Curriculum Structure for B. Tech. Computer Science & Engineering Programme

(In light of NEP 2020)

NCrF Level 6

(NEP_Version II)

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)
Near Kathora Naka, Amravati, Maharashtra
PIN 444604
www.gcoea.ac.in

BoS Member Secretary | BoS Chairman | Dean Academic | Principal

Structure for B. Tech. Programme in light of NEP 2020

For students admitted in 2023-24 onwards

Key Features of Curriculum

1. Multiple entry and exit option 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. Mandatory Non-Credit Courses.
6. Interdisciplinary and multidisciplinary education through single and double minors and open electives.
7. Skill based courses and multiple exit level.
8. Provision for learning in online mode through Swayam/ NPTEL etc courses
9. Provision for B.Tech. Honours with Research degree through research project.
10. Opportunity for learner to choose courses of their interest in all disciplines.
11. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.

12. Flexibility for all types of learners i.e. Good, Normal and Exit

Good Students	Normal Students	Exit
B. Tech. Major with Multidisciplinary Minor	B. Tech. Major with Multidisciplinary Minor	Additional 08 credits in the form of skill-based courses / labs, internship, mini projects shall be offered in 8 weeks.
B. Tech. Honors and Multidisciplinary Minor	--	
B. Tech. Honors with Research and Multidisciplinary Minor	--	
B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	--	

Credit Distribution for each year and Exit Option

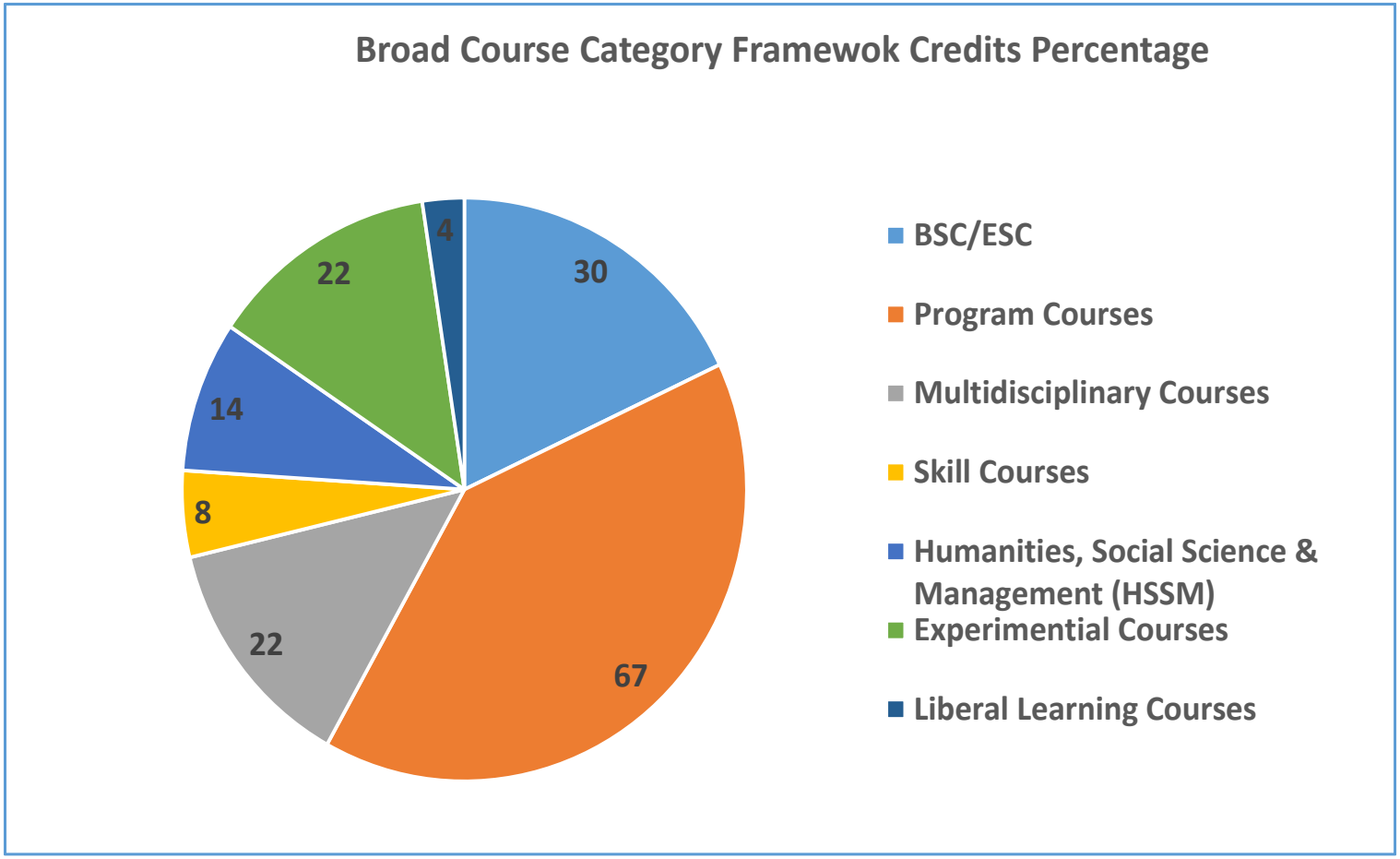
NCrFLevel	Year / Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	U. G. Certificate	43	08	51
5.0	Semester III & IV	U. G. Diploma	84	08	92
5.5	Semester V & VI	B. Vocational/B.Sc. Engg.	127	08	135
6.0	Semester VII & VIII	B. Tech.Major with Multidisciplinary Minor	167	--	167
		B. Tech. Honors and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. Honors with Research and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	167+18=185	--	185

BoS Member Secretary BoS Chairman Dean Academic Principal

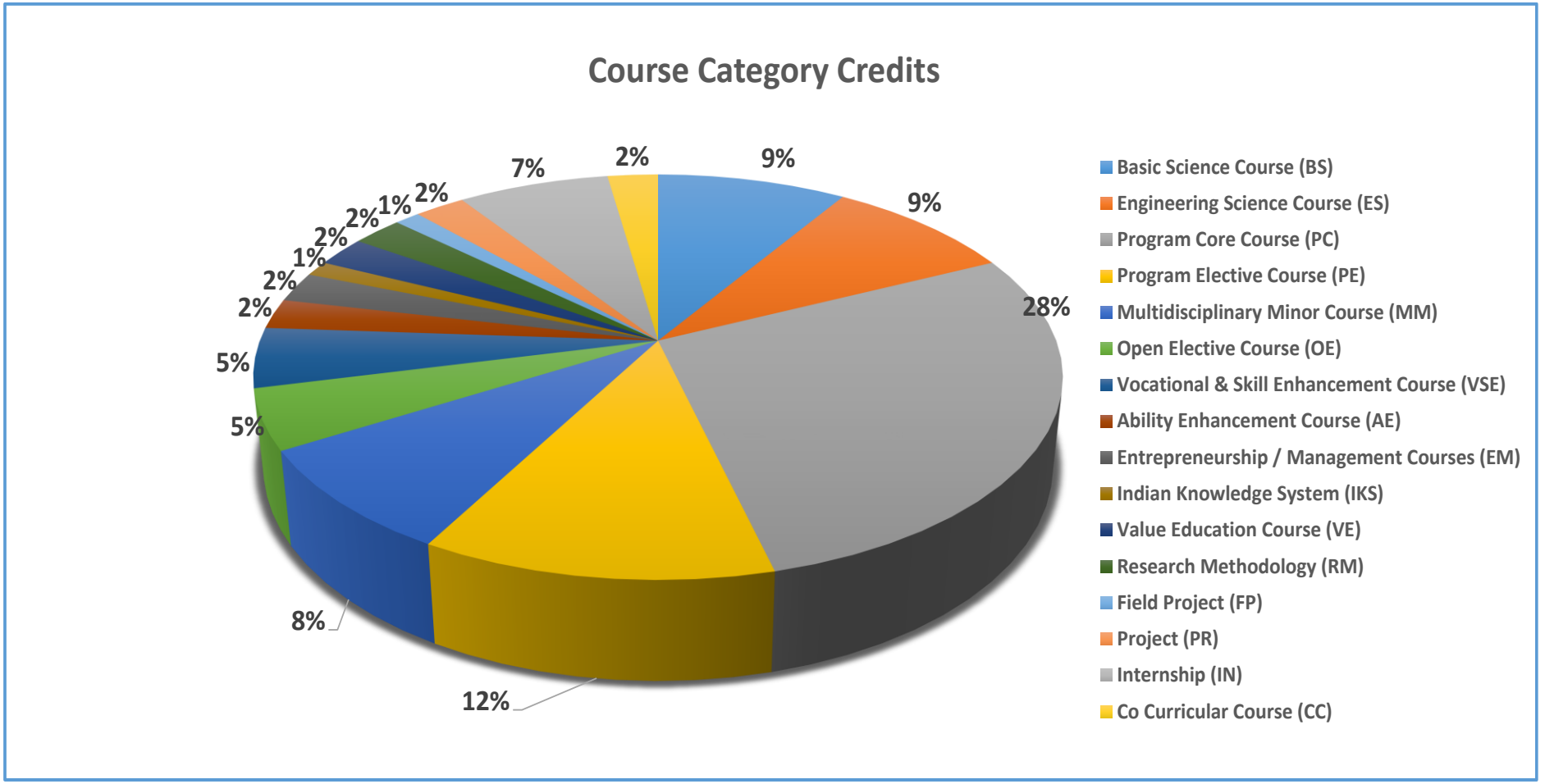
Course Category-wise Credit Distribution

