of the electoral procedure.	7

Reference Books:

1. Introduction to the Constitution of India by Durga Das Basu, Prentice Hall of India Pvt. Ltd., New Delhi
2. Indian Constitution by Subash Kashyap, National Book Trust
3. Constitution of India by Dr. P. K. Agrawal and Dr. K. N. Chaturvedi, Prabhat Prakashan 2017
4. Constitution of India by V. N. Shukla, Eastern Book Company

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE304

Title of Course: **Operating System**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course Outcomes:

After completing the course, the students will be able;

CO1	Outline various concepts and features of Operating systems.
CO2	Outline various concepts and features of Operating systems.
CO3	Outline various concepts and features of Operating systems.
CO4	How to prevent deadlock and various disk scheduling algorithms.
CO5	Outline various concepts in detail like paging and segmentation related to memory.

Unit	Content	Hours
I	Basics of OS: types; services; booting and dual booting; system calls: types. Process: states; types; PCB; Schedulers; Context Switching; threads: types; Multithreading.	9
II	CPU scheduling: algorithms (FCFS, SJF, PRIORITY, ROUND ROBIN); problems: multilevel queue scheduling; multi feedback queue; Starvation; Aging.	9
III	IPC: need; approaches (pipe, socket, file, signal, shared memory, semaphore); Process cooperation and synchronization: race condition; critical section; Classical problems: bounded buffer (producer consumer problem), dining philosopher problem, reader writers' problem).	9
IV	Deadlock: conditions causing it; methods to handle it; RAG; Bankers Algorithms and problems. Disk Scheduling: physical characteristics; algorithms (FCFS, SSTF, SCAN, C SCAN, etc). File system: sequential, linked list and indexed access.	9
V	Memory management: contiguous and non-contiguous; Fragmentation; Virtual memory: paging and segmentation; TLB; Demand paging; Page faults; thrashing; page replacement algorithms.	9
	Total	45

Reference Books:

1. Operating System concepts (9th edition) by Abraham Silberschatz, peter B. Galvin, Greg Gagne.
2. Guide to Operating systems (5tgh edition) by Greg Tomsho.
3. Modern Operating Systems by Andrew S. Tanenbaum.

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE305

Title of Course: **Data Structures and Program Design**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Use pointers and structures to build self-referential data types and understand linked list concepts.
CO2	Perform file operations in C using various file types and stream handling techniques.
CO3	Understand basic data structures, algorithm analysis, and array representations.
CO4	Apply sorting, searching, and hashing techniques with performance evaluation.
CO5	Implement stack and queue ADTs with algorithmic analysis and practical applications.

Unit	Content	Hours
I	**Pointers and Structures:** Structures, defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list	9
II	**File Handling:** Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush ().	8
III	**Data Structures and Algorithms Basics:** Introduction: Basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics. Algorithms: Definition, characteristics, analysis of an algorithm, asymptotic notations, time and space trade-offs. Array ADT: Definition, operations and representations – row-major and column- major.	9
IV	**Sorting, Searching and Hashing:** Sorting: Different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison. Searching: Necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods. Hashing: Hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques	10
V	**Stacks and Queues:** Stack ADT: Allowable operations, algorithms and their complexity analysis, applications of stacks–expression conversion and evaluation (algorithmic analysis), multiple stacks. Queue ADT: Allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.	9
	Total	45

Reference Books:

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Reema Thareja, Data Structures using C, Third Edition, Oxford University Press, 2023
3. Narasimha Karumanchi, Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles Fifth Edition, CareerMonk Publications, 2016.

			
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Text Books:

1. Programming in ANSI C: E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill
3. G.A.V. Pai, Data Structures and Algorithms: Concepts, Techniques and Application, First Edition, McGraw Hill, 2017.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
5. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Third Edition, Pearson Education, 2007.
6. Thomas H Cormen, Algorithms Unlocked, MIT Press, 2013

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE306

Title of Course: Computer Architecture and Organization

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Explain the organization and architecture of computer systems with machines instructions and programs.
CO2	Apply different data types on simple arithmetic and logical unit.
CO3	Explain instructions cycles and analyze the input/output devices with computer system.
CO4	Demonstrate the functions of different types of memory devices.
CO5	Analyze the functions of basic processing unit , parallel processing and pipelining.