Course Category	As per NEP GR	GCOEA Credits	CC	As per NEP GR	GCOEA Credits
BSC/ESC	30	30	BS	14-18	18
			ES	16--12	12
Program Courses	64-76	67	PC	44-56	47
			PE	20	20
Multidisciplinary Courses	22	22	MM	14	14
			OE	8	8
Skill Courses	8	8	VSE	8	8
Humanities, Social Science & Management (HSSM)	14	14	AE	4	4
			EM	4	4
			IKS	2	2
			VE	4	4
Experiential Courses	22	22	RM	4	4
			FP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**160-176**	**167**		**160-176**	**167**

BoS Member Secretary BoS Chairman Dean Academic Principal



BoS Member Secretary | BoS Chairman | Dean Academic | Principal


Course Category Credits
9%
9%
28%
12%
8%
5%
5%
2%
2%
1%
2%
2%
2%
7%
2%
Basic Science Course (BS)
Engineering Science Course (ES)
Program Core Course (PC)
Program Elective Course (PE)
Multidisciplinary Minor Course (MM)
Open Elective Course (OE)
Vocational & Skill Enhancement Course (VSE)
Ability Enhancement Course (AE)
Entrepreneurship / Management Courses (EM)
Indian Knowledge System (IKS)
Value Education Course (VE)
Research Methodology (RM)
Field Project (FP)
Project (PR)
Internship (IN)
Co Curricular Course (CC)

Semester-wise Credit Distribution

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	Basic Science Course (BS)	8	7	3						18	14-18
2	Engineering Science Course (ES)	8	4							12	12-16
3	Program Core Course (PC)		6	11	12	9	6	3		47	44-56
4	Program Elective Course (PE)					4	8	8		20	20
5	Multidisciplinary Minor Course (MM)			3	3	3	3	2		14	14
6	Open Elective Course (OE)				3	3		2		8	8
7	Vocational & Skill Enhancement Course (VSE)			2	1	2	1	2		8	8
8	Ability Enhancement Course (AE)	1	3							4	4
9	Entrepreneurship / Management Courses (EM)			1					3	4	4
10	Indian Knowledge System (IKS)	2								2	2
11	Value Education Course (VE)	2	2							4	4
12	Research Methodology (RM)								4	4	4
13	Field Project (FP)						2			2	2
14	Project (PR)							4		4	4
15	Internship (IN)								12	12	12
16	Co Curricular Course (CC)				2	2				4	4
	Total Credits	**21**	**22**	**20**	**21**	**23**	**20**	**21**	**19**	**167**	160-176

BoS Member Secretary BoS Chairman Dean Academic Principal

General Instructions:

(1) 10% content of syllabus of each theory course shall be completed by the students with self-study. The 10% portion of each course (for self-study) shall be declared by the concerned course-coordinator at the beginning of teaching of the course.

(2) Student can complete **any Course** or programme elective courses PE1 to PE5 in "online" mode, offered through SWAYAM/ NPTEL portal or equivalent platform which provides Evaluation mechanism with the permission of Departmental Faculty Board (DFB). In this case –

(i) Students can register and complete these online courses any time after beginning of third semester, 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 course offered by the institute in respective semester as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc) of the course, and successfully complete the course.

(3) In eighth semester, the students have to complete mandatory internship of one semester in the company/ organization approved by the DFB.

(4) In eighth semester during internship, the students have to complete the theory courses in any one of the two modes:

(i) **Online courses** offered through SWAYAM/ NPTEL or equivalent platform which provides Evaluation mechanism with the permission of DFB: In this case, students can register and complete these online courses any time after beginning of third semester and complete the course and submit the score card/ certificate before declaration of result of eighth semester.

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 course offered by the institute as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc) of the course personally as per the schedule declared by the institute, and successfully complete the course.

(ii) **Self-study mode:** In this case the student will have to study the course offered by the institute of his/her own. The student shall appear for all the college assessments/ examinations (CT1/CT2, TA and ESE) personally as per the schedule declared by the institute and successfully complete the course.

(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, 4th semester &6th semester and will commence from AY 2024-25 for UG Certificate, AY 2025-26 for UG Diploma, AY 2026-27 for B. Voc./B. Sc. Engineering degree.

(7) Students opting for exit at any level (after odd semesters or even semester) will have to earn additional 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. Engineering degree as per eligibility.

(8) Re Entry and Lateral Entry: Students opting for exit at any level after even semester, will have the option to re-enter the programme from where they left off in odd semesters within **four years of exit.** There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(9) Students opting for exit after odd semester, i.e. 1st, 3rd, 5th or 7th semester will have the option to re-enter the programme from where they left off in even semesters only. There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(10) Maximum period for completion of B. Tech. programme:

The student has to complete the degree programme within the stipulated **maximum period of eight years** from the date of admission to first year UG. The maximum duration of the programme includes the period of exit, withdrawal, absence and different kinds of leaves permissible to a student but it shall exclude the period of rustication of the student from the institute. However, genuine cases on confirmation of valid reasons may be referred to Academic Council for extending this limit by **additional one year**.

(11) Eligibility for admission to the UG Bachelor's Degree with Honours/ Research/Double Minor:

Students with minimum **CGPA of 7.5** without backlog courses at the end of fourth semester and should have earned 84 **credits** are eligible for admission to the UG Bachelor's Degree with Honours/ Research/ Double Minor.

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 course in Engg/Tech	8	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 I Engg/Tech	8	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) orB.Sc. (Engg./Tech)	8	2 Month Internship **OR** Online Two skill courses at Degree Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation @ **OR** Technical Project

BoS Member Secretary BoS Chairman Dean Academic Principal

SEMESTER –III														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
											Practical		Total	
			TH	TU	PR	Total	CT-1	CT-2	TA	ESE	ICA	ESE		
BS5	SH1301(A)	Linear Algebra and Statistical Methods	3			3	15	15	10	60			100	3
MM1	CS1315/16	Multidisciplinary Minor 1	3			3	15	15	10	60			100	3
PC3	CS1301	Fundamentals of Data Structure	3	1		4	15	15	10	60			100	4
PC4	CS1302	Object Oriented Methodology	3	1		4	15	15	10	60			100	4
PC5	CS1303	Discrete Mathematics	3			3	15	15	10	60			100	3
VSE1	CS1304	Data Structure Lab			2	2					25	25	50	1
VSE2	CS1305	Object Oriented Methodology Lab			2	2					50		50	1
EM1	CS1306	Innovation, Creativity& Entrepreneurship (Computer Workshop)			2	2					50		50	1
Total			**15**	**2**	**6**	**23**	**75**	**75**	**50**	**300**	**125**	**25**	**650**	**20**

BoS Member Secretary BoS Chairman Dean Academic Principal

SEMESTER –IV														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM2	CS1415/16	Multidisciplinary Minor 2	3			3	15	15	10	60			100	3
PC6	CS1401	Design and Analysis of Algorithm	3	1		4	15	15	10	60			100	4
PC7	CS1402	Database Management System	3			3	15	15	10	60			100	3
PC8	CS1403	Computer Organization and Architecture	3			3	15	15	10	60			100	3
OE1	SH1401	Open Elective 1	3			3	15	15	10	60			100	3
PC9	CS1404	Design and Analysis of Algorithm Lab			2	2					50		50	1
PC10	CS1405	Computer Organization and Architecture Lab			2	2					50		50	1
VSE3	CS1406	Database Management System Lab			2	2					25	25	50	1
CC1	SH1402	Co-curricular Course			4	4			20				20	2
Total			**15**	**1**	**10**	**26**	**75**	**75**	**70**	**300**	**125**	**25**	**670**	**21**

BoS Member Secretary BoS Chairman Dean Academic Principal

Co-Curricular Course:: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level /college level cultural activities, Drama, painting ,annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc **Co-Curricular Course Activities minimum hours :**:2 hours per week or 24 hours

EXIT CRITERIA FOR U. G. DIPLOMA														
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX2	CS1411	Mobile Application Development									50		50	4
EX2	CS1412	Computer Network and Internet Protocol									50		50	4
OR														
EX2	CS1413	**Internship / Technical Project**									100@		100	8

@ Based on seminar, Internship Report, Internship/ Project evaluation

BoS Member Secretary BoS Chairman Dean Academic Principal

Equivalence Scheme

Programme Name:-B. Tech. Computer Science & Engineering

S N	Course code with Name of course (old) Revised Curriculum 2019-20			Course code with Name of course(NEW) (NEP Version-II)		
	Code	Name	Credit	Code	Name	Credit
1	ETU331	Analog and Digital Integrated Circuit	3	←------No Equivalence -----→		
	SHU321 B SHU322B	Transform and Linear Algebra Differential Equation and Transform	4	←------No Equivalence -----→		
		_____		SH1301 (B)	Engineering Mathematics- III	3
	CSU321	Data Structure & Algorithms	3	CS1302	Fundamentals of Data Structure	4
	CSU322	Discrete Mathematics	3	CS1304	Discrete Mathematics	3
	CSU421	Object Oriented Programming	3	CS1303	Object Oriented Methodology	4
	CSU323	Data Structure & Algorithms Lab	2	CS1305	Data Structure Lab	1

BoS Member Secretary BoS Chairman Dean Academic Principal

2	CSU 426	Object Oriented Programming Lab	2	CS1306	Object Oriented Methodology Lab	1
3	CSU424	Design and Analysis of Algorithms	3	CS1402	Design and Analysis of Algorithm	4
4	CSU521	Database Management System	3	CS1403	Database Management System	3
5	CSU422	Computer Organization and Architecture	3	CS1404	Computer Organization and Architecture	3
6	SHU323	Introduction to Constitution of India	0	SH1401	Open Elective 1	3
7	SHU324	Effective Technical Communication	3	←------No Equivalence -----→		
8	ETU332	Analog and Digital Integrated Circuit Lab	2	←------No Equivalence -----→		
9	CSU324	IT Workshop (Sci Lab/MATLAB)	3	←------No Equivalence -----→		
10	CSU423	Operating System	3	CS1502	Operating System	4
	CSU428	Operating Systems Lab	3	CS1506	Operating System Lab	**1**
11	CSU425	Organizational Behaviour	3	←------No Equivalence -----→		

BoS Member Secretary BoS Chairman Dean Academic Principal

12	SHU422	Environmental Sciences	0	←------No Equivalence -----→		
13	←------No Equivalence -----→			CS1405	Design and Analysis of Algorithm Lab	1
14	CSU427	Computer Organization and Architecture Lab	2	CS1406	Computer Organization and Architecture Lab	1
15	CSU527	Database Management System Lab	2	CS1407	Database Management System Lab	1

SEMESTER –V														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
								Theory			Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM3	CS1515/16	Multidisciplinary Minor 3	3			3	15	15	10	60			100	3
PC 11	CS1501	Software Engineering	3			3	15	15	10	60			100	3
PC 12	CS1502	Operating System	3			3	15	15	10	60			100	3
PC 13	CS1503	Theory of Computation	3			3	15	15	10	60			100	3
PE1	CS1504	Program Elective 1	3			3	15	15	10	60			100	3
OE2	SH1501	Open Elective 2	3			3	15	15	10	60			100	3
VSE4	CS1505	Professional Software Lab			2	2					25	25	50	1
VSE5	CS1506	Operating System Lab			2	2					25	25	50	1
PE	CS1507	PE 1 Lab			2	2					25	25	50	1
CC2	SH1502	Co-curricular Course			4	4			20				20	2
MNC2	SH1503	Soft Skills	2			2			20				20	0
Total			**20**		**10**	**30**	**90**	**90**	**100**	**360**	**75**	**75**	**790**	**23**

Co-Curricular Course:: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level /college level cultural activities, annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc

Co-Curricular Course Activities minimum hours:2 hours per week or 24 hours

BoS Member Secretary BoS Chairman Dean Academic Principal

ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH1	CS1521	Parallel Computer Architecture (Swayam/MOOCS/NPTEL/ Online) from Basket													3
PEH2	CS1522	Introduction to Enterprise Resource Planning (Swayam/MOOCS/NPTEL/ Online) from Basket													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PER1	CS1531	Research Project Stage 1			08	08					100		100	4	
Total					08	08					100		100	4	

BoS Member Secretary BoS Chairman Dean Academic Principal

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN1	CS1541	Computer Vision	3				15	15	10	60			100	3
MN2	CS1542	Business Intelligence & Analytics	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

BoS Member Secretary BoS Chairman Dean Academic Principal

SEMESTER –VI														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
							Theory				**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM4	CS1615/16	Multidisciplinary Minor 4	3			3	15	15	10	60			100	3
PC 14	CS1602	Computer Network	3			3	15	15	10	60			100	3
PC 15	CS1603	Machine Learning	4			4	15	15	10	60			100	4
PE2	CS1604	Program Elective 2	3			3	15	15	10	60			100	3
PE3	CS1605	Program Elective 3	3	1		4	15	15	10	60			100	4
VSE6	CS1606	Computer Network Lab			2	2					25	25	50	1
PE	CS 1607	Program Elective 2 Lab			2	2					25	25	50	1
FP	CS 1608	Minor Project			4	4					25	25	50	2
MNC3	CS 1609	Privacy and Security in Online Social Media	2			2	15	15	20				50	0
MNC4	SH1601	NCC/NSS							20				20	0
Total			**18**	**1**	**8**	**27**	**90**	**90**	**90**	**300**	**75**	**75**	**720**	**21**

BoS Member Secretary BoS Chairman Dean Academic Principal

EXIT CRITERIA FOR EXIT CRITERIA FOR B. VOC.															
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX3	CS1611	User-Centric Mobile Computing									50		50	4
EX3	CS1612	Ethical Hacking									50		50	4
OR															
EX3	XX1613	Internship / Technical Project									100@		100	8

@ Based on seminar, Internship Report, Internship/ Project evaluation

BoS Member Secretary BoS Chairman Dean Academic Principal

ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH3	CS1621	Fundamentals of Information Retrieval (Swayam/MOOCS/NPTEL/ Online) from Basket													3
PEH4	CS1622	Functional and Logical Programming (Swayam/MOOCS/NPTEL/ Online) from Basket													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PER2	CS1631	Research Project Stage 2			12	12					100	100	200		6

BoS Member Secretary BoS Chairman Dean Academic Principal

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN3	CS1641	Natural Language Processing	3			3	15	15	10	60			100	3
MN4	CS1642	Affective Computing	3			3	15	15	10	60			100	3
	Total		6			6	30	30	20	120			200	6

BoS Member Secretary BoS Chairman Dean Academic Principal

SEMESTER –VII														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM5	CS1715/16	Multidisciplinary Minor 5	2			2	15	15	10	60			100	2
PC 16	CS1701	Cryptography and Cyber Security	3			3	15	15	10	60			100	3
PE4	CS1702	Program Elective 4	3	1		4	15	15	10	60			100	4
PE5	CS1703	Program Elective 5	4			4	15	15	10	60			100	4
OE3	SH1701	Open Elective 3	2			2	15	15	10	60			100	2
VSE7	CS1704	PE4 Lab			2	2					25	25	50	1
VSE8	CS1705	PE5 Lab			2	2					25	25	50	1
PR	CS1706	Project			8	8					50	50	100	4
MNC5	CS1707	(Example: Sensor Technology for Civil Engineering Applications)	2			2	15	15	20				50	0
Total			**16**	**1**	**12**	**29**	**90**	**90**	**70**	**300**	**100**	**100**	**750**	**21**

Note: Project Guide Teaching load: 8 hrs/week

Students can register for the elective in seventh semester under Multidisciplinary Minor 4 using **SWAYAM/NPTEL** etc. portal. Courses will be of completely student's choice but approved by DFB of concerned department (other than MM1 to MM3) and should be **at least of 12 weeks** including tutorials, which will be considered as **4 credit course**.

Students can register and complete online courses for Multidisciplinary Minor 4 any time after completion of semester IV, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of VII th semester.

ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Thoery				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH5	CS1721	Distributed System (Swayam/MOOCS/NPTEL/ Online) from Basket													3
PEH6	CS1722	Advanced Computer Architecture (Swayam/MOOCS/NPTEL/ Online) from Basket													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PER3	CS1731	Research Project Stage 3			16	16					100	200	300		8

BoS Member Secretary BoS Chairman Dean Academic Principal

ADDITIONAL CRITERIA FOR DOUBLE MINOR (SPECIALIZATION)														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN5	CS1741	Digital Forensics	3				15	15	10	60			100	3
MN6	CS1741	Automatic Speech Recognition	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

BoS Member Secretary BoS Chairman Dean Academic Principal

SEMESTER –VIII														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
								Theory			Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE	Total	
RM	SH1801	Research Methodology (Online through SWAYAM/NPTEL)	4			4	15	15	10	60			100	4
EM2	CS1802	Computer Aided Applied Single Objective Optimization	3			3	15	15	10	60			100	3
IN	CS1803	Internship (Online reviews - one in each month)									100	200	300	12
		Total	7			7	30	30	20	120	100	200	500	19

Note: Internship Guide Teaching load: 4 hrs/week

BoS Member Secretary BoS Chairman Dean Academic Principal

LIST OF PROGRAM ELECTIVES					
	PE1 CS1504	**PE2 CS1604**	**PE3 CS1605**	**PE4 CS1703**	**PE5 CS1705**
A	Artificial Intelligence	Mobile Computing	Computer Graphics	Internet Of Things	Block chain and Application
B	Computational Intelligence	Cloud Computing	Software Project Management	Parallel Computing	Data Analytics
C	Image Processing	High Processing Computing	Software Testing	Human Computer Interaction	Android App Development
	SWAYAM/NPTEL etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB	**SWAYAM/NPTEL**/etc related to vertical approved by DFB	**SWAYAM/NPTEL**etc related to vertical approved by DFB

SWAYAM/NPTEL etc. portal. Courses for PE1 to PE5 should be related to concerned vertical approved by DFB and should be **at least of 12 weeks** including tutorials.