Unit	Content	Hours
I	General Computer Architecture: Basic structure & Components of Computer System, Von-Neumann Model, Buses, Types of bus, Bus & memory transfer, Registers, Performance: Processor Clock, basic Performance Equation, Clock Rate, Memory Location & Address, Memory operations, Instructions, Addressing modes.	9
II	Arithmetic: Fixed Point addition, Subtraction, Multiplication, Division, Floating Point Arithmetic, sub word parallelism, Booth's Algorithm and Array Multiplier.	9
III	IPC: need; approaches (pipe, socket, file, signal, shared memory, semaphore); Process cooperation and synchronization: race condition; critical section; Classical problems: bounded buffer (producer consumer problem), dining philosopher problem, reader writers' problem).	9
IV	Memory: Introduction to memory, classification of primary & secondary memory, types of RAM & ROM, Memory Hierarchy, Allocation, Cache, Virtual memory, Memory Management unit, Mapping, Paging.	9
V	Introduction to Parallel processing concepts, Pipelining processing, Pipeline stages, Hazards, Instruction pipelining, Flynn's classification, Hardware multithreading, Multicore processor.	9
	Total	45

TEXT BOOKS:

1. Computer system Architecture, M.M.Mano, Pearson Education.
2. David A. Patterson and John L.Hennessey ," Computer Organisation and design ", Morgan Kauffan / Elsevier, Fifth edition, 2014.

Reference Books:

1. William Stallings "Computer Organization and Architecture ", 7th edition ,Pearson education , 2006.
2. Govindarajalu ," Computer Organization and Architecture ,Design principles and applications ".1st edition, TataMcGraw Hill,2005.

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCMEC307

Title of Course: **Operating Systems Lab**

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	Outline various concepts and features of Operating systems.
CO2	Solve problems related to CPU scheduling and differentiate them.
CO3	Outline issues that arise in IPC and their solution through semaphore.
CO4	How to prevent deadlock and various disk scheduling algorithms.
CO5	Outline various concepts in detail like paging and segmentation related to memory.

Sr. No	LIST OF PRATICALS
1	Basics of Operating system
2	WAP for non-pre-emptive scheduling algorithm.
3	WAP to stimulate the CPU scheduling SJF.
4	WAP for Round Robin algorithm.
5	WAP for Priority scheduling algorithm
6	WAP to stimulate Producer Consumer problem using semaphore.
7	WAP to stimulate Disk scheduling algorithms.
8	WAP to stimulate First fit, best fit and worst fit memory techniques.
9	WAP to stimulate file allocation techniques: sequential, linked list and indexed.
10	WAP to stimulate Deadlock Bankers algorithm

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCMEC308

Title of Course: Data Structures and Program Design Lab

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

1. Use pointers and structures to build self-referential data types and understand linked list concepts.
2. Perform file operations in C using various file types and stream handling techniques.
3. Understand basic data structures, algorithm analysis, and array representations.
4. Apply sorting, searching, and hashing techniques with performance evaluation.
5. Implement stack and queue ADTs with algorithmic analysis and practical applications.

List of Practicals:

1. Implement a Student Record System using Array of Structures
   a. Define a structure for student details (name, roll number, marks).
   b. Store and display records for multiple students using an array of structures.
2. Pointer Basics Exploration
   Write a program to demonstrate pointer declaration, initialization, dereferencing for value manipulation, and pointer arithmetic for memory traversal.
3. Write a Program to Read and Write Student Records to a File
   a. Use structures to store student data.
   b. Implement file I/O operations to save and retrieve records from a binary file.
4. Write a program to copy the contents of one file to another.
5. Analyze Time Complexity of Basic Array Operations:
   a. Implement insertion, deletion, and search operations on an array.
   b. Measure and compare time complexity using asymptotic notation.
6. Implement Row-Major and Column-Major Representation of 2D Arrays
   a. Write functions to access and manipulate elements using both representations.
   b. Compare memory access patterns and performance.
7. Compare Sorting Algorithms Based on Performance
   a. Implement at least three sorting algorithms (e.g., quick sort, merge sort, heap sort).
   b. Analyze and compare their time complexity on different input sizes.