LIST OF MULTIDICIPLINARY MINOR COURSES:

Sr No.	Offering Department	Name of Programme /Minor Course	Students from Department who can register
1	CSE	Data Science	CE,ME,EE,ENTC,INST
		Artificial Intelligence	CE,ME,EE,ENTC,INSTR
2	IT	Machine Learning	CE,ME,EE,ENTC,INST
		Software Engineering	CE,ME,EE,ENTC,INST
3	ENTC	IOT	CE,ME,EE,CSE,IT,INST
		Electronics and Telecommunication Engg.	CE,ME,EE,CSE,IT,INST
4	ME	Mechanical Engineering	CE,EE,ENTC,CSE,IT,INS
		Automation & Robotics	CE,EE,ENTC,CSE,IT,INS
		Industrial Management	ME,CE,ENTC,CSE,IT,EE,INST
5	CE	Building Construction and Management	ME,EE,ENTC,CSE,IT,INST
		Business Economics	ME,EE,ENTC,CSE,IT,INST,CE
6	EE	Energy Engineering	ME,CE,ENTC,CSE,IT,INST
		Electrical Motors & Drives	ME,CE,ENTC,CSE,IT,INST
7	INST	Instrumentation and Control	ME,CE,ENTC,CSE,IT,EE
		Banking and Finance	ME,CE,ENTC,CSE,IT,EE,INST

BoS Member Secretary BoS Chairman Dean Academic Principal

Name of Programme /Minor Course	Course Code	Civil Engineering		Mechanical Engineering			Electrical Engineering	
		Building Construction and Management (TRACK-I)	Business Economics (TRACK-II)	Mechanical Engineering (TRACK-I)	Automation & Robotics (TRACK-II)	Industrial Management (TRACK-III)	Energy Engineering(TRACK-I)	Electrical Motors & Drives (TRACK-II)
MinorCourse-1	XX1315/16/17	CE1315 Basics of Civil Engineering	CE1316 Principles of Macroeconomics	ME1315 Production Technology	ME1316 Hydraulics and Pneumatics	ME1317 Organizational Behaviour	EE1315 Introduction to Renewable Energy	EE 1316 Electrical Motors
MinorCourse-2	XX1415/16/17	CE1415 Building Construction	CE1416 Principles of Microeconomics	ME1415 New and Renewable Energy Sources	ME1416 Automation in Manufacturing	ME1417 Human Resource Management	EE1415 Energy Resources, Environment and Economics	EE 1416 Special Electrical Machines
MinorCourse-3	XX1515/16/17	CE1515 Building Planning & Drawing	CE1516 Business Statistics	ME1515 Automobile Engineering	ME1516 Mechatronic Systems	ME1517 Material Management	EE1515 Energy Efficiency in Electrical Utilities	EE 1516 Power Electronics
MinorCourse-4	XX1615/16/17	CE1615 Building Estimates & Tendering	CE1616 Financial Accounting	ME1615 Basic of Product Design	ME1616 Industrial Robotics	ME1617 Marketing Management	EE1615 Energy Management	EE 1616 Electrical Drives and Control
MinorCourse-5	XX1715/16/17	CE1715 Construction Management	CE1716 Minor Project	ME1715 Industrial Management and Quality Control	ME1716 Computer Integrated Manufacturing	ME1717 Corporate Financial Reporting and Analysis	EE1715 Project	EE 1716 Project

BoS Member Secretary BoS Chairman Dean Academic Principal

Name of Programme /Minor Course	Course Code	Electronics Engineering		Computer Engineering		Information Technology		Instrumentation Engineering	
		Internet of Things (TRACK-I)	**Electronics and Telecommunication Engg. (TRACK-II)**	**Data Science (TRACK-I)**	**AI (TRACK-II)**	**Machine Learning (TRACK-I)**	**Software Engineering (TRACK-II)**	**Instrumentation and Control (TRACK-I)**	**Banking and Finance(TRACK-II)**
MinorCourse-1	XX1315/16	ET1315 Introduction to internet of things	ET1316 Digital Circuits	CS1315 Fundamentals of data science	CS1316 Introduction to Artificial Intelligence	IT1315 Essential math for machine learning	IT1316 Data Structure & Algorithms	IN1315 Industrial Measurement I	IN1316 Bank operations Management
MinorCourse-2	XX1415/16	ET1415 IoT Architecture & Protocols	ET1416 Communication Engineering	CS1415 Computational Data Analytics	CS1416 Data Mining	IT1415 Artificial Intelligence	IT1416 Software Engineering	IN1415 Industrial Measurement II	IN1416 Strategic management and innovation in banking
MinorCourse-3	XX1515/16	ET1515 Programming with Arduino and Raspberry-Pi	ET1516 Microprocessor &Embedded System	CS1515 Natural Language Processing	CS1516 Introduction to Machine Learning	IT1515 Machine learning	IT1516 Object Oriented Design & Programming	IN1515 Control system Engineering	IN1516 Security analysis and portfolio management
MinorCourse-4	XX1615/16	ET1615 Industrial Internet of Things	ET1616 Wireless Communication	CS1615 Application of data science	CS1616 Optimization Methods in Machine Learning	IT1615 Deep Learning	IT1616 Software Testing	IN1615 Industrial Automation	IN1616 Spreadsheet based data analysis
MinorCourse-5	XX1715/16/17	ET1715 Project	ET1716 Project	CS1715 Marketing Analytics for Big Data	CS1716 Human Applications of AI	IT1715 Minor Project	IT1716 Minor Project	IN1715 Programming for PLAC,DCS & SCADA	IN1716 IT operations &Management

BoS Member Secretary BoS Chairman Dean Academic Principal

	LIST OF OPEN ELECTIVE COURSES		
	OE-I	**OE-II**	**OE-III**
Course Code	SH1401	SH1501	SH1701
A	**Appreciating Indian Music**	**Environmental law**	**Operational Research**
B	**Introduction to Human Psychology**	**Cyber law**	**Digital Marketing**
C	**Nanotechnology, Science and Application**	**Introduction to Mass Communication**	**Biology for Engineers**
D	**Introduction to Exercise Physiology & Sports Performance**	**Foreign Language Japanese (N5) /German (A1)**	**Foreign Language Japanese(N4) /German(A2)**
	SWAYAM/NPTEL **https://onlinecourses.nptel.ac.in/noc22_hs57/preview** **https://onlinecourses.nptel.ac.in/noc24_hs39/preview** **https://onlinecourses.nptel.ac.in/noc19_mm21/preview** **https://onlinecourses.nptel.ac.in/noc24_hs86/preview**	**SWAYAM/NPTEL**	**SWAYAM/NPTEL**

BoS Member Secretary BoS Chairman Dean Academic Principal

LIST OF PROGRAM ELECTIVES HONOR'S COURSES (Swayam/NPTEL)	
COURSE CODE	**<Computer System >**
CS1521	Parallel Computer Architecture
CS1522	Introduction to Enterprise Resource Planning
CS1621	Fundamentals of Information Retrieval
CS1622	Functional and Logical Programming
CS1721	Distributed System
CS1722	Advanced Computer Architecture

.

LIST OF MINOR COURSES FOR DOUBLE MINOR (SPECIALIZATION)							
COURSE CODE	**Civil Engineering**	**Mechanical Engineering**	**Electrical Engineering**	**Electronics Engineering**	**Computer Engineering**	**Information Technology**	**Instrumentation Engineering**
CS1541	CE1541/ABC				Computer Vision		
CS1542					Business Intelligence & Analytics		
CS1641					Natural Language Processing		
CS1642					Affective Computing		
CS1741					Digital Forensics		
CS1742					Automatic Speech Recognition		

Sample Guidelines for the Honour with Research Project

BoS Member Secretary BoS Chairman Dean Academic Principal

The purpose of this course is to introduce students to the process of conducting research projects/work. The students will be helped to conceptualise, design and execute a research project by a teacher guide.

Stage-1:

- Student have to complete online course related to topic/perquisite course prescribed by the assigned guide/BOS
  OR
- The focus will be on discussions and analysis of assignments. Learners will be encouraged to read books and research journals related to his/her research topic (literature review, theory and hypotheses etc) and share them in the seminars and evaluated by two member Team of department and same to be enter in ICA format.

Stage-2:

Sample steps:

- Research design/Methodology
- Sampling tool of data collection
- data processing and analysis
- Plan of research report
- Publish review paper in peer view journal/Scopus indexed journal and seminar on it
- The faculty supervisor will assess the method and procedures used by the learner
- At end evaluated by two member Team of department

Stage-3:

- If applicable initiate Actual implementation
- Data Analysis and Interpretation: The outcome of the research is presented in tabular form with the help of statistical procedures. The data are analysed and interpreted and presented in the form of a research report and presenatation/seminar.
- Report writing
- Publish paper on findings in peer view journal/Scopus indexed journal.
- Two member Team of department will assess the Findings method and procedures
- The faculty supervisor will assess the presentation of major findings depending on the methodology used, presentation of results, interpretation of the results with discussion, summary of the proposed research problem and conclusion.
- Two member Team of department (may evaluated by Guide and external expert) will assess the Findings method and procedures etc

Note : Guide Teaching load : 4 Hrs per student in Research stage -1 /2/3

SEMESTER – III

Course Code	SH1301A								Course category			BS05
Course Name	LINEAR ALGEBRA AND STATISTICAL METHODS											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2 hrs 30 min	00	00	100	03

Course Objectives:

1. To introduce the basic concept of statistics for analysing experimental data
2. To familiarize the students with concepts of probability and probability distribution.
3. To study about the mathematical tool like Z-transform, Laplace transform and its properties.
4. To introduce the concept of Vector spaces
5. To learn inner product spaces

Basic Statistics:

Measures of Central Tendency: Moments, Skewness and Kurtosis, Correlation and Regression, Probability distributions: Binomial, Poisson and Normal.

Random Variables and Probability Distributions:

Random variables, Discrete and Continuous random variables, Distribution functions, Probability distribution of continuous random variable. Joint distribution of discrete and continuous random variables, Conditional distribution, Mathematical expectation, Mean, moments and variance. Variance for joint distribution and Covariance.

Z-transform:

Definition, Properties of Z-transform, Inverse Z-transform by using properties, Partial fraction method, Residue method, Convolution theorem and power series method

Vector Spaces I:

Vector spaces and Subspaces, Linear dependence and Independence of vectors, Bases and dimensions, Coordinate vectors, Linear transformation, Algebra of linear transformation,

Vector Spaces II:

Representation of linear transformation of matrices relative to basis, Inner product, Inner Product Spaces, Norm and Orthogonality, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalisation process

Text Books:

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th edition, 2020.

3. Higher Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd, 2014

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968.
5. Advanced Engineering mathematics, Reena Garg, Khanna book publishing company, 2021
6. Engineering Mathematics (for semester III), Veerarajan T., Tata McGraw-Hill, New Delhi, 2010

Course Outcomes:

After successful completion of the course the students will be able to:

SH1301(A).1. Apply the basic concept of statistics for analysing experimental data.