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8. Design and implement a C program to:

Initialize a stack with a fixed maximum size. Perform and display the results of the following operations:

Push: Insert an element onto the stack.
Pop: Remove the top element from the stack.
Peek: View the top element without removing it.
isEmpty/isFull: Check the status of the stack.

9. Design and implement a C program to:

Create a queue with a fixed size.
Perform and display the following operations:
Enqueue: Add an element to the rear of the queue.
Dequeue: Remove an element from the front of the queue.
Peek: View the front element without removing it.
isEmpty/isFull: Check whether the queue is empty or full.

10. Evaluate Arithmetic Expressions using Stack
    a. Convert infix expressions to postfix.
    b. Evaluate the postfix expression using stack operations.

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCMEC309

Title of Course: Software Lab-I

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	Design and develop the programming concepts using Python.
CO2	Apply the data structures concepts in python programs
CO3	Understanding the use of code optimization techniques.
CO4	Illustrate the concept of OOPs through Programs.
CO5	Implement various file operation and handling exceptions

Sr. No	LIST OF PRATICALS
1	Program to check whether the string is palindrome or not.
2	A) Convert the list of elements into dictionary. B) Write a program to Merge the two lists
3	Write a program that takes input string from user and make separate list of characters, numbers and special characters.
4	Python program to accept three digits and print all possible combinations from digits
5	Program to print identity matrix
6	Reversing the list without using inbuilt method/function
7	A) Write a program to fetch email, mobile number and special characters from the file and make separate file for each of them after fetching it. B.) Filter the emails on the basis of domain name using Lambda Function
8	A) Write a program to check whether the number is Armstrong or not using function. B) Python program to reverse the given number using function.
9	Program to demonstrate the concept of exceptional handling.
10	Program to demonstrate implementation of Inheritance.

Books Recommended:

Text Books:

- 'Head-First Python' (2ndEdition) by Paul Barry, O'Reilly Publication
- "Python Data Science Handbook" by Jake VanderPlas

Reference Books:

- John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
- R. Nageswara Rao, "Core Python Programming", Dreamtech
- Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall

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III Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCMEC310

Title of Course: Case Study on Societal Issues

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	4	4	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1	Recognize pressing societal issues such as digital privacy, misinformation, accessibility, or environmental sustainability and analyze them using computational thinking.
CO2	Demonstrate the ability to design and implement technology-driven solutions (e.g., apps, algorithms, data models) that address specific societal problems.
CO3	Assess the impact of their proposed solutions on society, considering ethical, legal, and cultural dimensions.
CO4	Collaborate in diverse teams to research, design, and present case studies, integrating perspectives from social sciences, law, and engineering.
CO5	develop skills to present their case study outcomes through reports, presentations, and digital media, tailored to both technical and non-technical audiences.

Project Ideas for Societal Impact in CSE

1. **Fake News Detection System**
   - Use machine learning and NLP to identify and flag misinformation on social media.
   - Outcome: Tackles digital literacy and misinformation.
2. **Smart Waste Management App**
   - Build an IoT-based system to monitor waste bins and optimize collection routes.
   - Outcome: Promotes environmental sustainability and civic efficiency.
3. **Assistive Tech for Visually Impaired**
   - Develop a mobile app that uses computer vision to describe surroundings or read text aloud.
   - Outcome: Enhances accessibility and inclusion.
4. **Mental Health Chatbot**
   - Create an AI-powered chatbot that offers emotional support and connects users to resources.
   - Outcome: Addresses mental health awareness and support.
5. **Online Skill Development Platform for Rural Youth**
   - Design a web-based platform offering free coding and tech courses in local languages.
   - Outcome: Empowers underserved communities through education.
6. **Crowdsourced Disaster Response System**
   - Build a platform where users can report emergencies and get real-time help during natural disasters.
   - Outcome: Improves community resilience and emergency response.
7. **Gender Sensitivity Awareness Game**
   - Create an interactive game that educates users on gender equality and respectful behaviour.
   - Outcome: Promotes social awareness and ethical behaviour.
8. **AI-Based Career Guidance Tool**
   - Develop a tool that analyses student interests and academic performance to suggest career paths.