SH1301(A).2. Familiarize the students with concepts of probability and probability distributions.

SH1301(A).3. Study about the mathematical tool like Z-transform, Laplace transform and its properties.

SH1301(A).4. Apply the knowledge of Vector spaces for solving engineering problems

SH1301(A).5. Use inner product spaces concept to deal problems

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1301(A).1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301(A).2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301(A).3	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301(A).4	3	3	3	3	3	-		-	-	-	-	-	2	-	-
SH1301(A).5	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1301**								**Course category**			PC3
Course Name	**FUNDAMENTLAS OF DATA STRUCTURE**											
Teaching Scheme				Examination Scheme								Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
03	01	00	03	15	15	10	60	**2**hr 30 min	00	00	100	04

Course Objective:

1. To impart the knowledge of data structures and algorithms.
2. To analyse the algorithm with respect to time and space which will prove the efficiency of algorithm.
3. To assess how the choice of data structures and algorithm design methods impacts the performance of programs
4. To convert algorithms into efficient programs

Basic of Data Structure and Algorithm: Understanding the concept of Problem Solving, Design of Algorithms and Data Structures. Basic Terminologies: Elementary Data Organizations, Data Structures Operations and Types, Abstract Data Type (ADT),Writing Algorithms, Mathematical Notations and Functions, Algorithmic Notation, Introduction to Searching Algorithms: Linear and Binary Search, Analysis of an Algorithm: Complexity and Rate of Growth, Asymptotic Notations, Time-Space Trade-Off, Dictionaries, Introduction to Sorting Algorithms: Bubble, Selection, Insertion, Quick, Merge, Radix
Note: In this unit all the algorithms are implemented through a basic data structure called Array

Linked List: Introduction to Linked List, Types of Linked List, Representation of Linked List in Memory**,** Algorithms of several operation on Linked List and there analysis**,** String Processing: Storing Strings, String Operations, Word/Text Processing, String Pattern Matching Algorithms.

Stack and Queue: Introduction to Stack, Representation of Stack in Memory using Array and Linked List, Arithmetic Expression, Polish Notation, Application of Stack, Tower of Hanoi Problem, Recursion, Introduction to Queue, Representation of Queue in Memory using Array and Linked List, Types of Queues, Application of Queues.

Tree: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, Red Black Tree**,** Tree operations on each of the trees and their algorithms with complexity analysis**,** Applications of Binary Trees**,** Introduction to B Tree (Disk Based Data Structure)**,** Heap Sort.

Graph: Graph: Basic Terminologies and Representations**,** Graph search and traversal algorithms and complexity analysis, Minimum Spanning Tree Algorithms (Kruskal and Prim), Single Source Shortest Path (Dijkstra's) and Shortest Path Algorithms (Warshalls)**,** Hashing in Data Structures.

Text Book

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al. 2nd edition Computer Science Press

Course Outcomes

CS1301.1 Understand basic terminology of data organization with the available data structures and their behaviour.
CS1301.2 Analysing and understanding, the implementation of data structures on computer memory so that, one must able to choose appropriate data structure for a given specific problem.
CS1301.3 After implementation a student must be capable of doing quantitative analysis of algorithm.
CS1301.4 Demonstrate ability to devise an efficient algorithm and transform into efficient code.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1301.1	0	3	3	2	2	2	0	2	3	3	3	1	1	2	3
CS1301.2	1	2	2	1	3	1	2	1	0	1	2	2	1	1	3
CS1301.3	2	1	3	1	0	2	2		2	1	0	2	2	0	0
CS1301.4	3	2	3	1	2	0	1	2	1	3	1	2	0	3	2

0-Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlate

Course Code	CS1302	Course category	PC4
Course Name	OBJECT ORIENTED METHODOLOGY		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	01	00	04	15	15	10	60	2hr 30 min	00	00	100	04

Course Objective:

1. Learn basic terminology, formal logic, proofs, sets, relations, functions, recursion
2. Use formal logic proof and logical reasoning to solve problems
3. Relate the ideas of mathematical induction to recursion and recursively defined structures
4. Learning graphs, trees and related algorithms ,Relate, interpret and apply these concepts to various areas of computer science

Course Content

Principles of Objective Oriented Programming
Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming.

Token Expressions & Control Structures
Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators, Implicit Conversions, Operator Overloading, Operator Precedence, Control Structures.

Functions, Classes & Objects.
The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects, and Friendly Functions.

Constructors & Destructors, Operator Overloading, Inheritance
Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Type Conversions

Pointers, Virtual Functions & Polymorphism, Working with Files, Exception handling Pointers, Pointers to Objects, this pointer, Pointer to Derived Classes, Virtual

Functions, Classes for File Stream Operations, Opening and Closing a File, File Modes, File Pointers, Input Output Operations, Updating a File.
An Object Oriented Approach in Real Life Problems Object Orientation O Development O Themes, Modelling, Abstraction Models.

Text Books:

1. Object Oriented Design by Rumbaugh (Pearson publication)
2. Object-oriented programming in Turbo C++ By Robert Lafore,Galgotia Publication.
3. Object-oriented programming with C++ by E.Balagurusamy, 2nd Edition, TMH.

Course Outcomes:

On successful completion of the course, the student will:

CS1302.1 Master the fundamental principles of OO programming
CS1302.2 Master key principles in OO analysis, design and development.
CS1302.3 Master common patterns in OO design and implement them,
CS1302.4 Be familiar with alternative development processes,
CS1302.5 Be familiar with group/team projects and presentations.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1302.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1302.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1302.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-
CS1302.4	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-
CS1302.5	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1303**	**Course category**	PC5
Course Name	**DISCRETE MATHEMATICS**		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr 30 min	00	00	100	03

Course Objective:

1. Learn basic terminology, formal logic, proofs, sets, relations,
2. Use formal logic proof and logical reasoning to solve problems
3. Relate the mathematical induction to functions with recursively defined structures and analyse various counting techniques
4. Evaluate Boolean functions to simplify expression and study the algebraic structures
5. Interpret graphs, trees and related algorithms inorder to apply these concepts in various areas of computer science

Set Theory: Set, types of set, operations on set, properties, cardinality, cartesian product, venn diagrams; **Relation:** reflexivity, symmetry, antisymmetry, transitivity, equivalence relations, partial orders, equivalence of relation, binary relation, partial ordering relation.

Propositional Logic: syntax, semantics, validity and satisfiability, basic connectives and truth tables, logical equivalence, logical Implication, rules of inference, Quantifiers; **Proof Techniques**: Terminology, mathematical proofs of implication, double implication, equivalence, converse, inverse, contrapositive, negation, and contradiction.

Functions: Domain, target, range, surjections, injections, bijections, inverses, composition, sum and product of functions, recursion, division algorithm: prime numbers, Greatest common divisor: Euclidean algorithm; **Basic counting techniques:** inclusion and exclusion, pigeonhole principle, permutation and combination, modular arithmetic.

Boolean algebra: Identities, posets, lattices, hasse diagrams, duality, representation and minimization of boolean function, conjunctive and disjunctive normal form; **Algebraic structures:** Groups, semigroups, monoids, rings and fields.

Graphs: Degree, connectivity, path, cycle, sub graph, properties, types, bipartite, isomorphism, Eulerian and hamiltonian walk, graph coloring, planar graphs, perfect graph; **Trees**: Properties, Traversal strategies, Spanning trees, Shortest distances, Bi-connected component and Articulation Points.

Text Books:

l. Kenneth H. Rosen. Discrete Mathematics and its Applications, Tata McGraw Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C t. Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach. 3rd Edition by. Tata McGraw - Hill.

Reference Books:

1. J.P. Trernblay and R. Manohar, Discrete Mathematical Structure and It's Application to
2. Conrputer Science". TMG Edition, TataMcgraw-Hill
3. Nonnan L. Biggs. Discrete Mathematics,2nd Edition, oxfbrd universitl, press. Schaum's
4. Outlines Series. Seymour Lipschutz, Marc Lipson,
5. Discrete Mathematics. Tata Mccraw – Hill

Course Outcomes:

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

CS1303.1	Analyse sets with operations to identify their structure and show reasoning about the relations based on their observations
CS1303.2	Use logical notation to define and reason mathematically about the fundamentals of logics and proof techniques.
CS1303.3	Identify and Apply the definitions and conclusions of functions with recursive structures and identify reasoning of various counting techniques
CS1303.4	Comprehend and Evaluate the Boolean algebra with minimization of expression and know the structures of algebraic nature.
CS1303.5	Gain the knowledge of graphs and trees in order to identify model and solve real world problems related to them.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1303.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1303.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1303.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-
CS1303.4	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-
CS1303.5	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1304**							**Course category**			VSE1
Course Name	DATA STRUCTURE LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	25	25	50	01

Course Objective:

1. To impart the knowledge of data structures and algorithms.
2. To analyse the algorithm with respect to time and space which will prove the efficiency of algorithm.
3. To assess how the choice of data structures and algorithm design methods impacts the performance of programs
4. To convert algorithms into efficient programs

Sample List of Practical

Project 1 will be comprised of static sized array data structure involving sorting, searching, ADT such as dictionaries.

Project 2 will be comprised of linked list different types and string pattern matching algorithms

Project 3 will comprise of applications of stack and queue

Project 4 will comprise of Graph algorithm and its applications

Project 5 will comprise of Tree algorithms and its application

Project 6 will be a major application comprises most of the required contents of syllabus.

Note: Project 1 to 5 can be completed individually or group of two students and Project 6 containing at least 4 different modules which can be completed in the group of 3 to 4 students

Course Outcomes

CS1304.1 Understand basic terminology of data organization with the available data structures and their behaviour

CS1304.2 Analysing and understanding, the implementation of data structures on computer memory so that, one must able to choose appropriate data structure for a given specific problem.

CS1304.3 After implementation a student must be capable of doing quantitative analysis of algorithm.

CS1304.4 Demonstrate ability to devise an efficient algorithm and transform into efficient code.

CS1304.5 Implement the algorithms to solve real time problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1304.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1304.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1304.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-
CS1304.4	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-
CS1304.5	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

ICA – Internal Continuous Assessment shall be based on the practical record and knowledge/ skills acquired. The performance shall be assessed experiment wise using continuous assessment formats, A and B.

Course Code	**CS1305**								**Course category**			VSE2
Course Name	OBJECT ORIENTED METHODOLGY LABORATORY											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	50	00	50	01

Course Objectives:

To make the students aware and understand:

1. Allow programmers to think in terms of the structure of the problem rather than in terms of the structure of the computer.
2. Decompose the problem into a set of objects
3. Objects interact with each other to solve the problem
4. Create new type of objects to model elements from the problem space

Course Contents:

Minimum eight to ten experiments related to the course contents of Course (**OBJECT ORIENTED METHODOLOGY)** are to be performed.

List of experiments:

1. Understanding Data Types, Identifiers, and Constants in Object-Oriented Programming
2. WAP to change a variable's data type from one to another by using type casting.
3. Write a program to understand different operators in OOP.
4. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
5. Write a program to understand different control statements used in OOP
6. a) Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly. b) Write a Program to Demonstrate the Catching of All Exceptions.
7. WAP to swap two numbers by using call by reference & call by value functions.
8. Write a program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class.

9. Write programs that illustrate how the following forms of inheritance are supported: a)Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance
10. Program to open a file whose name is passed as command line argument and display its contents on output device and find the size of file in bytes

On successful completion of the course, the student will:

CS1305.1	Master the fundamental principles of OO programming
CS1305.2	Master key principles in OO analysis, design and development.
CS1305.3	Master common patterns in OO design and implement them,

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1305.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1305.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1305.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

ICA – Internal Continuous Assessment shall be based on the practical record and knowledge/ skills acquired. The performance shall be assessed experiment wise using continuous assessment formats, A and B.

Course Code	CS1306	Course category	EM1
Course Name	INNOVATION, CREATIVITY& ENTREPRENEURSHIP (COMPUTER WORKSHOP)		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	50	00	50	01

Course Objective:

1. To understand the need of innovation.
2. To analyse the problem statement for creativity.
3. To implement the engineering logic for innovation and creativity.

Any category based on given guidelines

Category 1: Project on software application
Category 2: Project on application of simulation tools for digital signal processing
Category 3: Project on system design
Category 4: Project on network security, web security and firewall

Course Outcome

After completion of course

CS1306.1 Students will able to understand the basic of matlab and design the project using matlab
CS1306.2 Students will implement the operations of Matlab for real time problems.
CS1306.3 Students will design GUI application using visualization of matlab.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1306.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1306.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1306.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

ICA – Internal Continuous Assessment shall be based on the practical record and knowledge/ skills acquired. The performance shall be assessed experiment wise using continuous assessment formats, A and B.

SEMESTER IV

Course Code	CS1401	Course category	PC
Course Name	DESIGN AND ANALYSIS OF ALGORITHM		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	01	00	04	15	15	10	60	2hr 30 min	00	00	100	04

Course Objectives

1. To write rigorous correctness proofs for algorithms designed using different algorithm.
2. Synthesize efficient algorithms in common engineering design situations.
3. To emphasize the relationship between algorithms and programming
4. To demonstrate familiarity with NP-Complete problems.
5. To design techniques and understand there efficiency using different analysis methods.

Algorithms: Algorithms as Technology, Algorithm Design Techniques, Asymptotic notations of analysis of algorithms, analysing control structures, complexity, worst case and average case analysis. **Mathematical foundations**: summation of arithmetic and geometric series, bounding summations using integration, recurrence relations.

Sorting Algorithms: Sorting Algorithms and there analysis using incremental approach such as insertion sort, bubble sort, selection sort, sorting in linear time.

Greedy method: basic strategy, application to job sequencing with deadlines problem, Elements of Greedy Methods.

Divide and conquer: Divide and conquer basic strategy, Recurrences, binary search, quick sort, merge sort. Maximum sub array and matrix multiplication problem.

Dynamic programming: basic strategy, Rod Cutting Problem, Elements of Dynamic Programming.

Graph and Tree Algorithms: Elementary Graph Algorithms, DFS, BFS, minimum cost spanning trees, single source shortest path, Network Flow, Topological Sorting

Backtracking basic strategy, 8- Queen's problem, graph colouring, Hamiltonian cycles etc.

Advance Topics: Basic Concepts of NP-hard and NP-complete problems, non-deterministic algorithms, Randomization Algorithms and Approximation Algorithms, RSA Cryptography Algorithm, Compression.

Text Books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al. Computer Science Press

Reference Books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Outcomes

CS1401.1 Students will be analyse the asymptotic performance of algorithms.
CS1401.2 Students will be understood the rigorous correctness proofs for algorithms.
CS1401.3 Students will be Demonstrate a familiarity with major algorithms and data structures.
CS1401.4 Students will be Apply important algorithmic design paradigms and methods of analysis.
CS1401.5 Students will be able to write the proof for correctness of algorithm.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1401.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CS1401.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
CS1401.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-
CS1401.4	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-
CS1401.5	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1402**	**Course category**	PC
Course Name	DATABASE MANAGEMNT SYSTEM		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr 30 min	00	00	100	03

Course Objectives:

1. To Understand the basic concepts of DBMS
2. To learn data models, conceptualize and depict a database system using ER diagram.
3. To understand the internal storage structures in a physical DB design.
4. To know the fundamental concepts of transaction processing techniques.

Introduction: Database System Applications, Purpose of Database System, Views of data, data models, Database Languages, database architecture and components of DBMS, Database System Applications, Database Users and Administrators, Database System Structure, History of Database Systems. Entity-Relationship Model, Basic Concepts, Design Issues, Entity-Relationship Diagram, ER Model, notations, examples.

Relational Model: Relational Data Model, Concept of relations, schema-instance distinction, referential integrity constraints, keys, referential integrity and foreign keys, relational algebra operators, Extended Relational-Algebra Operations SQL: Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.

Relational Database Design: Dependencies and Normal forms, dependency theory, functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF.

Query processing and optimization Evaluation of relational algebra expressions, query equivalence, join strategies, query optimization algorithms. **Storage strategies** Indices, B-trees, hashing.

Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

Advanced topics Object-oriented and object relational databases, logical databases, web databases, distributed databases, data warehousing and data mining.

Text Books:

1. Silberschatz Abraham, Korth Henry F., and Sudharshan S., "Database System Concepts", 6th edition Tata McGraw Hill, Sixth Edition, 2017.
2. Elmasri Ramez and Navathe Shamkant B., "Fundamentals of Database Systems", Pearson Education, Seventh Edition, 2017.

Reference Books:

1. Date C. J., Kannan A. and Swamynathan S., "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006

2. Chodorow Kristina, "MongoDB: The Definitive Guide", 2 nd edition, O'Reilly, 2013

Course Outcomes:

CS1402.1 Ability to install, configure and interact with a relational database management system.
CS1402.2 Ability to master the basics of SQL and construct queries using SQL.
CS1402.3 Ability to obtain sound knowledge in the theory, principles and applications of database management system.
CS1402.4 Ability to identify issues in data storage, transaction, and concurrency control of DBMS.

CO/PO Mappings:

CO	PO / PSO														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS1402.1	3	1	0	0	0	0	0	2	0	0	0	0	0	0	0
CS1402.2	3	1	2	0	3	0	0	2	0	0	0	2	3	0	0
CS1402.3	2	3	3	2	3	2	2	0	0	2	2	2	3	2	3
CS1402.4	3	3	0	0	2	0	2	0	2	3	2	2	2	2	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	**CS1403**							**Course category**			PC
Course Name	COMPTER ORGANIZATION AND ARCHITECTURE										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	00	00	03	15	15	10	60	2hr 30 min	00	00	100	03

Course Objective

1. To understand the basic of computer peripherals which computers work
2. To impart the knowledge on micro programming.
3. To analyse how I/O devices are accessed and its principles.
4. To understand the concept of pipelining techniques.

Introduction: Computer components and its functions, Processing unit, bus architecture, execution of a complete instruction, sequencing of control signals, Computer peripherals, I/O devices such as video terminals, video displays, graphic input devices, printers, magnetic disk, magnetic tape, CDROM systems, Threading and Multithreading .

Addressing modes, their application in implementation of HLL constructs and data structures, instruction formats, expanding op-code method, Micro programmed control, microinstruction format, microinstruction sequencing, bit slice concept.

Arithmetic, number representations and their operations, design of fast address, signed multiplication, Booth's Algorithm, bit-pair recording, division , floating point numbers and operations, guard bits and rounding.

Main memory organization, various technologies used in memory design, higher order memory design, multi module memories and interleaving, cache memory, concept of cache memory, mapping functions, replacement algorithms.

External devices: I/O modules, Programmed I/O, Interrupt I/O, I/O channels

Input-output organization, I/O mapped I/O and memory mapped I/O, Direct Memory Access (DMA), interrupts and interrupt handling mechanisms, device identification, vectored interrupts, interrupt nesting, I/O interfaces, synchronous vs. asynchronous data transfer, I/O channels.

RISC philosophy, pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, performance considerations, basic concepts in parallel processing & classification of parallel architectures. Introduction of Superscalar and vector superscalar.