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- Outcome: Supports youth empowerment and informed decision-making.

9. **Digital Public Distribution System Tracker**
   - Build a blockchain-based system to track ration distribution and prevent corruption.
   - Outcome: Enhances transparency and governance.
10. **Elderly Care Monitoring System**
    - Use sensors and mobile apps to monitor health and safety of senior citizens living alone.
    - Outcome: Supports aging populations and healthcare access.

Expanded Project Ideas for Societal Impact

1. **Water Quality Monitoring System**
   - Use IoT sensors and data analytics to track water pollution levels in rivers or lakes.
   - Outcome: Supports environmental protection and public health.
2. **AI-Powered Legal Aid Chatbot**
   - Build a chatbot that provides basic legal guidance to underserved communities.
   - Outcome: Promotes access to justice and legal awareness.
3. **Digital Literacy Campaign Platform**
   - Create a web portal that teaches digital skills to senior citizens or rural populations.
   - Outcome: Bridges the digital divide and empowers marginalized groups.
4. **Smart Traffic Violation Detection**
   - Use computer vision to detect helmetless riders or signal violations.
   - Outcome: Enhances road safety and law enforcement.
5. **Online Civic Engagement Portal**
   - Develop a platform for citizens to report local issues and track government responses.
   - Outcome: Encourages transparency and participatory governance.
6. **AI-Based Drug Interaction Checker**
   - Build a tool that helps users check for harmful drug combinations.
   - Outcome: Improves healthcare safety and awareness.
7. **Crowdsourced Missing Persons Tracker**
   - Create a system where users can report and match missing person cases using facial recognition.
   - Outcome: Assists law enforcement and families in reunification efforts.
8. **Digital Platform for NGO Collaboration**
   - Design a system that connects NGOs with volunteers, donors, and beneficiaries.
   - Outcome: Strengthens social service networks and resource sharing.
9. **Cyberbullying Detection Tool**
   - Use sentiment analysis and pattern recognition to flag abusive content online.
   - Outcome: Promotes safer digital environments for youth.
10. **Disability-Friendly Navigation App**
    - Build a location-based app that maps wheelchair-accessible routes and facilities.
    - Outcome: Enhances mobility and inclusion for people with disabilities.

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE403

Title of Course: **Advanced Data Structures**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	1	--	4	4	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Implement and analyse operations on linked lists, stacks, and queues.
CO2	Apply tree structures and balancing techniques with time analysis.
CO3	Use graph algorithms for traversal, pathfinding, and spanning trees.
CO4	Implement heaps and disjoint sets for sorting and connectivity tasks.
CO5	Apply advanced data structures like tries and segment trees with amortized analysis.

Unit	Content	Hours
I	**Linked Lists:** Singly Linked Lists: Representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. Doubly and Circular Linked Lists: Operations and algorithmic analysis. Linked representation of stacks and queues.	10
II	**Trees and Their Variants: Trees:** Basic tree terminologies, binary tree and operations, binary search tree (BST) and operations with time analysis of algorithms, threaded binary trees. Self-balancing Search Trees: Tree rotations, AVL tree and operations.	8
III	**Graphs:** Graphs: Basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's and Kruskal's algorithms).	8
IV	**Heaps and Disjoint Sets:** Binary heap, Min-heap and Max-heap operations, Heap applications in priority queues and sorting, Disjoint Set ADT, Union-Find operations, Applications in dynamic connectivity and Kruskal's MST	8
V	**Advanced Data Structures and Applications: Tries**: Prefix trees for efficient string matching and retrieval, Segment **Trees & Binary Indexed Trees**: Efficient range query and update operations, **Amortized Analysis**: Techniques and practical examples (e.g., stack expansion, dynamic arrays)	6
	Total	40

Text Books

1. G.A.V. Pai, Data Structures and Algorithms: Concepts, Techniques and Application, First Edition, McGraw Hill, 2017.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Third Edition, Pearson Education, 2007.
4.Thomas H Cormen, Algorithms Unlocked, MIT Press, 2013

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Reference Books

1. Reema Thareja, Data Structures using C, Third Edition, Oxford University Press, 2023
2. Narasimha Karumanchi, Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles Fifth Edition, CareerMonk Publications, 2016.
3. Aditya Bhargava, Grokking Algorithms: An Illustrated Guide for Programmers and Other Curious People, First Edition, Manning Publications, 2016.
4. K. R. Venugopal and Sudeep R. Prasad, Mastering C, Second Edition, McGraw Hill,2015.
5. A. K. Sharma, Data Structures using C, Second Edition, Pearson Education, 2013.

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE404

Title of Course: Software Engineering

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	--	--	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	**Understand basic software engineering methods, models and lifecycle phases.**
CO2	**Apply process models suited to project requirements.**
CO3	**Perform requirements elicitation, system modelling, and software design.**
CO4	**Implement, test, and maintain software products effectively.**
CO5	**Analyze and mitigate software risks, ensure quality assurance as well as demonstrate project management skills including planning and scheduling.**

Unit	Content	Hrs
I	Fundamentals of Software Engineering: - Software and Software Engineering, Software Engineering Process, Practice, Myths, Software Development Projects, Software Development Life Cycle, Process Models, Agile Process, Extreme Programming, Agile Process Models, Core Principles and Framework Activity.	09
II	Requirement Analysis and Specifications: - Understanding Requirements, Requirement Gathering and Analysis, Software Requirements Specifications (SRS), Formal System Specification, Software Requirement Models.	09
III	Design and Modelling: - Design Concepts, Design Models, Function oriented Design, Architectural Design, Component-Level Design, User Interface Design, Pattern-Based Design, WebApp Design, Object Modelling Using UML, Object-Oriented Software Development.	09
IV	Coding and Testing: - Coding Standards and Guidelines, Code review and Software Documentation, Software Testing Strategies, Unit Testing, White-Box Testing, Black-Box Testing, Debugging, Programme Analysis Tools, Integration Testing, Object-Oriented Application Testing, Web Application Testing, System Testing.	09
V	Software Project Management: - Project Management Concepts, Project Planning, Software Measurement and Metrics, Project Estimation Techniques, Project Scheduling, Organization and Team Structure, Staffing, Risk Management, Software Configuration Management, Software Reliability and Quality Management.	09

Text/Reference Books:

1. Software Engineering- A Practitioner's Approach (7th Ed.)- Roger S. Pressman, TMH
2. Fundamentals of Software Engineering (5th Ed.)- Rajib Mall, PHI.
3. Software Engineering (9th Edition)- Ian Summerville, Pearson.
4. Software Engineering: Theory and Practice (4th Ed.)- Shari Pfleeger, Pearson.
5. Software Engineering- David Gustafson, Schaum's Series

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE405

Title of Course: **Theory of Computation**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
3	1	--	4	4	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able;

CO1	Build regular expressions for a given language.
CO2	Design different types of automata.
CO3	Classify languages as regular and non-regular languages.
CO4	Detect ambiguity in a grammar and convert into unambiguous grammar and normal forms.
CO5	Design pushdown automata and Turing machines for a given language.