TextBooks:

1. Computer Organization & Architecture By Stalling W, 6th Edition , Pearson Education 2003
2. Computer Organization , Hamacher, Carl V. et al, McGraw Hill

References:

1. Computer Organization & Design, the Hardware/ Software Interface, Patterson D. A, Hennessy J. L.
2. Structured Computer Organization , Tanenbaum A.S, Prentice Hall of India Ltd

Course Outcomes:

CS1403.1 Students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.

CS1403.2 Students will be able to identify where, when and how enhancements of computer performance can be accomplished.

CS1403.3 Students will learn the sufficient background necessary to read more advance texts as well as journal articles on the field.

CS1403.4 Student will see how to use concepts of computer organization in real-life settings using various PC performance improvements.

CO/PO Mappings:

CO	PO / PSO														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS1403.1	3	1	0	0	0	0	0	2	0	0	0	0	0	0	0
CS1403.2	3	1	2	0	3	0	0	2	0	0	0	2	3	0	0
CS1403.3	2	3	3	2	3	2	2	0	0	2	2	2	3	2	3
CS1403.4	3	3	0	0	2	0	2	0	2	3	2	2	2	2	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	**CS1404**							**Course category**			PC
Course Name	DESIGN AND ANALYSIS OF ALGORITHM LABORATORY										
Teaching Scheme				Examination Scheme							Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	50	00	50	01

Course Objectives

1. To write rigorous correctness proofs for algorithms designed using different algorithm design techniques and understand there efficiency using different analysis methods.
2. Synthesize efficient algorithms in common engineering design situations.
3. To emphasize the relationship between algorithms and programming

Sample list of experiments-

- Write a program to implement searching algorithm with time complexity.
- Write a program to implement sorting algorithm.
- Implement 0/1 Knapsack problem using Dynamic Programming.
- From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
- Print all the nodes reachable from a given starting node in a digraph using BFS method.
- Check whether a given graph is connected or not using DFS method.
- Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
- Implement N Queen's problem using Back Tracking.
- Case study on real world application.

Course Outcomes

CS1404.1 Students will analyse the asymptotic performance of algorithms.
CS1404.2 Students will understood the rigorous correctness proofs for algorithms.
CS1404.3 Students will demonstrate a familiarity with major algorithms and data structures.

CO-PO-PSO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1404.1	3	1	0	0	0	0	0	2	0	0	0	0	0	0	0
CS1404.2	3	2	2	0	3	0	0	2	0	0	0	2	3	0	0
CS1404.3	2	3	2	1	3	2	2	0	0	2	2	2	3	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	**CS1405**							**Course category**			PC
Course Name	COMPUTER ORGANIZATION AND ARCHITECTURE LABORATORY										
Teaching Scheme				Examination Scheme							Credits
				Theory					Practical		Total	
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	50	00	50	01

Course Objectives

1. To understand the basic of computer peripherals which computers work
2. To impart the knowledge on micro programming.
3. To analyse how I/O devices are accessed and its principles.

Following is the sample list of practical based on syllabus

1. Study of peripherals, components of a Computer System.
2. Study of GNUSim simulator for 8085
3. Design an assembly program for Binary Addition
4. Design an assembly program for Binary Multiplication
5. Study of Logisim Tool.
6. Design of half-adder circuit using basic gates.
7. Design of full-adder circuit using basic gates.
8. Design Ripple Carry adder.

Course Outcomes

CS1405.1 Students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.

CS1405.2 Students will be able to identify where, when and how enhancements of computer performance can be accomplished.

CS1405.3 Students will learn the sufficient background necessary to read more advance texts as well as journal articles on the field.

CO/PO Mappings:

CO	PO / PSO														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS1405.1	1	2	3	0	2	0	1	1	0	0	0	0	2	0	0
CS1405.2	2	3	3	0	0	0	1	0	0	0	0	0	3	2	0
CS1405.3	3	2	0	0	0	0	0	0	0	0	0	0	3	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	**CS1406**							**Course category**			PC
Course Name	DATABASE MANAGEMENT SYSTEM LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
00	00	02	02	00	00	00	00	---	25	25	50	01

Course Objectives:

1. To give a good formal foundation on the relational model of data.
2. To present SQL and procedural interfaces to SQL comprehensively.
3. To design database using normalization

The sample list of programs based on ORACLE or MY SQL is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to achieve the minimum expected outcomes.

List of Experiments:

1. SQL and installation of SQL server/oracle.
2. Data Definition Language (DDL) commands in RDBMS
3. Data Manipulation Language (DML) and Data Control Language (DCL)
4. Data types and create a database and write the program to carry out the following operation.
5. Create tables department and employee with required constraints.
6. Working with null values, matching the pattern from the table.
7. Aggregate functions: grouping the result of a query.
8. Set operators, Nested Queries, Joins and Sequences.
9. Views, indexes, database security and privileges: Grant and Revoke commands, Commit and Rollback commands.
10. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters.
11. Triggers and Cursor Management in PL/SQL.
12. Procedures and Functions
13. Automatic Backup of Files and Recovery of Files.
14. As a designer identify the views that may have to be supported and create views.
15. Mini Project Using Oracle 9i or MY SQL

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE – The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Lab Outcomes:

CS1406.1 Ability to design and implement a database schema for a given problem-domain.

CS1406.2 Ability to normalize a database.

CS1406.3 Populate and query a database using SQL DML/DDL commands.

CO/PO/ Mappings:

CO	PO / PSO														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS1406.1	0	0	3	0	3	0	0	0	0	0	3	2	0	3	0
CS1406.2	0	3	3	0	2	0	0	0	0	0	1	0	2	3	0
CS1406.3	1	1	3	0	3	1	0	0	0	0	0	0	2	1	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	SH1401A							Course Category			OE1
Course Name	Appreciating Indian Music										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	Ct-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	30	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To familiarize students with the historical and cultural context of Indian Classical Music.
2. To introduce students to the fundamental concepts of raga, tala, and improvisation.
3. To develop students' listening skills through analysis and appreciation of classical music recordings.
4. To provide students with practical training in basic vocal or instrumental techniques.
5. To encourage critical thinking and reflection on the aesthetic and philosophical aspects of Indian Classical Music.

Course Contents:

Introduction to Indian Music:
Historical overview: origins, evolution, and major developments, definitions (sangeet, swar and its types, saptak and its types, aroha, aavaroha, pakad, alankar, wadi swar, sanvadi swar,varjit swar, sthayi and antara) Regional variations and prominent classical music traditions (Hindustani and Carnatic). Influence of spirituality, mythology, and philosophy on Indian Classical Music.

Fundamentals of Raga:
Understanding the concept of raga (melodic framework) and its elements, Notation systems and the role of improvisation within the framework of raga (Paluskar and Bhatkhande lipi), Different THAATs and their brief information, Definition of Raga, Sargam geet, the concept of Khyal , aalap and tana, Raga and Time Association, Basic ragas (Bhupali, Yaman, Bhimpalasi and Kedar) along with Aaroha, avaroha, pakad and sargam geet and khyal.

Introduction to Taala:
Understanding the components of a tala cycle (Defining- Taal, Lay and its types, matras, theaka, sum,tali, kaal, avartan).
Study of common talas (Teental, Rupak, Kehrarva, Dadra and Bhajni Theaka)
Practical exercises in clapping and counting rhythms to internalize talas.

Introduction to Musical Instruments:
Classification of Indian Musical Instruments (String, wind, percussion and Solid Instruments), components parts of Indian classical instruments along with neat sketch
Biography- Ustad Zakir Husen (Tabla), Pandit Appa Jalgaokar (Harmonium)
Pandit Ravi Shankar (Sitar), Pandit Hari Prasad Chaurasiya (Flute), Dr. N Rajam (Violin)

Textbooks:
1. Indian Classical Music By Ravi S. Prasanna
2. Appreciating Indian Music By Emmons E. White
3. Fundamental of Indian Music By. S. Sharma.

References:
1. Indian Music By Dr. Thakur J. Sing
2. Finding the Raga By Amit Choudhari.
3.History of Indian Music By B. A. Pingle
4. Raga Harmony By L. Subramaniam

Course Outcomes:
After successful completion of this course student will be able to

SH1401A.1: Students will demonstrate an understanding of the historical development and cultural significance of various genres and styles of Indian music.
SH1401A.2: Students will understanding classical, folk, and contemporary forms, by discussing key historical milestones and movements.
SH1401A.3: Students will be able to applying knowledge of musical elements such as raga, tala, swara, and laya to identify stylistic features, structural patterns, and aesthetic qualities.
SH1401A.4: Students will develop skills and competencies relevant to careers in music education. SH1401A.5: Students will develop skills and competencies relevant to research, arts administration, cultural advocacy, or related fields, preparing them for further academic pursuits or professional endeavors in the music industry.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401A.1	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.2	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.3	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.4	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2

SH1401A.5	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	**SH1401B**						**Course Category**			**OE1**
Course Name	**Introduction to Human Psychology**									
Teaching Scheme				**Examination Scheme**						**Credits**
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	CT-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

To make the students will be able to:

1. Understand the human behaviour.
2. Helps humans in exerting more control over situations
3. Basic cognitive processes that guide human behaviours.
4. Tackling everyday problems and attaining optimal solutions
5. Knowledge about human cognitive systems in designing sophisticated Artificial Intelligence (AI) systems.

Course Contain:

Introduction to Cognitive Psychology:

- History,
- Theory
- Research in Human Cognition

Basic Cognitive Processes:

- Object Perception and Recognition
- Attentional Processes and cognition
- Memory Introduction
- Long Term Memory

Organizational Knowledge:

- Memory of general knowledge.
- Concept Formation
- Visual and Spatial Memory

The Use of Knowledge:

- Human language skills.
- Thought process and Problem Solving
- Reasoning
- Decision Making

Textbooks:

1. Kathleen Galotti, Cognitive Psychology, Cengage Learning.
2. Robert Stenberg, Applied Cognitive Psychology, Cengage Learning.