Unit	Content	Hours
I	Chomsky hierarchy, Design of Finite State Machines, Acceptance of strings and languages, Non-Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	09
II	Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets, Inter conversion between RE and RG. Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach Normal form.	09
III	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NPDA. Linear bounded automata and context sensitive language,	09
IV	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church's hypothesis, Types of Turing Machine, Universal Turing Machine.	09
V	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Ackermann Function.	09

Text/Reference Books:

1. Introduction to Automata Theory, Languages, and computation,3rd Edition, Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman, Pearson Education
2. Introduction to languages and the Theory of Computation, 3rd Edition, John C. Martin, Mc Graw Hill
3. Introduction to the Theory of Computation,2nd Edition, Michael Sipser, GALE CENGAGE Learning
4. Theory of Computation, 1st Edition, Dr. O. G. Kakde, Laxmi Publication

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STEMCCSE406

Title of Course: **Professional Management Techniques**

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

Course outcomes:

After completing the course, the students will be able;

CO1	To familiarize the prospective engineers with elementary Principles of Management.
CO2	To acquaint the students with organizational techniques that are useful in their profession in Business decision making which will enhance their employability.
CO3	To apply controlling and directing principles to the firm under different scenarios.
CO4	To apply management skills to create balance in their firm and evaluate policy options for addressing economic issues.

Unit	Content	Hours
I	Introduction to management, definition & nature of management, employment trend in industries; functions of management; Principles; Managerial Roles, Planning; types; Steps; Techniques, Planning activities.	8
II	Organising: Introduction, definitions, activities of organising, formal & Informal; Organisational Structure, enhancing corporate performance; Types; Staffing; delegating, establishing work relationships, process; Importance.	8
III	Controlling: Introduction, process; budgetary and non-budgetary control techniques; Directing; Elements; steps; functions; Importance, measuring performance, benchmarking, evaluating and correcting performance.	8
IV	Management in global environment: globalization and international business, cross-cultural management, strategic management, IT role in management	6
	Total	30

Reference Books:

1. Principles Of Management Govindarajan, M. Natarajan, S.
2.Essentials of Principles of management *: K. Sundar* ; Published by Vijay Nicole Imprints Pvt.Limited.
3.Tripathy PC & Reddy PN , "Principles of Management " , Tata Mcgraw Hill , 1999.

Text Books:

1. Managerial Breakthrough: The Classic Book on Improving Management Performance.
2. Principles of Management by Sultan chand & sons
3. Principles Of Management, 1st Edn by Charles W. L. Hill (Author), Steven Mcshane (Author).

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE407

Title of Course: **Advanced Data Structures Lab**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

1. Implement and analyze operations on linked lists, stacks, and queues.
2. Apply tree structures and balancing techniques with time analysis.
3. Use graph algorithms for traversal, pathfinding, and spanning trees.
4. Implement heaps and disjoint sets for sorting and connectivity tasks.
5. Apply advanced data structures like tries and segment trees with amortized analysis.

List of Practical's:

1. Design a program using a singly linked list to manage a dynamic contact list with functionalities for insertion, deletion, search, and alphabetical sorting.
2. Implement a doubly linked list to mimic browser navigation with back and forward options.
3. Create a circular linked list to simulate a music playlist where songs loop continuously and can be added/removed dynamically.
4. Develop a program demonstrating stack and queue operations using linked representations. Provide visual feedback after each operation.
5. Write a program to creates a Binary Search Tree from a list of integers and perform the following operations:
   - **Insertion**: Add new nodes while maintaining BST properties.
   - **Search**: Locate a specific value.
   - **Traversal**: Display the tree contents using in-order, pre-order, and post-order traversals.
6. Design an AVL tree to maintain a catalog of products (e.g., by price or name). Demonstrate balancing after each insertion/deletion.
7. Represent campus locations as a graph and apply BFS and DFS to find various routes. Extend it to Dijkstra's algorithm for shortest paths between buildings.
8. Create a graph to model user friendships. Use DFS/BFS to determine mutual friends and suggest new connections.
9. Implement a min-heap to manage patient treatment order based on severity scores. Include enqueue, dequeue, and heapify operations.
10. Design an efficient tree data structure that supports fast insertion, deletion, and prefix-based search for large-scale text datasets, while minimizing memory usage.

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE408

Title of Course: **Theory of Computation Lab**

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able;

CO1	Develop a deep understanding of Automata Theory including finite automata (DFA, NFA), pushdown automata, and Turing machines.
CO2	Apply knowledge of formal languages such as regular languages, context-free languages, and context-sensitive languages, and their grammars.
CO3	Design and analyze computational machines and recognize language acceptors for different classes of formal languages.
CO4	Construct computational models including automata, grammars, and Turing machines to solve theoretical and practical computational problems.
CO5	Gain skills to design automata for languages, minimize automata, convert between equivalent computational models, and analyze language properties.

List of Practical

1. Write a Program to design a Deterministic Finite Automata over 0's and 1's which accept Number of zeros Mod 3 is equal to Number of ones Mod 2.
2. Write a Program to design a Deterministic Finite Automata for divisibility by 4 testers for any decimal number.
3. Write a Program to design a Deterministic Finite Automata over 0's and 1's which accept all strings ends with either '00' or '11'.
4. Design a DFA which accept one or more occurrences of 'a' followed by one or more occurrences of 'b' followed by one or more occurrences of 'c' by using JFLAP tool.
5. Design a NFA which accept zero or more occurrences of '0' followed by zero or more occurrences of '1' followed by zero or more occurrences of '2' and convert the same to its equivalent DFA by using JFLAP tool.
6. Design an optimized/minimized DFA by using a suitable example by Myhill-Nerod Theorem using JFLAP tool.
7. Find an equivalent regular expression for the given finite automata by Arden's Theorem using JFLAP tool.
8. Design a PDA over a's and b's which accept all string contains L = { $a^n b^{2n}$ where n>=1} using JFLAP tool.
9. Design a PDA over a's and b's which accept any palindrome string using JFLAP tool.
10. Design a Turing Machine which accept a string L = {wcw where w=$(a/b)^+$ and 'c' is a separator} using JFLAP tool.

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE410

Title of Course: Human Values and Ethics

Teaching Scheme					Examination Scheme (Theory)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	Total
2	--	--	2	2	--	30	20	50

Course outcomes:

After completing the course, the students will be able;

CO1	Students will be able to understand ethical principles, promoting human values.
CO2	It will help to grasp different ethical frameworks and understand their implications.
CO3	Help to learn about specific codes of conduct for various professions and the ethical responsibilities associated with those professions.
CO4	Develop the ability to analyse ethical dilemmas, identify potential consequences, and make well-reasoned decisions.

SR. NO.	PRACTICAL LIST
1	To understand concept of Values, importance and its application.
2	To know about formation of values; self & integrated personality; understanding personal values.
3	Understanding moral & spiritual values; Value spectrum for good life.
4	Understanding value crisis at societal values; work culture; social; responsibility; cooperation.
5	Psychological values; mutual health; integrity; honesty; empathy.
6	To understand ethics & ethical value; principal scope of professional ethics.
7	Value for global citizenship; equality; justice & human dignity.
8	To know about types of ethics, ethics of rights, ethics of core, ethics of responsibility; moral judgement.
9	To get core competency; communication; teamwork; planning
10	To get functional competency; analytical thinking; decision making; partnership building; conflict resolution
11	To know workplace ethics; conflict of interest; confidentiality; impact of technology on ethics
12	To get aware environmental ethics; engineers as responsible experimenters; code of ethics.

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IV Semester B. Tech. Computer Science & Engineering (NEP 2020)

Course Code: STPCCCSE411

Title of Course: Software Lab-II

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	50	--	50

Course outcomes:

After completing the course, the students will be able;

CO1	To understand the concept of python database connectivity.
CO2	Use of pandas library files in python.
CO3	Understanding the concept of pyspark using python.
CO4	Implementing aggregate function using pyspark .

SR. NO.	PRACTICAL LIST
1	Program to demonstrate the python database connectivity using mysql.
2	Program to demonstrate the python database connectivity using mysql.
3	Program to demonstrate the python database connectivity using mysql.
4	Read csv file and apply different types of joins on it using pandas.
5	Read a csv file and apply different data selection function on that file.
6	Read a csv file into dataframe, drop null values and filter the rows based on condition using pyspark.
7	Apply group by and aggregate function on csv file using pyspark.
8	Read two different csv file and join them using pyspark.
9	Read csv file and apply window function on that file.
10	Read csv file and apply window function on that file.

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