References:

1. Bridger Riegler, Cognitive Psychology, Pearson Press
2. Stephen Kosslyn, Cognitive Psychology, PHI Press

Course Outcomes:

At the end of this course, students will demonstrate the ability to
SH1401B.1: To learn history of Human Psychology.
SH1401B.2: To understand, theory and research in Human Psychology.
SH1401B.3: To learn the Basic Cognitive Processes.
SH1401B.4: To understand about Organizational Knowledge.
SH1401B. 5: Apply the knowledge of human Psychology to developed process of problem solving, reasoning, decision making.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401B.1	2	3	0	0	0	0	0	1	2	0	0	0	3	1	2
SH1401B.2	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.3	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.4	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.5	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	SH1401C								Course Category			OE1
Course Name	Nanotechnology, Science and Application											
Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	Ct-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs. 30 min	-	-	20	00

Course Objectives:

Students will be able to:
1. To understand the history, background and nature of Nano science and nanotechnology as well as the quantum and Nano sized scale effect on materials.
2. To acquire theoretical understanding of different types of nanostructure
3. To understand the synthesis technique and its types.
4. To learn the different methods of characterization.
5. Aim to approach towards advance research and application of nanoparticals.

Course Contents:

Basics of Nanoscience:

Introduction, Effect of reduction of dimensions on physical properties, History of Nanotechnology, Quantum size effect,

Different classes of Nanomaterial's:

Classification based on dimensionality-Quantum Dots, Wells and Wires, preparation of quantum nanostructures, conduction electrons and dimensionality, Fermi gas and density of states, potential wells, partial confinement, properties dependent on density of states, exitons, single electron tunnelling.

Material Synthesis Method:

Nanostructures of one dimension: Crystalline growth, Template based synthesis. Nanostructures of two dimensions: Fundamentals of thin film growth, physical vapour deposition, chemical vapour deposition, atomic layer deposition, self-assembly, Sol-Gel films, and electrochemical deposition.

Material Characterization Methods:

UV visible microscopy, Scanning electron microscopy (SEM), Transmission electron microscope (TEM), x-ray diffraction (XRD). Atomic Force Microscope (AFM)

Application of Nanomaterial's:

Agriculture field, Medical field, Space Technology, Food Technology, Water Treatment, Energy Sector, Automobile, Electronics Field, Textile Field, Cosmetic.

Textbooks:

1. Introduction to Nanotechnology by C.P. Poole Jr. and F.J. Oweus, Wiley Interscience
2. Nano-Technology by Gregory Timp (Editior), AIP Press, Springer.
3. Pradeep T., "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education Pvt. Ltd.

Reference Books and website links:

1. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press
2. Graphene: Synthesis and applications, edited by Wonbong Choi and Jo-won Lee.
3. Semiconductor Nanostructures and Nanodevices Vol 1-5-A. A. Balandin, K. L.Wang.
4. Springer Handbook of Nanotechnology: Bharat Bhushan
5. Nanofabrication towards biomedical application: Techniques, tools, Application and impact: Ed. Challa S., S. R. Kumar, J. H. Carola
6. A. S. Edelstein and R. C. Cammarata, "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Pub., 1998.
7. G. Cao, Nanostructures & Nanomaterials: Synthesis, Properties & Applications , Imperial College Press, 2004.
8. G.A. Ozin and A.C. Arsenault, "Nano chemistry : A chemical approach to nanomaterials", Royal Society of Chemistry, 2005.

9. Joel I. Gersten, "The Physics and Chemistry of Materials", Wiley, 2001.
10. K.W. Kolasinski, "Surface Science: Foundations of Catalysis and Nanoscience", Wiley, 2002.
11. Physical Chemistry – Atkins Peter, Paula Julio.
12. Nanotechnology in Biology and Medicine: Methods, Devices, and Applications.

Course Outcomes:

On completion of the course, students will be able to:

SH1401C.1: To learn basic of Nano science with special, emphasize on nanomaterial's.
SH1401C.2: Correlate physical behavior of materials at the Nano scale.
SH1401C.3: Understand the physical, chemical and other important methods for synthesis of nanoparticles.
SH1401C.4: Understand the various characterization techniques of Nano materials.
SH1401C.5 Apply the knowledge gained to suggest different applications of Nano science and technology.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401C.1	2	0	2	0	0	0	0	0	1	2	2	3	2	2	1
SH1401C.2	3	2	3	0	2	0	2	0	0	3	2	3	2	2	1
SH1401C.3	3	2	3	2	0	0	3	3	1	3	3	3	2	2	1
SH1401C.4	3	2	3	2	2	0	2	0	0	3	3	3	2	2	1
SH1401C.5	3	2	3	2	2	0	3	1	0	3	3	3	2	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1**411							**Course category**			EX1
Course Name	**MOBILE APPLICATION DEVELOPMENT**										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				CT	TA	ESE	ESE Duration	ICA	ESE		
00	00	00	02	00	00	00	----	50	00	50	04

Course Objective: The students will

1. Understand the basics of android and its tools.
2. Understand the android operating system and development tool kit.
3. Analyse the requirements for developing the android applications.
4. Implement the UI components and layout.
5. Design secure android application.

Course Content:

Android and its tools: Introduction to Android, open handset alliance, Android Ecosystem, need of Android, Features of Android, Tools and software required for developing android application.

Installation and Configuration of Android: introduction of operating system, Android development tool kit, Dalvik Virtual Machine, Difference between JVM and DVM. Steps to install and configure Android Studio and SDK

UI Components and Layout: Control flow, Directory Structure, Components of a screen, fundamentals of UI design, Linear layout, absolute layout, frame layout, table layout, Relative Layout.

Designing User Interface with View: Text view- edit text, button, image, toggle button, radio button and radio group. List view- grid view, image view, scroll view

Security and Application Deployment: Location based services- creating the project, getting the maps API key, displaying the map, navigation, getting location data monitoring location.

Text Book:

1. Android by Dixit, Prasanna Kumar, Vikas Publications, New Delhi 2014, ISBN: 9789325977884

2. Pro Android 5 by Maclean David, Koatineni Satya, Allen Grant, Apress Publication, 2015, ISBN: 978-1-4302-4680-0

Reference Book:

1. Android Programming for Beginners by Hortan John Packet Publication, 2015, ISBN: 978-1-78588-326-2

Course Outcomes:

CS1411.1. Interpret features of Android operating system.
CS1411.2. Configure Android environment and development tools.
CS1411.3. Develop rich Interface by using layout and controls.
CS1411.4. Use User Interface components for android application development.
CS1411.5. Publish android applications.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1411.1	2	0	2	0	0	0	0	0	1	2	2	3	2	2	1
CS1411.2	3	2	3	0	2	0	2	0	0	3	2	3	2	2	1
CS1411.3	3	2	3	2	0	0	3	3	1	3	3	3	2	2	1
CS1411.4	3	2	3	2	2	0	2	0	0	3	3	3	2	2	1
CS1411.5	3	2	3	2	2	0	3	1	0	3	3	3	2	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	**CS1**412							**Course category**			EX2
Course Name	**COMPUTER NETWORK AND INTERNET PROTOCOL**										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				CT	TA	ESE	ESE Duration	ICA	ESE		
00	00	00	02	00	00	00	----	50	00	50	04

Course objective:

1. Describe and analyse the most common application architectures in the Internet
2. Understand the most important application-layer protocols work and the service they provide
3. Analyse and explain important design considerations at the transport layer, including describing how TCP's flow control and congestion control works
4. Motivate and explain how routing and forwarding is implemented on the Internet, including describing how IP addressing and fragmentation works
5. Describe and explain different link-layer technologies and how they work

Course Content:

Introduction to Computer Network: A brief history, data networks from Circuit Switching Network to packet Switching Network, Network Protocol Stack, Services at different layers of the protocol stack.

Application Layer: Domain name system, The Web, Hypertext Transfer Protocol (HTTP), Internet Mail Transfer (IMT), File Transfer Protocol (FTP)

Transport Layer Primitives: Connection Establishment and Closure, Flow Control and Congestion Control at the Transport Layer. Transmission Control Protocol – Basic Features, TCP Congestion Control.

Network Layer Primitives – IP Addressing, IP Routing – Intra Domain Routing Protocols, Inter Domain Routing Protocols (BGP), IP Services – SNMP, ARP

Data Link Layer Service Primitives – Forwarding, Flow Control, Error Control, Media Access Control - Channel Access Protocols, Framing, End to End Principles of Computer Networks.

Text Book:

1. Kurose, J. F. & Ross, K. W. (2017), Computer networking: a top-down approach. Seventh Edition. Pearson.

2. Computer Networks by Bhushan Trivedi, Oxford University Press

Course Outcome: After completion of course student will be able to

CS1412.1. Explain, describe, and analyse a typical network architecture, including the importance of network layers and encapsulation.
CS1412.2. Explain the different basic types of protocols, communication channels, and network types.
CS1412.3. Analyse network traces containing the most common Internet protocols
CS1412.4. Apply the communication protocol for network.
CS1412.5. Analyse, specify and design the topological and routing strategies for an IP based networking infrastructure

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS1412.1	2	0	2	0	0	0	0	0	1	2	2	2	1	2	1
CS1412.2	3	2	3	0	2	0	2	0	0	3	2	1	2	2	1
CS1412.3	3	2	3	2	0	0	3	3	1	3	3	2	3	2	1
CS1412.4	3	2	3	2	2	0	2	0	0	3	3	2	2	2	1
CS1412.5	3	2	3	2	2	0	3	1	0	3	3	3	3	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated