M.Sc. COMPUTER SCIENCE

LOCF SYLLABUS – 2021

SCHOOLS OF EXCELLENCE

WITH CHOICE BASED CREDIT SYSTEM (CBCS)

DEPARTMENT OF INFORMATION TECHNOLOGY
SCHOOL OF COMPUTING SCIENCES
ST. JOSEPH'S COLLEGE (AUTONOMOUS)
Special Heritage Status Awarded by UGC
Accredited at A^{++} Grade (IV Cycle) by NAAC
College with Potential for Excellence by UGC
DBT-STAR & DST-FIST Sponsored College
Tiruchirappalli - 620 002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS)
POSTGRADUATE COURSES

St. Joseph's College (Autonomous), a pioneer in higher education in India, strives to maintain and uphold the academic excellence. In this regard, it has initiated the implementation of five "Schools of Excellence" from the academic year 2014 – 15, to meet and excel the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system enhances the optimal utilization of both human and infrastructural resources. It also enhances academic mobility and enriches employability. The School system preserves the identity, autonomy and uniqueness of every department and reinforces Student centric curriculum designing and skill imparting. These five schools adhere to achieve and accomplish the following objectives.

Optimal utilization of resources both human and material for the academic flexibility leading to excellence.

Students experience or enjoy their choice of courses and credits for their horizontal mobility.

The existing curricular structure as specified by TANSCHE and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice based credit system.

Human excellence in specialized areas

Thrust in internship and / or projects as a lead towards research and

The multi-discipline nature of the School System caters to the needs of stake-holders, especially the employers.

Credit system:

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The credits and hours of each course of a programme is given in the table of Programme Pattern. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses, a student must earn a minimum of 110 credits as mentioned in the programme pattern table. The total number of minimum courses offered by the Department is given in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)
LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

Outcome –Based Education (OBE): is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs):

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Programme Educational Objectives (PEOs): The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC)

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE)

Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

DSE: Four courses are offered, one course in each semester.

Note: To offer **one DSE**, a minimum of two courses of equal importance / weightage is a must.

One DSE Course in semester two is offered as interdisciplinary/common course among the departments in a School (Common Core Course) at the PG level.

Generic Elective Courses

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Two GE Courses are offered, one each in semesters II and III. The GE course offered in semester II is within the school level and the GE in semester III is Between Schools level

The Ability Enhancement Courses (AEC)

One Main discipline related Ability Enhancement Course for 3 credits is offered for a PG programme by the Department.

Skill Enhancement Courses (SECs)

These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme.

One SEC is offered in semester II as a compulsory course on Soft Skills, offered by the Department of Human Excellence, common to all the students of PG programme.

Self–paced Learning: It is a course for two credits. It is offered to promote the habit of independent/self learning of Students. Since it is a two credit course, syllabus is framed to complete within 45 hours. It is not taught in the regular working hours.

Comprehensive Examinations: A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL and etc.

Course Coding:

The following code system (10 alphanumeric characters) is adopted for Post Graduate courses:

21	PXX	N	XX	NN/NNX
Year of Revision	PG Department Code	Semester number.	Part Category	running number/with choice

N:- Numerals X :- Alphabet

Part Category

CC - Core Theory

CP- Core Practical

IS- Internship

SP- Self Paced Learning

CE- Comprehensive Examination

PW- Project Work & viva-voce

Electives Courses

ES – Department Specific Electives

EG- Generic Electives

EC - Additional core Courses for Extra Credits (If any)*

Ability Enhancement Courses

AE – Ability Enhancement Course

SE – Skill Enhancement Course – Soft skills

CW - SHEPHERD & Gender Studies (Outreach)

CIA AND SEMESTER EXAMINATION

Continuous Internal Assessment (CIA):

Distribution of CIA Marks	
Passing Minimum: 50 Marks	
Library Referencing	5
3 Components	35
Mid-Semester Test	30
End-Semester Test	30
CIA	100

MID-SEM & END-SEM TEST

Centralised – Conducted by the office of COE

1. Mid-Sem Test & End-Sem Test: (2 Hours each); will have Objective and Descriptive elements; with the existing question pattern PART-A; PART-B; PART-C and PART D.
2. One of the CIA Component II/III for UG & PG will be of 15 marks and compulsorily a online objective multiple choice question type.
3. The online CIA Component must be conducted by the Department / faculty concerned at a suitable computer centre.
4. The one marks of PART-A of Mid-Sem and End-Sem Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS.
5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.

Duration of Examination must be rational; proportional to teaching hours 90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level)	Lower Order Thinking			Higher Order Thinking			Total
K- LEVELS	K1	K2	K3	K4	K5	K6	%
SEMESTER EXAMINATIONS	15	20	35	30			**100**
MID / END Semester TESTS	12	20	35	33			**100**

QUESTION PATTERN FOR SEMESTER EXAMINATION	
SECTION	**MARKS**
SECTION–A (No choice ,One Mark) **THREE** questions from each unit **(**15x1 =15)	**15**
SECTION-B (No choice ,2-Marks) **TWO** questions from each unit (10x2 =20)	**20**
SECTION-C (Either/or type) (7- Marks) **ONE** question from each unit (5x7 =35)	**35**
SECTION-D (3 out of 5) (10 Marks) **ONE** question from each unit (3x10 =30)	**30**
Total	**100**

BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.							**Max Mark : 100**
K- LEVELS / **SECTIONS**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION–A (One Mark, No choice) (15x1 =15)	15						**15**
SECTION-B (2-Marks, No choice) (10x2=20)		10					**20**
SECTION-C (7- Marks) (Either/or type) (5x7=35)			5				**35**
SECTION-D (10 Marks) (3 out of 5) (3x10=30) Courses having only **K4** levels				3			**30**
Courses having **K4** and **K5** levels **One K5 level question is compulsory**				2	1		
(Courses having **all the 6** cognitive levels **One K5 and K6 level questions can be compulsory**				1	1	1	
Total	**15**	**20**	**35**	**30**			**100**

QUESTION PATTERN FOR MID/END TEST		
SECTION		**MARKS**
SECTION–A (No choice, One Mark)	(7x1 =7)	**7**
SECTION-B (No choice , 2-Marks)	(6x2 =12)	**12**
SECTION-C (Either/or type) (7- Marks)	(3x7 =21)	**21**
SECTION-D (2 out of 3) (10 Marks)	(2x10=20)	**20**
	Total	**60**

BLUE PRINT OF QUESTION PAPER FOR MID/END TEST							
DURATION: 2. 00 Hours.							**Max Mark: 60.**
K- LEVELS / **SECTIONS**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION –A (One Mark, No choice) (7 x 1 = 7)	7						**07**
SECTION-B (2-Marks, No choice) (6 x 2 = 12)		6					**12**
SECTION-C (Either/or type) (7-Marks) (3 x 7 =21)			3				**21**
SECTION-D (2 out of 3) (10 Marks) (2x10=20) Courses having only **K4** levels				2			**20**
Courses having **K4** and **K5** levels **One K5 level question is compulsory**				1	1		
Courses having **all the 6** cognitive levels **One K6 level question is compulsory**					1	1	
Total Marks	**07**	**12**	**21**	**20**			**60**
Weightage for 100 %	**12**	**20**	**35**	**33**			**100**

Assessment pattern for two credit courses.

S. No.	Course Title	CIA	Semester Examination	Total Marks
1	Self Paced Learning Course	25 + 25 = 50	50 Marks MCQ (COE)	100
2	Comprehensive Examinations	25 +25 = 50	50 Marks (MCQ) (COE)	100
3	Internship	100	--	100
4	Field Visit	100	--	100
5	Ability Enhancement Course (AEC) for PG (3 credits)	50 (Three Components)	50 (COE) Specific Question Pattern	100
Assessment Pattern for Courses in Part - IV				
6	Value Education Courses and Environmental Studies	50	50 Marks (For 2.00 hours) (COE)	100
7	Skill Enhancement Courses(SECs)	50 marks (by Course in-charge) 50 Marks (by an External member from the Department)		100
8	SEC: SOFT SKILLS (For UG and PG)	100	(Fully Internal)	100

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) respectively. These two are calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$	$WAM\,(\text{Weighted Average Marks}) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{i=1}^{n} C_i}$
Where, C_i is the Credit earned for the Course i G_i is the Grade Point obtained by the student for the Course i M_i is the marks obtained for the course i and n is the number of Courses **Passed** in that semester.	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

i) The classification of final results shall be based on the CGPA, as indicated in Table-2.

ii) For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99 and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good', and 'Above Average' respectively.

iii) A Pass in SHEPHERD will continue to be mandatory although the marks will not count for the calculation of the CGPA.

iv) Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	**10**	**O**
80 and above and below 90	**9**	A+
70 and above and below 80	**8**	**A**
60 and above and below 70	**7**	**B+**
50 and above and below 60	**6**	**B**
Below 50	**0**	**RA**

Table-2: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	**O**	**Outstanding**
8.00 to 8.99	A+	Excellent
7.00 to 7.99	**A**	**Very Good**
6.00 to 6.99	**B+**	**Good**
5.0 0 to 5.99	**B**	**Above Average**
Below 5.00	**RA**	**Re-appearance**

Credit based weighted Mark System is adopted for the individual semesters and cumulative semesters in the column 'Marks secured' (for 100)

Declaration of Result

Mr./ MS. _____ has successfully completed the Post Graduate in _____ programme. The candidate's Cumulative Grade Point Average (CGPA) is _____ and the class secured is _____ by completing the minimum of 110 credits.

The candidate has also acquired _____ (if any) extra by attending MOOC courses.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes(POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment in done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Mean Scores of COs = $\frac{\text{Sum of values}}{\text{Total No.of POs \& PSOs}}$		**Mean Overall Score =** $\frac{\text{Sum of Mean Scores}}{\text{Total No.of COs}}$	
Result	**Mean Overall Score**	**< 1.2**	**# Low**
		≥ 1.2 and < 2.2	**# Medium**
		≥ 2.2	**# High**

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes (POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment in done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

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Result	**Mean Overall Score**	**< 1.2**	**# Low**
		≥ 1.2 and < 2.2	**# Medium**
		≥ 2.2	**# High**

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

VISION

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

MISSION

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value-driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- Graduates will be able to accomplish professional standards in the global environment.
- Graduates will be able to uphold integrity and human values.
- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

POs - PG

1. Graduates will be able to apply assimilated knowledge to evolve tangible solutions to emerging problems.
2. Graduates will be able to analyze and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professionals and entrepreneurs upholding human values.
5. Graduates groomed with ethical values and social concern will be able to understand and appreciate cultural diversity, promote social harmony and ensure sustainable environment.

Programme Specific Outcomes (PSOs)	
PSO1	Acquire fundamental knowledge in problem solving, general computing and comprehensive knowledge in Computer Science.
PSO2	Competence to identify, analyze, design, optimize and implement system solutions using contemporary computing techniques which propels towards employability.
PSO3	Gain fundamental knowledge in computational methods and tools for solving real-time problems and implanting the quest for continual learning of novel and in-demand skills.
PSO4	Demonstrate the ability to act as a leader, or as a part of a team to create multi-functional Software Solutions.
PSO5	Ability to showcase discrete practical experiences by implementing various strategies that utilizes a variety of software techniques that are ethical and would be beneficial to the society.

M.Sc. COMPUTER SCIENCE					
PROGRAMME STRUCTURE					
Sem.	**Specification**	**No. of Courses**	**No. of Hours**	**Credits**	**Total Credits**
I-IV	Core Courses: Theory	**7**	**6x5=30 1x6=6**	**5**	**35**
I-IV	Core Courses: Practicals	6	6x3=18	**2**	**12**
II	Self-paced learning	1	-	**2**	**2**
IV	Comprehensive Examination	1	-	**2**	**2**
III	Mini Project work & Viva Voce	1	-	**7**	**7**
IV	Major Project work & Viva Voce	1	1x30=30	**20**	**20**
I- IV	Discipline Specific Elective	4	4x5=20	**4**	**16**
I	Ability Enhancement Course	1	1x4=4	**3**	**3**
II	Skill Enhancement Course (Soft Skills)	1	1x4=4	**3**	**3**
II	Generic Elective IDC (WS)	1	1x4=4	**3**	**3**
III	Generic Elective IDC (BS)	1	1x4=4	**3**	**3**
I - III	Online Courses (MOOC)	3	-	**(2)**	**(6)**
I-IV	**Outreach Programme**	**-**	**-**	**-**	4
	Total		**120**		**110(6)**

M.Sc. COMPUTER SCIENCE							
PROGRAMME PATTERN							
Course Details					**Scheme of Exams**		
Sem	**Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
I	21PCS1CC01	Programming in Java	5	5	100	100	100
	21PCS1CC02	NoSQL with MongoDB	5	5	100	100	100
	21PCS1CC03	Mathematical Foundations	5	5	100	100	100
	21PCS1CP01	Practical I – Java	3	2	100	100	100
	21PCS1CP02	Practical II – MongoDB	3	2	100	100	100
	21PCS1ES01A	**DSE-1:** Data Structures and Algorithm Design Methods	5	4	100	100	100
	21PCS1ES01B	**DSE-1:** High Performance Computing					
	21PCS1AE01	**AEC:** Big Data Analytics	4	3	50	50	50
		Extra Credit courses (MOOC)-1	-	(2)			
		Total	**30**	**26 (2)**			
II	21PCS2CC04	Programming with C# using ASP.NET	6	5	100	100	100
	21PCS2CC05	Data Science Using Python	5	5	100	100	100
	21PCS2CP03	Practical III – ASP.NET	3	2	100	100	100
	21PCS2CP04	Practical IV - Python	3	2	100	100	100
	21PCS2SP01	**Self-Paced Learning:** Computer Networks	-	2	50	50	50
	21PCS2ES02A	**DSE-2:** Internet of Things	5	4	100	100	100
	21PCS2ES02B	**DSE-2:** Compiler Design					
	21PSS2SE01	**SEC**: Soft skills	4	3	100	-	100
	21PCS2EG01	**GE-1**(WS): Mobile Adhoc Networks (MANET)	4	3	100	100	100
	21PMA2EG01	**GE-1**(WS): Mathematical Foundations (Offered by Math's)					
		Extra Credit courses (MOOC)-1	-	(2)			
		Total	**30**	**26 (2)**			
III	21PCS3CC06	Web Design using PHP	5	5	100	100	100
	21PCS3CC07	Smart Device Programming using Android	5	5	100	100	100
	21PCS3CP05	Practical V - PHP	3	2	100	100	100
	21PCS3CP06	Practical VI - Android	3	2	100	100	100
	21PCS3ES03A	**DSE-3:** Artificial Intelligence	5	4	100	100	100
	21PCS3ES03B	**DSE-3:** Computational Intelligence					
	21PCS3ES04A	**DSE-4**: Digital Marketing	5	4	100	100	100
	21PCS3ES04B	**DSE-4:** Ethical Hacking					
	21PCS3EG02	**GE-2** (BS): Advances in Computer Science	4	3	100	100	100
	21PCS3CE01	Comprehensive Examination	-	2	50	50	50
	21PCS3PW01	Mini Project Work	-	7	100	100	100
		Extra Credit courses (MOOC)-2		(2)			
		Total	**30**	**34 (2)**			
IV	21PCS4PW02	Major Project work & Viva Voce	30	20	100	100	100
		Total	**30**	**20**			
I-IV	21PCW4OR01	Outreach program (SHEPHERD)		4			
		Total (Four Semesters)	**120**	**110(6)**			

*The courses with a scheme of Exam 50 in CIA and SE will be converted to 100 for grading.

GENERIC ELECTIVE -1: 2nd Semester Within school (WS)- Offered to students belong to other Departments in the School							
Course Details					Scheme of Exams		
School	**Course Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
SBS	21PBI2EG01	Herbal Technology	4	3	100	100	100
	21PBT2EG01	Medical Biotechnology	4	3	100	100	100
	21PBO2EG01	Medicinal Botany	4	3	100	100	100
SCS	21PCA2EG01	Applied Statistics using R	4	3	100	100	100
	21PMA2EG01	Mathematical Foundations	4	3	100	100	100
	21PCS2EG01	Mobile Adhoc Networks (MANET)	4	3	100	100	100
SLAC	21PEN2EG01A	Indian Literature in Translation	4	3	100	100	100
	21PEN2EG01B	English Literature For Competitive Examinations					
SMS	21PCO2EG01	Supply Chain Management	4	3	100	100	100
	21PEC2EG01	Labour Economics	4	3	100	100	100
	21PHR2EG01	Organizational Behaviour	4	3	100	100	100
	21PCC2EG01	Stress Management	4	3	100	100	100
SPS	21PCH2EG01	Industrial Products	4	3	100	100	100
	21PPH2EG01A	Solar Energy and Utilization	4	3	100	100	100
	21PPH2EG01B	Renewable Energy Resources	4	3	100	100	100

GENERIC ELECTIVE -2: 3rd Semester Between schools (BS)- Offered to students in the Departments belong to other Schools (Except the school offering the course)							
Course Details					Scheme of Exams		
School	**Course Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
SBS	21PBI3EG02	First Aid Management	4	3	100	100	100
	21PBT3EG02	Food Technology	4	3	100	100	100
	21PBO3EG02	Horticulture and Landscaping	4	3	100	100	100
SCS	21PCA3EG02	Web Design	4	3	100	100	100
	21PMA3EG02	Operations Research	4	3	100	100	100
	21PCS3EG02	Advances in Computer Science	4	3	100	100	100
	21PDS3EG02	Deep Learning	4	3	100	100	100
SLAC	21PEN3EG02	English for Effective Communication	4	3	100	100	100
SMS	21PCO3EG02	Basics of Taxation	4	3	100	100	100
	21PEC3EG02	Managerial Economics	4	3	100	100	100
	21PHR3EG02	Counselling and Guidance	4	3	100	100	100
	21PCC3EG02	Dynamics of Human Behaviour in Business	4	3	100	100	100
SPS	21PCH3EG02	Health Science	4	3	100	100	100
	21PPH3EG02A	Physics for Competitive Exam	4	3	100	100	100
	21PPH3EG02B	Nano Science	4	3	100	100	100

Semester	Course Code	Title of the Course	Hours	Credits
I	**21PCS1CC01**	**CORE-1: PROGRAMMING IN JAVA**	**5**	**5**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	find solutions for a range of problems using object-oriented programming.	**K1**
CO-2	explain the Java Event-Handling model GUI Components.	**K2**
CO-3	solve problems using the fundamental syntax and semantics of the Java Programming Language.	**K3**
CO-4	examine JDBC programming techniques in Java.	**K4**
CO-5	evaluate Remote real-time applications using RMI and Servlet.	**K5, K6**

Unit-I: Classes and Objects **(15-Hours)**

General Form of a Class - Creation of Objects -Usage of Constructors - 'this' Keyword-Constructor Overloading-Copy Constructors-Static Data Members - Static Methods- Finalize Method. Inheritance and Polymorphism: Inheriting Variables in a Class - Inheriting Methods in a Class - Inheritance and Constructors Abstract Classes - Final Classes.

Unit-II: Interfaces and Packages **(15-Hours)**

Interfaces-Structure of an Interface - Implementation of an Interface Inheritance. Packages - Placing the Classes in a Package - Package Hierarchy Access Control Modifiers. Applets: The Life Cycle of an Applet -The Applet Class Development and Execution of a Simple Applet - Syntax of Applet Tag- Methods in the Graphic Class.

Unit-III: Swings **(15-Hours)**

Applet class - Icons - JLabel Control - JOptionPane Class - JTextField Control JButton Control - JCheckBox Control - JRadioButton Control Menus. Exception Handling: Default Exception Handling - Exception and Error Classes - Catch Block Searching Pattern - Custom Exceptions. I/O Streams: Text and Binary Formats of Data Input Stream and Output Stream Classes - Reader and Writer Classes - Data Output Stream and Data Input Stream Classes.

Unit-IV: Threads **(15-Hours)**

Life Cycle of a Thread - Creating and Running Threads - Method in the Thread Class - Setting the Priority of a Thread - Synchronization. Networking: TCP Server Socket Class - TCP Socket Class. Java Database Connectivity: Establishing A Connection - Creation of Data Tables Entering Data into The Tables - Table Updating.

Unit-V: Remote Method Invocation **(15-Hours)**

Remote Interface-Java.Rmi.Server Package The Naming Class - Creating RMI Client And Server Classes. Servlet: Servlet and Dynamic Webpages Life Cycle of a Servlet a Simple Servlet Javax.Servlet Package Retrieving the Values of Parameters. Cookies: Creating a Cookie and Sending it to the Client – Retrieving the Stored Cookies.

Book for Study

1. C. MUTHU, *Programming with JAVA*, Second Edition, Vijay Nicole Imprints Private Limited, Chennai, 2011.
   Unit I - *Chapter 5, Chapter 6*
   Unit II - *Chapter 7, Chapter 8*
   Unit III - *Chapter 11, Chapter 14*
   Unit IV - *Chapter 13, Chapter 15, Chapter 18*
   Unit V - *Chapter 19, Chapter 2*0

Books for Reference

1. Herbert Schildt, *Java 2: Complete Reference*, 11th Edition, Tata McGraw Hill, New Delhi, 2018.
2. E Balagurusamy, *Programming with JAVA*, 6th Edition, Tata McGraw Hill, New Delhi, 2019.
3. Mark Lassoff, *Java Programming for Beginners*, 1st Edition, Packt Publishing, UK, 2017.

Relationship matrix for Course outcomes, Programme outcomes / Programme Specific Outcomes

Semester	**Course Code**			**Title of the Course**						**Hours**	**Credits**
I	**21PCS1CC01**			**CORE-1: PROGRAMMING IN JAVA**						**5**	**5**
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	2	2	3	2	3	3	3	2	3	3	2.6
CO-2	2	3	2	2	3	3	3	2	2	3	2.5
CO-3	1	2	3	2	3	3	2	3	2	2	2.3
CO-4	2	2	3	2	2	3	3	2	3	3	2.5
CO-5	2	2	3	3	2	2	3	2	3	3	2.5
Mean Overall Score											**2.48 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1CC02	CORE-2: NOSQL WITH MONGODB	5	5

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	show the fundamental concepts of NoSQL and key value to engage the database.	K1
CO-2	comprehend the structure of NoSQL to implement MongoDB .	K2
CO-3	apply the basic queries on MongoDB to solve real time problem.	K3
CO-4	analyze the different concept of aggregation to implement and retrieve the data using mathematical methods.	K4
CO-5	estimate the various strategies Replication and Sharding for implementing various software solutions.	K5, K6

Unit-I: NoSQL Database **(15-Hours)**

RDBMS Vs NOSQL - Data Management with Distributed Databases- ACID and BASE- Four types of NOSQL Databases. Key Value Databases: Introduction to key value databases- Essential Features of Key-value Databases- Key-Value Database Data Modelling Terms- Key-Value Architecture Terms- Key-Value Implementation Terms.

Unit-II: Document Database **(15-Hours)**

Introduction to Document Database: Document managing Multiple Document in Collection- Basic Operations on document Database- Types of Partitions- Data modelling and Query Processing Normalization, De-normalization, and the Search for proper Balance.

Unit-III: Introduction to MongoDB **(15-Hours)**

Documents- Collections- Databases- Starting MongoDB- Data Types- Inserting and Saving Documents- Removing Documents- Updating Documents- Introduction to find- Query Criteria- Type-Specific Queries- $where Queries- Introduction to Indexing- Using explain () and hint () - Types of Indexes.

Unit-IV: Aggregation **(15-Hours)**

The Aggregation Framework- Pipeline Operations- MapReduce- Aggregation Commands- Normalization versus Denormalization- Optimizations for Data Manipulation- When Not to Use MongoDB.

Unit-V: Replication **(15-Hours)**

Introduction to Replication- Configuring a Replica Set- Changing Your Replica Set Configuration- How to Design a Set- Member Configuration Options- Components of a Replica Set. Sharding: Introduction to Sharding- Understanding the Components of a Cluster- Starting the Servers- How MongoDB Tracks Cluster Data.

Books for Study

1. Dan Sullivan, *NoSQL for Mere Mortals*, Addison-Wesley, USA, 2015.
   Unit-I *Chapter 2, Chapter3*
   Unit-II *Chapter 6*

2. Kristina Chodorow, *MongoDB: The Definitive Gu*ide, O'Reilly, USA, 2013.
   Unit - III *Chapter 2, Chapter3, Chapter 4, Chapter 5*
   Unit – IV *Chapter 7*
   Unit – V *Chapter 9, Chapter10*

Books for Reference

1. Kyle Banker, Piter Bakkum, Shaun Verch, *MongoDB in Action*, Dream tech Press, New Delhi, 2016.
2. David Hows, Eelco Plugge, Peter Membray, Tim Hawkins, *The Definitive Guide to MongoDB*, Apress, UK, 2013.
3. Pramod J. Sadalage and Martin Fowler, *NoSQL Distilled. A Brief Guide to the Emerging World of Polyglot Persistence*, Pearson, Chennai, 2012.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
I	21PCS1CC02			CORE-2: NOSQL WITH MONGODB				5		5
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	2	2	3	3	3	2	3	2	2	2.4
CO-2	2	2	3	3	2	3	3	3	2	3	2.6
CO-3	2	2	2	2	2	2	3	3	2	3	2.3
CO-4	3	2	2	3	2	2	3	2	2	3	2.4
CO-5	2	2	3	2	3	2	3	3	2	3	2.5
Mean Overall Score											2.44 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1CC03	CORE-3: MATHEMATICAL FOUNDATIONS	5	5

CO No.	CO- Statements On successful completion of this course, students will be able to	Cognitive Levels (K- Levels)
CO-1	understand the rudimentary knowledge in Mathematical Logics.	K1
CO-2	demonstrate the use of Operations Research approaches to solve real-time problems in Industry.	K2
CO-3	gain Fundamental knowledge in recurrence relations, statistical methods to improve decision making and develop critical thinking and objective analysis of decision problems.	K3
CO-4	examine Transportation and Assignment problems using appropriate method.	K4
CO-5	evaluate various cryptographic techniques through mathematical knowledge that utilizes a variety of software techniques that would aid the society.	K5, K6

Unit-I: Mathematical Logic **(15-Hours)**

Propositions - Precedence Rules for Operators – Truth tables –Tautologies-Contradiction - Laws of Equivalence -Substitution Rules – Evaluation of Constant Proposition theorem - Well Defined Formula – Duality Law.

Unit-II: Recursion and Statistical Analysis **(15-Hours)**

The Many Faces of Recursion- Sequences – Recurrence Relation- Some Common Recurrence Relation. Statistical analysis: F-distributions - chi-square Test- T test.

Unit-III: Operation Research **(15-Hours)**

Introduction - Basics of OR - OR & Decision Making - Linear Programming- Mathematical Formulation- Graphical Solution - Canonical & Standard Forms of LPP.

Unit-IV: Simplex Method **(15-Hours)**

Simplex Method – Big M method – Assignment model Transportation Problem: North West Corner method – Least cost method – VAM method.

Unit-V: Coding Theory **(15-Hours)**

Introduction– Cryptography- Caesar Cypher Coding- Matrix Encoding- Scrambled Codes- Hamming Metric - Hamming Distance - Error Detecting -Capability of an Encoding.

Books for Study

1. David Gries, *The Science of Programming*, Narosa Pub. House, New Delhi, 1993.
   Unit-I: *Chapters (Sec. 1, 2 ,3.1 to 3.3)*
2. Alan Doerr, Kenneth Levasseur, *Applied Discrete Structure for Computer Science*,

GalgotiaPub., New Delhi, 1995.
Unit-II: *Chapter 8(Sec 8.1-8.4)*
3. S.C.Gupta & V.K.Kapoor, *Fundamentals of Mathematical Statistics*, 11th Edition, Sultan Chand and Sons, New Delhi, 2007.
Unit- II:*Chapter 13,14 (Sec 14.5.1, 14.2, 13.3)*
4. KantiSwarup, Gupta, ManMohan, *Operations Research*, 7th Edition, Sultan Chand & Sons, New Delhi, 1994.
Unit:III:*Chapter 1(Sec 1.1,1.9) Chapter 2(Sec 2.1,2.2, 2.3,2.4) Chapter 3 (Sec 3.1,3.2,3.5)*
Unit-IV: *Chapter 4(Sec 4.1,4.4) Chapter 10(Sec 10.1,10.2,10.3) Chapter 11(11.1,11.2,11.3,11.7)*
5. James L. Fisher, *Application Oriented Algebra*, Dun Donnelly Pub., New York, 1977.
Unit-V: *Chapter 9(Sec 9.1 - 9.5)*

Books for Reference

1. Hamdy A. Taha, Operation *Research An Introduction*, 10th Edition, University of Arkansas, Pearson Education, New Jersey U.S, 2017.
2. Kenneth Rosen , *Discrete Mathematics and Its Applications*, 8th Edition, MC Graw Hill Education, India, 2019.
3. Oscar Levin, *Discrete Mathematics an open Introduction*, First Edition, University of Northern Colorado, Create Space Publication, U.S, 2018.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
I	21PCS1CC03	CORE-3: MATHEMATICAL FOUNDATIONS					5	5			
Course Outcomes(COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	3	2	3	3	3	3	2	3	2.7
CO-2	2	2	3	3	2	3	3	3	2	3	2.6
CO-3	3	3	3	2	3	3	3	3	2	3	2.8
CO-4	3	3	2	2	2	3	3	3	2	2	2.5
CO-5	3	3	2	3	3	3	3	3	2	3	2.8
Mean Overall Score											2.68 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	**21PCS1CP02**	**PRACTICAL –I: JAVA**	**3**	**2**

CO No.	CO- Statement	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	show the behavior of Exception handling and Multithreading.	**K1**
CO-2	demonstrate the basic concepts of OOPS.	**K2**
CO-3	apply the JDBC methods to establish connection with database.	**K3**
CO-4	examine the GUI techniques such as Event handling, Applet and Swing.	**K4, K5**
CO-5	develop programming aspect with files and networking.	**K6**

List of Exercises:

1. Classes & Objects
2. Packages & Interfaces
3. Inheritance
4. Exception Handling
5. Multithreading
6. Applet
7. Swing
8. Event Handling Mechanisms
9. Streams and Files
10. Networking
11. JDBC
12. JavaBean
13. Servlets

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours				Credits
I	21PCS1CP01	PRACTICAL - I: JAVA					3				2
Course Outcomes↓ (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	1	1	2	3	2	2	2	3	2	3	2.1
CO-2	1	3	3	3	2	2	3	3	2	3	2.5
CO-3	2	2	2	3	2	3	3	2	3	3	2.5
CO-4	3	2	3	3	3	2	2	3	3	2	2.6
CO-5	2	3	3	3	2	3	3	2	2	3	2.6
Mean Overall Score											2.46 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1CP02	PRACTICAL-II: MONGODB	3	2

CO No.	CO- Statements	Cognitive Level (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	understand the fundamental design concepts of database using MongoDB.	K1
CO-2	comprehend the regular expression and indexing for solving real time problem.	K2
CO-3	apply distributed techniques for querying documents and modification.	K3
CO-4	analyze clustering and projecting techniques to interpret the data set.	K4
CO-5	estimate the various strategies to Manipulate data.	K5, K6

List of Exercises:

1. Basic Queries Using MongoDB
2. Indexes
3. Comparison operations
4. Project
5. Group
6. Match
7. Sort
8. Search Text
9. Logical Operations
10. Set Operations
11. Replication
12. Sharding

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course								Hours	Credits
I	21PCS1CP02	PRACTICAL-II: MONGODB								3	2
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	2	2	2	3	3	2	3	2	2	2.3
CO-2	3	2	3	3	2	3	3	3	2	3	2.7
CO-3	2	2	2	2	3	2	3	2	2	2	2.2
CO-4	3	2	2	3	2	3	2	3	2	3	2.5
CO-5	2	3	3	2	3	3	3	3	2	2	2.6
Mean Overall Score											2.46 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1ES01A	DSE-1: DATA STRUCTURES AND ALGORITHM DESIGN METHODS	5	4

CO No.	CO- Statements	Cognitive Level (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the fundamentals of data structure with their implementation and its applications.	K1
CO-2	infer the complexity of algorithms.	K2
CO-3	apply the Greedy methods to solve real time problems.	K3
CO-4	compare different sorting and searching techniques.	K4,K5
CO-5	design new algorithms with Dynamic Programming Techniques for Analytical Problems.	K6

Unit-I: Introduction to Data Structure (15-Hours)

Arrays - Memory Allocation - Stacks - Operations On Stacks – Evaluation of Arithmetic Expressions – Queues – Representation - Circular Queue - Round Robin Algorithm.

Unit-II: Advance Data Structures (15-Hours)

Single Linked List - Circular Linked List - Double Linked List. Trees - Binary Trees – Traversals – Expression Tree - Binary Search Tree.

Unit-III: Algorithm Specification (15-Hours)

Recursive Algorithms. Divide and Conquer: General Method - Binary Search - Finding The Maximum and Minimum - Merge Sort- Quick Sort- Insertion Sort - Selection Sort.

Unit-IV: Algorithm Design Methods (12-Hours)

The Greedy Method: General Method - Knapsack problem - Job Sequencing with Deadlines - Minimum Cost Spanning Trees - Optimal Merge Patterns. Algorithm Design Methods: Sub goals - Hill Climbing and Working Backward - Heuristics - Backtrack Programming.

Unit-V: Dynamic Programming (15-Hours)

Dynamic Programming: General Method - Multistage Graphs – General Weights - All Pair Shortest Paths - Optimal Binary Search Trees - Traveling Salesperson Problem.

Books for Study

1. Debasis Samanta, *Classic Data Structures*, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi. 2017.

   Unit-I *Chapter 2 (Sec: 2.3.1), Chapter 4 (Sec 4.4, 4.5.1), Chapter 5 (Sec 5.3, 5.4.1, 5.5.3)*

   Unit-II *Chapter 3 (Sec: 3.2, 3.3, 3.4), Chapter 7 (Sec 7.4.3, 7.5.1, 7.5.2)*

2. Ellis Horowitz, SartajSahni, *Fundamentals of Computer Algorithms*,Galgotia Publications, New Delhi. 2007.

   Unit-III *Chapter 1 (Sec: 1.2), Chapter 3 (Sec 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6)*

Unit-IV*Chapter 4 (Sec: 4.1, 4.2, 4.4, 4.5 and 4.7)*
Unit-V *Chapter 5 (Sec: 5.1, 5.2, 5.3, 5.5, and 5.9)*

3. S.E. Goodman and S.T. Hedetniemi, *Introduction to the Design and Analysis of Algorithms,* Tata McGraw Hill, International Edition. New Delhi, 1987.
Unit-IV *Chapter 3 (Sec: 3.1, 3.2, and 3.3)*

Books for Reference

1. Jean-Paul Tremblay and Paul G.Sorenson, *An introduction to data structures with applications,* 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi. 2017.
2. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, *Fundamentals of Computer algorithms*, 2nd Edition, Universities Press, Hyderabad, 2008.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, *Data Structures and Algorithms,* Addison Wesley, United States. 1987.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course							Hours	Credits
I	21PCS1ES01A	DSE-1: Data Structures and Algorithm Design Methods							5	4
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	3	2	1	3	2	2	1	2	2.1
CO-2	3	2	2	3	2	1	3	3	2	1	2.2
CO-3	3	2	3	3	3	3	2	1	3	1	2.4
CO-4	1	2	1	1	3	2	3	3	1	3	2.0
CO-5	3	1	2	1	3	2	3	3	3	2	2.3
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1ES01B	DSE-1: HIGH PERFORMANCE COMPUTING	5	4

CO No.	CO- Statements	Cognitive Level (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	define the principles of Parallel Algorithm Design.	K1
CO-2	understand the fundamental concepts, techniques in Parallel Computation Structuring and Design.	K2
CO-3	solve the algorithms using Parallel Programming Principle	K3
CO-4	distinguish various architectures of high-performance computing systems.	K4
CO-5	interpret modern design structures of pipelined and multiprocessors systems.	K5, K6

Unit-I: Modern Processors (15-Hours)

Stored-program computer architecture – General-purpose cache-based microprocessor architecture – Memory hierarchies – Multi core processors - Multithread processors - Vector processors - Basic optimization techniques for serial code - Common sense optimizations - Simple measures - large impact - Role of compilers.

Unit-II: Parallel Computers (15-Hours)

Data access optimization - Balance analysis and light speed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems –Networks - Basics of parallelization- Parallelism – Parallel scalability.

Unit-III: Principles of Parallel Algorithm Design (15-Hours)

Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations

Unit-IV: Sorting and Graph Algorithms (15-Hours)

Dense matrix Algorithm: Matrix-vector multiplication - Martix- matrix multiplication- **Sorting:** Issues in sorting on parallel computing - Sorting networks - Bubble sorts and its variants - Quick sort - Graph algorithms - Definition and representation - Prims algorithm - Dijkstra's algorithm - All pairs shortest path - Transitive closure – Connected components

Unit-V: Shared-Memory Parallel Programming with Openmp (15-Hours)

Short introduction to OpenMP, Advanced OpenMP: Wavefront parallelization, Profiling OpenMP programs Performance pitfalls, Case study:OpenMP - parallel Jacobi algorithm & Parallel sparse matrix-vector multiply.

Books for Study

1. Georg Hager and Gerhard Wellein, *Introduction to High Performance Computing for Scientists and Engineers*, Chapman & Hall, CRC Press, New York, 2010.
   Unit-I *Chapter 1, Chapter 2(section 2.2,2.3,2.4)*
   Unit-II *Chapter 4, Chapter 5*
   Unit –V *Chapter 6, Chapter 7*

2. AnanthGrama and George Karypis, *Introduction to parallel computing*, Addison-Wesley, USA, 2009.
   Unit-III *Chapter 3, Chapter 4*
   Unit – IV *Chapter 8, Chapter 9, Chapter 10*

Books for Reference

1. John Levesque and Gene Wagenbreth, *High Performance Computing: Programming and Applications*, Chapman & Hall, CRC Press, New York, 2010.
2. Wen-Mei W Hwu, David B Kirk, *Programming Massively Parallel Processors A Hands-on Approach*, Third Edition, Morgann Kaufmann, USA, 2016.
3. Rezaur Rahman, *Intel Xeon Phi Coprocessor Architecture and Tools*, Apress Open, UK, 2013.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
I	21PCS1ES01B	DSE-1: HIGH PERFORMANCE COMPUTING					5	4			
Course Outcomes(COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	2	3	2	3	3	3	2.6
CO-2	3	2	3	2	1	3	3	2	3	2	2.4
CO-3	3	2	1	3	3	2	3	3	2	3	2.5
CO-4	2	3	3	2	3	2	2	2	2	3	2.4
CO-5	3	2	3	1	3	3	3	3	3	2	2.6
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21PCS1AE01	AEC: BIG DATA ANALYTICS	4	3

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	comprehend the overview of an exciting growing field of big data analytics.	K1, K2
CO-2	perform the fundamentals of various big data analytics techniques.	K3
CO-3	analyze the HADOOP and Map Reduce technologies associated with Distributed File System	K4
CO-4	evaluate the Job Execution in Hadoop Environment.	K5
CO-5	discuss the programming tools in Hadoop Echo System.	K6

Unit-I: Overview of Big Data **(12-Hours)**

What is big data – Structuring Big data – Elements of Big data – Big data analytics- Careers in Big data. EXPLORING THE USE OF BIG DATA IN BUSINESS: Use of big data in social networking - Preventing Fraudulent Activities – Detecting Fraudulent Activities in Insurance Sector – Retail Industry.

Unit- II: Technologies for Handling Big Data **(12-Hours)**

Distributed and parallel computing for Big data – Hadoop – Cloud computing and big data – In-Memory computing technology for big data. Understanding Hadoop Ecosystem: Hadoop Ecosystem – Hadoop Distributed File System – MapReduce – Hadoop YARN.

Unit- III: HBase **(12-Hours)**

HBase Architecture – Storing big data with HBase – Interacting with the Hadoop Ecosystem – Combining HBase and HDFS – Hive – Pig and Pig Latin – Sqoop – Zookeeper – Flume – Oozie. Mapreduce and Hbase: MapReduce framework – Techniques to optimize MapReduce Jobs -Uses of MapReduce – Role of HBase in big data processing.

Unit-IV: Big Data Technology **(12-Hours)**

Exploring the big data stack – virtualization and big data. Storing Data in Database and Data Warehouse: RDBMS and Big data – Non- Relational Database – Polyglot Persistence – Interacting big data with Traditional data warehouse.

Unit- V: Hadoop Yarn Architecture **(12-Hours)**

YARN Architecture – Working of YARN – YARN Schedulers. Exploring Hive: Hive services – Data Types in Hive – Hive DDL- Data manipulation in Hive- Data Retrieval Queries.

Book for Study

1. DT Editorial Services, *BIG DATA BLACK BOOK*, Dreamtech Press, New Delhi, 2017.

Unit-I *Chapter 1 (Pages 1-20), Chapter 2 (Pages 29-44)*
Unit-II *Chapter 3 (Pages 53-74), Chapter 4 (Pages 83-104)*
Unit-III *Chapter 4 (Pages 103-115), Chapter 5 (Pages 121-142)*
Unit-IV *Chapter 6 (Pages 150-162), Chapter 7 (Pages 177-187),*
Unit-V *Chapter 10 (Pages 277-293), Chapter 12 (Pages 311-335)*

Books for Reference

1. Michael Minelli, Michaele Chambers, Ambiga Dhiraj, *Big Data, Big Analytics,* Wiley, UK, 2014.
2. Dr.Arvind Sathi, *Big Data Analytics: Disruptive Technologies for changing the game,* published by Elsevier, New York, 2013.
3. Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, *Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics,* Published by Apress Media, UK, 2013.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course						Hours		Credits
I	21PCS1AE01	AEC: BIG DATA ANALYTICS						4		3
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	2	3	3	3	2.4
CO-2	3	2	2	3	2	2	2	2	3	2	2.3
CO-3	2	2	3	2	3	3	2	2	3	3	2.5
CO-4	2	2	2	3	2	2	2	3	2	2	2.2
CO-5	2	2	3	2	2	2	3	2	2	3	2.3
Mean Overall Score											2.34 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2CC04**	**CORE-4: PROGRAMMING WITH C# USING ASP.NET**	**6**	**5**

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the fundamental concepts of .NET Framework.	**K1**
CO-2	explain the use of database in Entity Framework.	**K2, K5**
CO-3	develop C# programs using Object-Oriented Programming Concepts.	**K3**
CO-4	examine Intelligent Applications using Machine Learning and Windows Desktop Applications using Resources and Templates.	**K4**
CO-5	interpret the webpages using RAZOR PAGES and MVC.	**K6**

Unit-I: Understanding .NET (18-Hours)

Building console apps using Visual Studio Code. SPEAKING C#: Introducing C# – Understanding C# basics – Working with variables – Working with null values – Exploring console applications further. Controlling Flow and Converting Types: Operating on variables – Understanding selection statements – Understanding iteration statements – Casting and converting between types.

Unit-II: Writing, Debugging, and Testing Functions (18-Hours)

Writing functions – Debugging during development – Logging during development and runtime – Unit testing functions. Building Your Own Types with Object-Oriented Programming: Talking about object-oriented programming – Building class libraries – Building class libraries – Storing data within fields – Writing and calling methods – Controlling access with properties and indexers.

Unit-III: Implementing Interfaces and Inheriting Classes (18-Hours)

Setting up a class library and console application – Simplifying methods – Raising and handling events – Implementing interfaces – Inheriting from classes – Casting within inheritance hierarchies – Inheriting and extending .NET types. WORKING WITH DATABASES USING ENTITY FRAMEWORK CORE: Understanding modern databases – Setting up EF Core – Defining EF Core models – Querying EF Core models – Loading patterns with EF Core – Manipulating data with EF Core.

Unit-IV: Building Websites Using Asp.Net Core Razor Pages (18 Hours)

Understanding web development – Understanding ASP.NET Core – Exploring Razor Pages – Using Entity Framework Core with ASP.NET Core – Using Razor class libraries. Building Websites Using the Model-View-Controller Pattern: Setting up an ASP.NET Core MVC website – Exploring an ASP.NET Core MVC website – Customizing an ASP.NET Core MVC website. Customizing an Asp.Net Core MVC Website: Understanding the benefits of a CMS – Understanding Piranha CMS – Defining components, content types, and templates – Testing the Northwind CMS website.

Unit-V: Building Intelligent Apps Using Machine Learning (18-Hours)
Understanding machine learning – Understanding ML.NET – Making product recommendations. Building Windows Desktop Apps: Understanding legacy Windows application platforms – Understanding the modern Windows platform – Creating a modern Windows app – Using resources and templates – Using data binding.

Book for Study

1. Mark J. Price, *C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development*, 4thEdition, Packt Publishing Ltd.., Birmingham, UK, 2019.
   Unit-I – *Chapter 1, Chapter 2, Chapter 3*
   Unit-II – *Chapter 4, Chapter 5*
   Unit-III – *Chapter 6, Chapter 11*
   Unit-IV – *Chapter 15, Chapter 16*
   Unit-V – *Chapter 19, Chapter 20*

Books for Reference

1. Troelsen, Andrew, Japikse, Philip, *Pro C# 8 with .NET Core 3 Foundational Principles and Practices in Programming*, 9thEdition, Apress., New York City, 2020.
2. Freeman Adam, *Pro ASP.NET Core 3*, 8th Edition, Apress., New York City, 2020.
3. E Balagurusamy, *Programming in C#*, 4th Edition, McGraw Hill Education Private Limited, Uttar Pradash, India, 2015.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
II	21PCS2CC04	CORE-4: PROGRAMMING WITH C# USING ASP.NET					6	5			
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	1	2	3	3	2	3	3	2	3	3	2.5
CO-2	2	2	2	2	3	2	2	3	2	3	2.3
CO-3	1	3	3	3	2	3	2	2	2	3	2.4
CO-4	2	2	2	3	3	2	2	3	2	3	2.4
CO-5	2	2	3	2	2	2	3	2	3	3	2.4
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2CC05**	**CORE-5: DATA SCIENCE USING PYTHON**	**5**	**5**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	gain the outline knowledge in Data Science through Big Data Analytics.	**K1**
CO-2	explain the various programming paradigms in Python.	**K2**
CO-3	discover the relationship among the numerical data using Numpy for doing statistical analysis.	**K3,K4**
CO-4	interpret the data through Matplotlib for visualization to give possible solutions.	**K5**
CO-5	build Data Frames using pandas for Business Solutions that require Data Analytics.	**K6**

Unit – I: The Way of the Program (**15-Hours)**

Program – Running Python - The First Program – Arithmetic Operators – Values and Types – Formal and Natural language - Debugging. Variables - Expressions and Statements**:** Assignments Statements – Variable Names – Expressions and Statements – Script mode – Order of Operations- String Operations – Comments. Functions –Function Call – Math Functions – Composition – Adding New Functions – Definitions and Uses – Flow of Execution – Parameters and Arguments – Variable and Parameters – Stack Diagrams

Unit – II: Conditionals and Recursion **(15-Hours)**

Floor Division and Modulus – Boolean Expression – Logical Operators- Conditional Execution – Alternative Execution – Chained Conditionals – Nested Conditionals – Recursion – infinite Recursion – Keyboard Input. Fruitful Functions: Return values - Incremental Development= Composition- Boolean Functions – More Recursion – Leap of faith. Iteration: reassignment – Updating variables – while – Break – algorithms.

Unit – III: Strings **(15-Hours)**

Len – Traversal – String Slices – Strings are immutable – searching – Looping and Counting – String methods – The in operator – string Operation. Lists: A List is a sequence – lists are mutable – traversing a List – List Operations – List slices – List methods- Map, filter and Reduce – Deleting Elements – Lists and strings – Objects and values – Aliasing – List arguments. Dictionaries: A Dictionary is a Mapping – Dictionary as a collection of counters – Looping and Dictionaries – Reverse Lookup – Dictionaries and Lists- Memos- Global Variables. Tuples: Tuples Are Immutable - Tuple Assignment - Tuples as Return Values - Tuples as Return Values - Variable-Length Argument Tuples - Lists and Tuples - Dictionaries and Tuples.

Unit – IV: The Numpy Library **(15-Hours)**

Numpy a Little History – nd array - The Heart of the library – Basic Operations – Indexing, Slicing and Iterating – Conditional and Boolean Arrays – Shape Manipulation – Array Manipulation - General Concepts - Structured Arrays – Reading and Writing Array Data on Files. PANDAS LIBRARY – An Introduction: Introduction to Pandas Data Structures - Functionalities on Indexes - Operation between Data Structures – Function Application and

mapping – Sorting and Ranking – Correlation and Covariance – Not a Number – Hierarchical indexing and Levelling.

Unit – V: Data Visualization with Matplotlib (15-Hours)

Matplotlib Library – Architecture – pyplot – The Plotting Window – kwargs – Adding Elements to The Chart – Saving Charts – Handling Date Values – Chart Typology – Line Charts – Histograms – Bar Charts – Pie Charts – Advanced Charts – 3D Toolkit – Multi-Panel Plots

Books for Study

1. Allen B. Downey, *Think Python*, 2nd Edition, Published by O'Reilly Media Inc., USA, 2015.
   Unit – I *Chapter 1,2,3*
   Unit – II *Chapter 5,6,7*
   Unit – III *Chapter8,10,11,12*
2. Fabio Nelli, *Python Data Analytics with Pandas, NumPy, and Matplotlib,* 2ndSecond Edition, Apress, UK, 2018.
   Unit – IV *Chapter 3,4,5*
   Unit – V *Chapter 7*

Books for Reference

1. Michael Minelli, Michele chambers, Ambiga Dhiraj, *Big Data Analytics-Emerging Business Intelligence and Analytic Trends for Today's Business*, Wiley CIO Series, New Jersey, USA, 2014.
2. Chun, J Wesley, *Core Python Programming*, 3rd Edition, Pearson, UK, 2012.
3. Jake VanderPlas, *Python Data Science Handbook*, O'Reilly Media Publishers, USA, 2016.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credits
II	21PCS2CC05			CORE 5: DATA SCIENCE USING PYTHON					5	5
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	3	3	3	3	2.8
CO-2	3	3	3	2	2	3	3	3	3	2	2.7
CO-3	3	3	3	3	2	3	3	2	2	3	2.7
CO-4	3	3	3	3	2	3	3	2	2	3	2.7
CO-5	3	3	3	2	2	3	3	2	2	3	2.6
Mean Overall Score											2.7 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2CP03**	**PRACTICAL-III: ASP.NET**	**3**	**2**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	show console applications.	**K1**
CO-2	demonstrate conditional statements and looping.	**K2**
CO-3	apply OOPS concepts to programming.	**K3**
CO-4	contrast webpages with RAZOR, MVC and CMS.	**K4**
CO-5	build a database using EF core.	**K5, K6**

List of Exercises:

1. Build a console application
2. Demonstrate the conditional statements and looping
3. Write a program using functions
4. Inheritance and interface
5. Create a database using entity framework
6. Build website using RAZOR pages
7. Build website using MVC model
8. Build website using Piranha CMS
9. Testing Northwind CMS website
10. Build a program with ML.NET
11. Create a windows application
12. Construct a windows application with data binding

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
II	**21PCS2CP03**			**Practical-III: ASP.NET**				**3**		**2**
Course Outcomes (COs)↓	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	2.3
CO-2	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	2.5
CO-3	**1**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	2.3
CO-4	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	2.5
CO-5	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	2.6
Mean Overall Score											**2.44 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2CP04**	**PRACTICAL-IV: PYTHON**	**3**	**2**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	demonstrate forms using various Python functions.	**K1, K2**
CO-2	apply rich controls and conditional statement logic in Python.	**K3**
CO-3	analyze the data using various statistical and mathematical functions for Decision Making.	**K4**
CO-4	interpret the data through Matplotlib for visualization to give possible solutions.	**K5**
CO-5	build applications using Pandas.	**K6**

List of Exercises:

1. Variables, Data Types
2. Strings and Functions.
3. Loops, Arrays, Sorting
4. Dictionaries, Lists and Tuples.
5. Multidimensional Data.
6. Files
7. Array Function using Numpy
8. Aggregation function using Numpy
10. Pandas – Series
11. Pandas – Data Frame
12. Data Visualization –Matplotlib

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
II	**21PCS2CP04**			**PRACTICAL-IV: PYTHON**				**3**		**2**
Course Outcomes(COs)↓	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	2.5
CO-2	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	2.6
CO-3	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	2.7
CO-4	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**1**	**3**	2.6
CO-5	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**1**	**3**	2.6
Mean Overall Score											**2.74 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2SP01**	**SELF-PACED LEARNING: COMPUTER NETWORKS**	**-**	**2**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	define the services, functions, and inter-relationship of different layers in network models	**K1, K2**
CO-2	apply various protocols used in communication.	**K3**
CO-3	discover the inter-operability of modules in different layers and their enactment.	**K4**
CO-4	understand the various networks and switching concept	**K5**
CO-5	estimate the functionality of various Networking Technologies using protocols.	**K6**

Unit-I: Introduction

Data Communications - Networks - The Internet – Protocols and Standards - Network Models - Layered Tasks - The OSI Model – Layers in the OSI Model - TCP/IP Protocol Suite – Addressing.

Unit-II: Physical Layer and Media

Analog and Digital - Analog to Digital Conversion - Transmission Modes - Digital to Analog Conversion - Multiplexing - Transmission Media - Guided Media - Unguided Media - Switching – Circuit Switched Networks – Datagram Networks - Virtual Circuit Networks

Unit-III: Data Link Layer

Error Detection and Correction – Block Coding - Cyclic codes - Checksum - Data Link Control- Framing - Flow and error control - Protocols – Noiseless Channels - Noisy Channels -Point to Point Protocol - Channelization - IEEE 802.11 - Bluetooth - Cellular Telephony - Satellite Networks.

Unit-IV: Network Layer

IPV4 Addresses - IPV6 Addresses - Internetworking - IPV4 - IPV6 - Transition from IPv4 to IPv6 - Address mapping - ICMP – IGMP - Delivery - Forwarding - Unicast Routing Protocols - Multicast Routing Protocols.

Unit-V: Transport Layer and Application Layer

Process to Process Delivery - UDP - TCP - SCTP - Data Traffic - Congestion - Congestion Control - Quality of Service. Application Layer: NameSpace - Domain Name Space – Remote Logging - Email & File Transfer.

Book for Study

1. Behrouz A. Forouzan, *Data Communications and Networking,* 4th Edition,Tata McGraw Hill Publishing Company Limited, New York, 2009.

Unit-I *Chapter 1, Chapter 2*
Unit-II *Chapter 3, Chapter 4, Chapter 6, Chapter 7*
Unit-III *Chapter 10, Chapter 11, Chapter 16*
Unit-IV *Chapter 20, Chapter 21*

Unit-V *Chapter 24, Chapter 25 Chapter 26*

Books for Reference

1. William Stallings, *Data and Computer Communication,* 9th Edition, Dorling Kindersley Pvt. Ltd., India, 2018.
2. Andrew S. Tanenbaum, Nickolas Feamster, *Computer Networks,* 5th Edition, Pearson Education India, United Kingdom, 2019.
3. James F. Kurose and Keith W. Ross, *Computer Networks,* 7th Edition, Pearson Education, Inc., New York, 2017

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
II	21PCS2SP01	SELF-PACED LEARNING: COMPUTER NETWORKS					-	2			
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	2	1	2.1
CO-2	2	3	2	2	3	3	3	2	2	2	2.4
CO-3	1	2	3	3	3	2	3	3	1	2	2.3
CO-4	1	3	2	3	3	2	2	2	2	2	2.2
CO-5	2	2	2	2	2	3	2	1	2	3	2.1
Mean Overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2ES02A**	**DSE -2: INTERNET OF THINGS (IOT) (COMMON CORE/INTER DISCIPLINARY)**	**5**	**4**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	understand the characterization and significance of the Internet of Things.	**K1, K2**
CO-2	recognize building blocks of Internet of Things and its characteristics.	**K3**
CO-3	distinguish the factors that contributed to the emergence of IoT.	**K4**
CO-4	comprehend the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.	**K5**
CO-5	propose IoT based solutions for up-and-coming commercial and private prospects that can benefit the society.	**K6**

Unit-I: Introduction (15-Hours)

Introduction to IoT – Genesis – IoT and Digitization – IoT Impact – Convergence of IoT and OT – IoT Challenges. Smart Objects: Sensors – Actuators – Smart Objects – Micro-Electro Mechanical Systems – Sensor Networks.

Unit-II: IoT Network Architecture and Design (15-Hours)

New Network Architectures – Comparing IoT Architectures – A Simplified IoT Architecture – The Core IoT Functional Stack – IoT Data Management and Compute Stack.

Unit-III: Connecting Smart Objects (15-Hours)

Communications Criteria – Topology – IoT Access Technologies.

Unit-IV: Application Protocols for IoT (15-Hours)

The Transport Layer – IoT Application Transport Methods - SCADA – COAP – MQTT.

Unit-V: Smart and Connected Cities (15-Hours)

Strategy for Smarter Cities – Smart City IoT Architecture – Smart City Security Architecture – Smart City Use Cases. TRANSPORTATION: Transportation and Transports – Transportation Challenges – Use Cases for Transportation – IoT Architecture for Transportation.

Book for Study

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*, Cisco Press, USA, 2017.
   Unit-I *Chapter 1, Chapter 3*
   Unit-II *Chapter 2*
   Unit-III *Chapter 4*

Unit-IV *Chapter 6*
Unit-V *Chapter 12 and Chapter 13*

Books for Reference

1. Pethuru Raj and Anupama C. Raman, *The Internet of Things Enabling Technologies, Platforms, and Use Case*, CRC Press, USA, 2017.
2. Maciej Kranz, *Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry*, Wiley, United Kingdom, 2016
3. Adrian McEwen and Hakim Cassimally, *Designing the Internet of Things*, John Wiley and Sons, United Kingdom, 2014.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
II	21PCS2ES02A	DSE -2: INTERNET OF THINGS (IOT) (COMMON CORE/INTER DISCIPLINARY):					5	4			
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	3	2	2	2	3	2	2	1	2.2
CO-2	2	3	3	2	3	3	2	2	2	2	2.4
CO-3	1	2	3	2	2	2	2	3	1	2	2.0
CO-4	2	3	3	3	2	2	2	2	2	2	2.3
CO-5	2	2	2	2	2	3	2	1	2	3	2.1
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2ES02B**	**DSE -2: COMPILER DESIGN (COMMON CORE/INTER DISCIPLINARY):**	**5**	**4**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	define the Loop Optimization and DAG for source code.	**K1**
CO-2	explain the data structures for Block Structured Languages.	**K2**
CO-3	apply various parsing and conversion techniques for the design of a compiler.	**K3**
CO-4	analyze the concept of parsing techniques.	**K4**
CO-5	evaluate the Code Optimization and code generation techniques.	**K5, K6**

Unit-I: Introduction **(15-Hours)**

Different Phases of Compiler - Finite State Automation and Lexical analysis - A Simple Approach to the Design of Lexical Analyzers - Regular Expressions - A Language for Specifying Lexical Analyzers.

Unit-II: Syntax Specification **(15-Hours)**

Context Free Grammars - Parsers – Derivation and Parse trees- Shift Reduce Parsing - Operator Precedence Parsing - Top-Down Parsing – Predictive Parsers.

Unit-III: Code Generation **(15-Hours)**

Intermediate Code Generation - Translation - Implementation of Syntax - Directed Translators - Intermediate Code – Postfix Notation - Parse Trees and Syntax Trees - Three Address Codes, Quadruples and Triples.

Unit-IV: Symbol Tables **(15-Hours)**

Contents of a Symbol Table - Data Structures for Symbol Tables - Implementation of a Simple Stack Allocation Scheme - Implementation of Block Structured Languages - Storage Allocation in Block Structured Languages - Errors - Lexical Phase Error.

Unit-V: Code Optimization and Code Generation **(15-Hours)**

Elementary Code Optimization technique - Loop Optimization - DAG Representation of Basic Blocks - Value Numbers and Algebraic Laws - Object Programs - Problems in Code Generation - A Machine Model - A Simple Code Generator.

Book for Study

1. Alfred V. Aho, Jeffery D.Ullman, *Principles of Compiler Design,* Narosa, New Delhi, 2002.

Unit-I *Chapter 1 (Sec: 1.1-1.11), Chapter 3 (Sec: 3.1-3.7)*
Unit-II *Chapter 4 (Sec: 4.1, 4.2), Chapter 5 (Sec: 5.1-5.5)*
Unit-III *Chapter 7 (Sec: 7.1-7.6)*
Unit-IV *Chapter 9 (Sec: 9.1, 9.2), Chapter 10 (Sec: 10.1, 10.2, 10.4), Chapter 11 (Sec: 11.1, 11.2)*

Unit-V *Chapter 12 (Sec: 12.1-12.4), Chapter 15 (Sec: 15.1-15.4)*

Books for Reference

1. Torben, Egidius Mogensen, *Introduction to Compiler Design*, 2nd Edition, Springer International Publishing, Denmark, 2017.
2. Seth D. Bergmann, *Compiler Design: Theory, Tools, and Examples*, Rowan University, Open Educational Resources, New Jersey, 2017.
3. Des Watson, *A Practical Approach to Compiler Construction*, Springer International Publishing, UK, 2017.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	**Course Code**	**Title of the Course**					**Hours**				**Credits**
II	**21PCS2ES02B**	**DSE -2: COMPILER DESIGN (COMMON CORE/INTER DISCIPLINARY):**					**5**				**4**
Course Outcomes (COs)↓	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	2.3
CO-2	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	2.3
CO-3	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	2.2
CO-4	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	2.4
CO-5	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	2.4
Mean Overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
II	21PSS2SE01	SEC: SOFT SKILLS	4	3

Course outcomes (COS)
Upon completion of this course, students will:

- be exposed and trained in various nuances of Soft Skills in a Professional manner responding to the requirements of national and international market
- be able to synthesize the knowledge and practical skills learnt to be personal effective in any managerial positions
- be equipped to construct plans and strategies to work for better human society
- be able to illustrate the problems at work and home and design solutions and maintain a balance of work and home
- be able to connect on a continuum and maintain growth and sustainability and creativity in employment that increases in productivity, profit for individuals and the society.

Module 1: Effective Communication & Professional communication

Effective communication: Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication. JOHARI Window as a tool of effective communication.

Professional Communication: The Art of Listening, The passage, Kinesthetic, Production of Speech, Speech writing , Organization of Speech, Modes of delivery, Conversation Techniques, Good manners and Etiquettes, Different kinds of Etiquettes, Politeness markers.

Module II. Resume Writing & Interview Skills

Resume Writing: Meaning and Purpose. Resume Formats. Types of s Resume. Functional and Mixed Resume**,** Steps in preparation of Resume, Model resumes for an IT professional Chronological, Types of interviews, Creative resumes using online platforms

Interview Skills: Common interview questions, Dos and Don'ts for an interview, Attitude, Emotions, Measurement, Body Language, Facial expressions, Different types of interviews, Telephonic interviews, Behavioral interviews and Mock interviews (Centralized).

Module III: Group Discussion & Team Building

Group Discussion: Group Discussion Basics, GD as the first criterion for selecting software testers, Essentials of GD, Factors that matter in GD, GD parameters for evaluation, Points for GD Topics, GD Topics for Practice, Tips for GD participation. Video shooting of GD presentation & Evaluation (Centralized)

Team Building: Characteristics of a team, Guidelines for effective team membership, Pedagogy of team building, Team building skills. Team Vs Group – synergy, Types of synergy, Synergy relates to leadership, Stages of Team Formation, Broken Square-Exercise, Leadership, Leadership styles, Conflict styles, Conflict management strategies & Exercises

Module IV: Personal Effectiveness

Personal Effectiveness: Self Discovery: Personality, Characteristics of personality, kinds of self, Personality inventory table, measuring personality, intelligence and Exercises

Self Esteem: Types -High & Low self esteem, Ways of proving self esteem, Hypersensitive to criticism, activities. Goal setting: Goal setting process, Decision making process & Exercises.
Stress Management: Identifying stress, Symptoms of stress, Responding to Stress, Sources of stress, Coping with stress and Managing stress.

Module V: Numerical Ability

Average, Percentage, Profit and Loss**,** Problems of ages, Simple Interest, Compound Interest, Area, Volume and Surface Area, Illustration, Time and Work, Pipes and Cisterns, Time and Distance**,** Problems on Trains**,** Illustrations, Boats and Streams, Calendars and Clocks.

Module VI: Test of Reasoning

Verbal Reasoning: Number series, letter series, coding and decoding, logical sequence of words, Assertion and Reasoning, Data Sufficiency, Analogy, Kinds of relationships.

Non-Verbal Reasoning: Completion of Series**,** Classification, analogical, Pattern comparison, Deduction of figures out of series, Mirror Reflection Pattern, Hidden figures, Rotation pattern, Pattern completion and comparison, Sense of direction, Blood relations.

Text cum Exercise book

1. Melchias G, Balaiah John, John Love Joy (Eds), 2018. Winners in the Making: A primer on soft skills. SJC, Trichy.

References

* Aggarwal, R.S. *Quantitative Aptitude, S.Chand & Sons*
* Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non Verbal Reasoning*. S.Chand & Co, Revised Edition.
* Covey, Stephen. (2004). *7 Habits of Highly effective people,* Free Press.
* Egan, Gerard. (1994). *The Skilled Helper* (5th Ed). Pacific Grove, Brooks/Cole.
* Khera ,Shiv (2003). *You Can Win.* Macmillan Books , Revised Edition.

Other Text Books

* Murphy, Raymond. (1998). *Essential English Grammar*. 2nd ed., Cambridge University Press.
* Prasad, L. M. (*2000). Organizational Behaviour, S.Chand & Sons.*
* Sankaran, K., & Kumar, M. *Group Discussion and Public Speaking.* M.I. Pub, Agra, 5th ed., Adams Media.
* Schuller, Robert. (2010) . *Positive Attitudes*. Jaico Books.
* Trishna's (2006). *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
** Yate, Martin. (2005). H*iring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

Semester	Course Code	Title of the Course	Hours	Credits
II	**21PCS2EG01**	**GE-1(WS): MOBILE ADHOC NETWORKS (MANET)**	**4**	**3**

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the knowledge of Mobile Adaptability.	**K1**
CO-2	illustrate the concepts in Context-Aware Computing.	**K2**
CO-3	develop the knowledge of Wireless Network Security Mechanisms.	**K3**
CO-4	classify the various techniques of AdHoc Networks.	**K4**
CO-5	estimate the feasible Security Mechanisms for WPAN, WLAN.	**K5, K6**

Unit-I: Mobile Computing (12-Hours)

Adaptability - The Key to Mobile Computing - Mechanisms for Adaptation - Development or Incorporation of Adaptations in Applications. MOBILITY MANAGEMENT: Concept of Mobility Management - Location Management - Principles and Techniques.

Unit-II: Data Dissemination (12-Hours)

Mobile Data Caching - Mobile Cache Maintenance Schemes – Mobile web Caching. Context-Aware Computing: Ubiquitous of Pervasive Computing - Various Definitions and Types of Contexts - Context Aware Computing & Applications - Middleware Support. Introduction to Mobile Middleware: Definition of Mobile Middleware - Application - Agents - Service Discovery.

Unit-III: Introduction To Ad Hoc And Sensor Networks (12-Hours)

Overview - Properties of an Ad hoc Network -Unique Features of Sensor Networks - Proposed Applications - Challenges - Constrained Resources - Security - Mobility.

Unit-IV: Wireless Security (12-Hours)

Traditional Security Issues – Mobile and Wireless Security Issues. - Problems in Ad-hoc Networks. Approaches To Security: Limit the Signal-Encryption - Integrity Codes - IPSec – Other Security Related Mechanisms.

Unit-V: Security in WPAN (12-Hours)

Security in Wireless Personal Area Networks - Basic Idea - Bluetooth Security Modes - Basic Security Mechanisms. ENCRYPTION: Authentication - Limitation and Problems. Security in WLAN: Security in Wireless Local Area Networks - Basic Ideas - Wired-Equivalent Privacy (WEP) - WEP Fixes and Best Practices.

Book for Study

1. Frank Adelstein, Sandeep K.S., Gupta, Golden G. Richard III, Loren Schwibert *Fundamentals of Mobile and Pervasive Computing*, TMG Ed.Pvt.Ltd., New Delhi, 2005.
   Unit-I *Chapter 1, Chapter 2*
   Unit-II *Chapter 3 Chapter 4, Chapter 5*
   Unit-III *Chapter 8 Chapter 9*

Unit – IV *Chapter 12 (12.1-12.4), Chapter 13*
Unit – V *Chapter 14, Chapter 15*

Books for Reference

1. Raj Kamal, *Mobile Computing,* 3rd Edition, Oxford University Press Pvt.Ltd., England 2019.
2. Wolfgang Osterhage, *Wireless Network Security*, 2nd Edition, CRC Press, United States, 2018.
3. Jing (Selina) He, Mr. Shouling Ji, Yingshu Li, Yi Pan , *Wireless Ad Hoc and Sensor Networks Management, Performance, and Applications*, CRC Press, United States, 2019.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
II	21PCS2EG01	GE-1(WS): MOBILE ADHOC NETWORKS (MANET)	4	3

Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	3	3	2	2	3	3	2	2.5
CO-2	2	3	3	3	3	1	3	2	3	3	2.6
CO-3	2	3	2	1	3	3	3	2	2	1	2.2
CO-4	2	3	3	1	2	2	3	2	3	3	2.4
CO-5	1	3	2	3	2	3	2	3	3	3	2.5
Mean Overall Score											2.44 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3CC06	CORE-6: WEB DESIGN USING PHP	5	5

CO No.	CO- Statements On successful completion of this course, students will be able to	Cognitive Levels (K- Levels)
CO-1	understand the PHP basic syntax for variable types, structures and controls.	K1, K2
CO-2	identify the appropriate programming environment for developing dynamic client-side and server-side web applications.	K3
CO-3	classify the tools to create dynamic website.	K4
CO-4	distinguish the various existing libraries for developing real-time applications.	K5
CO-5	build Dynamic web sites using server-side PHP Programming and Database connectivity.	K6

Unit-I: Introduction to Dynamic Web Content (15-Hours)

HTTP and HTML: Berners-Lee's Basics -The Request/Response Procedure -The Apache Web Server - What Is a WAMP, MAMP, or LAMP -Installing AMPPS on Windows INTRODUCTION TO PHP: Incorporating PHP Within HTML - The Structure of PHP

Unit-II: Expressions and Control Flow in PHP (15-Hours)

Expression -Operator – Conditionals -Looping -Implicit and Explicit Casting -PHP Dynamic Linking ESSENTIAL PHP: Creating your Development Environment- Mixing HTML and PHP - Command Line.PHP Strings and Arrays: String Function - Modifying Data in an Array -Deleting Array Elements - Array with Loops - PHP Array Functions – Sorting Array - Splitting Array - Merging Array.

Unit-III: Creating Function (15-Hours)

Passing Function - Passing Arrays to Function - Passing by Reference - Using Default Arguments - Passing Variable Numbers of Argument - Returning Data from Function – Nesting Functions. Practical PHP: Date and Time Functions - File Handling - System Calls Reading Data in Web Pages: Setting up Web Pages to communicate with PHP - Text field - Checkbox - Radio Button - Password Controls – List Boxes -Button - Hidden Control - File Upload.

Unit-IV: PHP Browser Handling Power (15-Hours)

PHP's Server Variables - HTTP Header - Getting the User's Browser Type - HTTP Header - Data Validation - Client-Side Data Validation. Expressions and Control Flow in Javascript: Expressions - Literals and Variables – Operators -Validating User Input with JavaScript - Regular Expressions- JavaScript Functions - JavaScript Arrays- Validating User Input with JavaScript

Unit –V: Working with Database **(15-Hours)**

Creating a MYSQL Database – Creating a New Table – Putting Data into the New Database – Accessing the Database –Update data into the Database– Insert data into the Database – Delete data from Database– Handling and Avoiding Errors – Session and Cookies. Manipulating and Creating Images: Upload Images – Converting Image Files Types- Validating User Input

Books for Study

1. Robin Nixon, *Learning PHP, MYSQL & JavaScript*, Fifth Edition, O· REILLY, USA, 2018.
   - **Unit-I** *Chapter 1 (Pages 1-15), Chapter 2 (Pages 35-38)*
   - **Unit-II** *Chapter 4 (Pages 63-90),*
   - **Unit -III** *Chapter 7(Pages 139-145)*
   - **Unit- IV** *Chapter 14(Pages 329-338), Chapter 16(Pages 371- 380)*
2. Steven Holzner, *The Complete Reference PHP*, Tata McGraw Hill Pvt.Ltd., Noida, India, 2008.
   - **Unit-II** *Chapter 1 (Pages 1-15), Chapter 1 (Pages 81-120*
   - **Unit-III** *Chapter 4 (Pages 123 -160), Chapter 5(Pages 169-190)*
   - **Unit-IV** *Chapter 6 (Pages 203 -237)*
   - **Unit-V** *Chapter 10 (Pages 361 -380), Chapter 11(Pages 395 -401)*

Books for Reference

1. Robin Nixon, *Learning PHP, MySQL & JavaScript With jQuery, CSS & HTML5*,5th Edition, USA, 2018.
2. Steven Holzner, *PHP: The Complete Reference*, McGraw-Hill Education, 2017.
3. Jeremy McPeak, Paul Wilton, *Beginning JavaScript* ,5th Edition, John Wiley & Sons, Inc, USA, 2015.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
III	21PCS3CC06			CORE 6: WEB DESIGN USING PHP				5		5
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	3	2	3	3	2	3	3	2.6
CO-2	2	2	3	3	2	2	3	2	2	3	2.4
CO-3	2	3	3	2	3	2	2	3	3	2	2.5
CO-4	3	2	2	3	2	3	2	2	3	2	2.4
CO-5	2	3	3	2	2	2	2	3	2	3	2.4
Mean Overall Score											2.46 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	**21PCS3CC07**	**CORE-7: SMART DEVICE PROGRAMMING USING ANDROID**	**5**	**5**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	understand the fundamental concepts of mobile devices and types of mobile operating systems to know about comprehensive knowledge in the field of computer science.	**K1**
CO-2	demonstrate the android development environment and build the mobile apps for society.	**K2**
CO-3	develop the user interfaces by using various android widgets to be acceptable for users.	**K3**
CO-4	compare the major components of Android APIs for solving real time problems.	**K4, K5**
CO-5	build android SQLite database for managing the third-party data in safe and secure manner using the various android controls.	**K6**

Unit-I: Mobile Application Development (15-Hours)

Mobile Device Evolution – Smart Phone's- Tablet PC's – Classic MAD Challenges – Mobile Platform – Types of Mobile Platforms (Mobile OS) – Mobile Applications - Cross Platform Mobile Apps Development- Benefits of Cross Platform MAD – Cross Platform System Architecture.

Unit-II: ANDROID (15-Hours)

Introduction to Android – History of Android – Android Architecture – App Architecture – Activities in Depth – Services in Depth– Installing the Android SDK – Installing an Android Platform – Creating an Android Virtual Device – Starting the AVD. Creating Android Project: Starting a New Project in Eclipse -Deconstructing Your Project – Setting up an Emulator – Creating Launch Configuration – Running the Hello Android App – Understanding the Project Structure

Unit-III: User Interface Recipes (15-Hours)

Customizing the Window – Creating and Displaying Views – Creating Popup Menu Actions – Scrolling Text View Ticker – Animating a View – Creating Drawables as Backgrounds – Applying Masks to Images

Unit-IV: Understanding Android Resources (15-Hours)

Understanding Resources - Dimensions - Styles - Themes - Values - Menus – Colors - Working with Resources - Moving Strings into Resources - Making Your Apps Global with Resources. Turning Your Application into A Home-Screen Widget: Working with App Widgets in Android - Working with Remote Views - Using App Widget Providers - Working with Pending Intents - Understanding the Android Intent System - Understanding Intent Data -Evaluating Intents - Using Pending Intents - Creating the Home-Screen Widget -

Implementing the App Widget Provider Communicating with the App widget - Building the App Widget's Layout - Doing Work Inside an App Widget Provider.

Unit-V: Persisting Data **(15-Hours)**

Persisting Data – Reading and Writing Files – Using Files As Resources - Managing Database – Querying the Database – Backing Up Data – Sharing Your Database – Sharing Your Other Data.

Books for Study

1. Yonathan Akilu Redda, *Cross Platform Mobile Applications Development*, NTNU, Norway, 2012.
   Unit-I *Chapter 2 (Sec: 2.1, 2.2, 2.3,2.4), Chapter 3 (Sec 3.1,3.2,3.3)*
2. Dave smith, Jeff Friesen, *Android Recipes Problem Solution Approaches*, Apress, UK, 2011.
   Unit-II *Chapter 1(Sec: 1.1, 1.2, 1.3,1.4)*
   Unit-III *Chapter 2(Sec: 2.1, 2.2, 2.8, 2.13, 2.14, 2.15, 2.17)*
   Unit -V *Chapter 5(Sec: 5.2, 5.3, 5.4 ,5.5,5.6,5.7,5.8,5.9)*
3. DonnFelker, *Android Application Development for dummies*, Wiley Publishing Inc, USA,2011.
   Unit-II *Chapter 3(Pages 55-90)*
   Unit-IV *Chapter 6 (Pages 155-161), Chapter7 (Pages 164-184)*

Books for Reference

1. Michael Burton, *Android App Development for Dummies*, 3rd Edition, Wiley Publication New Jersey, 2015
2. Rick Boyer *Android 9 Development Cookbook*, 3rd Edition, Packt Publishing, India , 2018
3. Sujit Kumar Mishra, *Fundamentals of Android App Development*, English Edition, BPB Publication, New Delhi, 2020

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
III	21PCS3CC07	CORE-7: SMART DEVICE PROGRAMMING USING ANDROID					5	5			
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	3	3	3	2	1	3	3	2	2.5
CO-2	2	2	3	3	3	2	2	3	2	2	2.4
CO-3	2	3	2	3	1	1	3	2	3	3	2.3
CO-4	2	2	3	2	2	3	1	3	3	2	2.3
CO-5	2	3	1	3	3	2	3	3	2	3	2.5
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3CP05	PRACTICAL-V: PHP	3	2

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	understand the Functionality of PHP Language.	K1, K2
CO-2	identify the basic Concepts of MySQL.	K3
CO-3	examine the web applications using PHP with MySQL.	K4
CO-4	decide suitable features for developing Interactive Websites using JavaScript.	K5
CO-5	create server side and client side programming, depending on the task to be performed.	K6

List of Exercises:

1. Creating simple webpage using PHP
2. Use of conditional statements in PHP
3. Use of looping statements in PHP
4. Usage of array functions
5. File manipulation using PHP
6. String Functions and Arrays
7. Functions using PHP
8. Create a session and cookies
9. Form Validation using PHP
10. Database connectivity in PHP with MySQL
11. Insertion, Updation and Deletion of rows in MYSQL tables
12. JavaScript validation

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
III	21PCS3CP05			PRACTICAL-V: PHP				3		2
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	3	2	2	3	2	3	2.5
CO-2	2	2	2	3	2	2	3	2	3	2	2.3
CO-3	3	3	2	2	3	3	3	2	3	3	2.7
CO-4	2	2	3	2	2	2	2	3	2	2	2.2
CO-5	3	3	2	2	3	3	2	2	3	3	2.6
Mean Overall Score											2.46 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3CP06	PRACTICAL-VI : ANDROID	3	2

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	list the various android controls and properties for problem solving in the field of computer science.	K1
CO-2	demonstrate the knowledge in computational methods and build mobile applications based on customer requirements and fulfill their needs.	K2
CO-3	choose the appropriate Android development environment, tools and apply meaningful business solutions.	K3
CO-4	compare the suitable android widgets and user interfaces for industry needs.	K4,K5
CO-5	build the mobile applications based on multi-functional software solutions for the society.	K6

List of Exercises:

1. Simple Programs using controls
2. Changing the Color properties
3. Working with Text
4. Image Manipulation
5. Menu Creation
6. Widgets
7. Implicit Intents
8. Explicit Intents
9. Adding Audio & Video
10. Animating a view
11. Create An Application Using Links
12. Data Storing & Retrieving

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
III	21PCS3CP06			PRACTICAL-6: ANDROID				3		2
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	2	2	1	3	2	2	2.3
CO-2	2	2	3	3	3	2	2	3	2	2	2.4
CO-3	3	3	1	3	1	2	3	3	3	3	2.5
CO-4	2	1	3	2	2	3	2	3	3	2	2.3
CO-5	2	3	1	3	3	2	3	3	3	3	2.6
Mean Overall Score											2.42 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3ES03A	DSE-3: ARTIFICIAL INTELLIGENCE	5	4

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	define the basic principles, models, and algorithms of Artificial Intelligence.	K1
CO-2	understand knowledge representation, reasoning, and machine learning techniques to real-world problems.	K2
CO-3	choose appropriate Artificial Intelligence functions and components involved in intelligent systems such as Robotic Perception, Image-Processing Operations to create optimal models.	K3, K4
CO-4	evaluate Artificial Intelligence with Human Intelligence and Traditional Information Processing.	K5
CO-5	create logical statements from informal language to propositional logic expressions.	K6

Unit-I: Artificial Intelligence (15-Hours)

Introduction - The Turing Test - Goals of AI - Roots of AI - Artificial Consciousness - Techniques Used in AI - Sub-fields of AI - Perception, Understanding, and Action - Physical Symbol System Hypothesis - Considerations for Knowledge Representation - Knowledge Representation Using Natural Language.

Unit-II: Logic and Reasoning Patterns (15-Hours)

Role of Knowledge - Propositional Logic - Reasoning Patterns. First Order Predicate Logic: Introduction - Representation in Predicate Logic - Syntax and Semantics - Conversion to Clausal Form - Substitutions and Unification - Resolution Principle - Complexity of Resolution Proof - Interpretation and Inferences - Most General Unifiers - Unfounded Sets.

Unit-III: Real-World Knowledge Representation and Reasoning (15-Hours)

Introduction - Taxonomic Reasoning - Techniques for Common Sense Reasoning – Ontologies - Ontology Structures - Reasoning Using Ontologies - Ontological Engineering - Situation Calculus – Non monotonic Reasoning - Default Reasoning.

Unit-IV: Robotics (15-Hours)

Introduction - Robot Hardware - Robotic Perception - Planning to Move - Planning Uncertain Movements – Moving - Robotic Software Architectures - Application Domains. Perception: Image Formation - Early Image-Processing Operations - Reconstructing the 3D World.

Unit-V: Philosophical Foundations (15-Hours)

Weak AI: Can Machines Act Intelligently? - Strong AI: Can Machines Really Think? - The Ethics and Risks of Developing Artificial Intelligence - Summary, Bibliographical and Historical Notes, Exercises. AI: The Present and Future: Agent Components - Agent Architectures.

Books for Study

1. K.R.Chowdhary, *Fundamentals of Artificial Intelligence,* Springer Nature India Private Limited, New Delhi, 2020.
   Unit I *Chapter 1*
   Unit II *Chapter 2 and Chapter 3*
   Unit III *Chapter 6*
2. S. Russell, P. Norvig, *Artificial Intelligence: A Modern Approach,* 3rd Edition, Prentice-Hall, Inc, New Jersey, 2010.
   Unit IV *Chapter 25, Chapter 24*
   Unit V *Chapter 26, Chapter 27*

Books for Reference

1. Sridhar Seshadri, *A first course in Artificial Intelligence and Agent Technology*, 1st Edition, LAP LAMBERT Academic Publishing, India, 2017.
2. Wolfgang Ertel, *Introduction to Artificial Intelligence*, Springer International Publishing G, Germany, 2017.
3. Kevin Knight, Elaine Rich, Shivashankar B. Nair, *Artificial Intelligence,* 3rd , MC Graw Hill Education, India, 2017.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3ES03A	DSE-3: ARTIFICIAL INTELLIGENCE	5	4

Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	3	3	3	3	3	2	2.8
CO-2	3	3	3	2	2	3	3	3	3	3	2.9
CO-3	2	3	3	3	2	3	3	2	2	2	2.5
CO-4	3	3	3	3	3	2	2	3	3	3	2.8
CO-5	3	3	2	3	2	3	3	3	2	3	2.7
Mean Overall Score											2.74 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3ES03B	DSE-3: COMPUTATIONAL INTELLIGENCE	5	4

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the fundamental theory and concepts of Neural Networks	K1
CO-2	explain the Perceptron and Counter Propagation Network	K2
CO-3	make use of the Fuzzy Logic and its concepts in various systems	K3
CO-4	analyze different Neural Network architectures, algorithms, applications and their limitations.	K4
CO-5	evaluate the various Genetic Algorithms and their applications	K5, K6

Unit- I: Neural Networks **(15-Hours)**

Introduction: - Application of Scope of Neural Networks - Fuzzy Logic – Genetic Algorithms – Hybrid Systems – Soft Computing. Artificial Neural Network: An Introduction **–** Fundamental Concept – Evolution of Neural Networks – Basic Models of ANN – Important Terminologies of ANNs.

Unit – II: Supervised Learning Network **(15-Hours)**

Introduction– Perceptron Networks – Adaptive Linear Network – Multiple Adaptive Linear Network – Back Propagation Network. ASSOCIATIVE MEMORY NETWORKS: Introduction – Training Algorithms for Pattern Association – Auto Associative Memory Network – Hetero Associative Memory Network – Bidirectional Associative Memory – Hopfield Networks.

Unit – III: Unsupervised Learning Network **(15-Hours)**

Introduction **–** Kohenen Self Organizing Feature Map– Learning Vector Quantization – Counter Propagation Networks – Adaptive Resonance Theory Network.

Unit – IV: Fuzzy Logic **(15-Hours)**

Fuzzy set theory – Crisp sets – Fuzzy sets – Crisp relations – Fuzzy Relations. Fuzzy Systems**–** Crisp Logic – Predicate Logic – Fuzzy Logic – Fuzzy Rule Based System – De fuzzification Methods.

Unit – V: Genetic Algorithms **(15-Hours)**

Fundamentals of Genetic Algorithms – Genetic Algorithms: History – Basic Concepts – Creation of offspring – Working Principle – Encoding – Fitness Function – Reproduction.

Books for Study

1. Dr S N Sivanadam, S N Deepa, *Principles of Soft Computing,* 1st Edition, Wiley India (P) Ltd, India, 2008.
   - **Unit – I** *Chapter 1, Chapter 2 (Sec. 2.1-2.4)*
   - **Unit - II** *Chapter 3(Sec. 3.1 – 3.5), Chapter 4(Sec. 4.1-4.6)*
   - **Unit – III** *Chapter 5(Sec. 5.1,5.3-5.6)*
2. S Rajasekaran, G A Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications,* PHI Learning Private Limited, New Delhi, 2017.
   - **Unit – IV** *Chapter7(Sec. 7.1-7.5)*
   - **Unit – V** *Chapter 10 (Sec 10.1 -10.7)*

Books for Reference

1. N.K.Bose, Ping Liang, *Neural Network fundamental with Graph, Algorithms & Applications*, 1stEdition, TMH, New Delhi, 1998.
2. Rich E, Knight K, *Artificial Intelligence*, 3rd Edition, TMH, New Delhi, 2012.
3. Sandhya Bansal, Rajiv Goel, *Fundamentals of Soft Computing*, Notion Press, Chennai, 2020.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
III	21PCS3ES03B			DSE-3: COMPUTATIONAL INTELLIGENCE				5		4
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	2	3	3	3	2	3	2.5
CO-2	3	2	2	2	1	3	3	3	2	3	2.4
CO-3	2	2	3	2	1	3	3	3	2	3	2.4
CO-4	3	2	3	2	2	2	3	3	2	3	2.5
CO-5	3	2	2	2	2	3	3	3	1	3	2.4
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3ES04A	DSE-4: DIGITAL MARKETING	5	4

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	show the acquaintance of the concepts of Digital Marketing and Display Advertising.	K1,K2
CO-2	identify the concepts of Search Engine Advertising.	K3
CO-3	classify the knowledge of Facebook Marketing and Twitter Marketing.	K4
CO-4	distinguish various applications of Search Engine Optimization and social media.	K5
CO-5	elaborate various techniques of Web Analytics.	K6

Unit-I: Digital Marketing **(15-Hours)**

Introduction to Digital Marketing: Internet Users – Digital Marketing Strategies – Skills Required in Digital Marketing – Digital Marketing Plan. Display Advertising: Introduction – Concept of Display Advertising – Types of Display Ads – Buying Models – Display Plan – Targeting – Make a Good Ad.

Unit-II: Advanced Display Advertising **(15-Hours)**

Programmatic Digital Advertising – Analytics Tools – YouTube Advertising. Search Engine Advertising: Introduction – Pay for Search Advertising – Understanding Ad Placement – Understanding AdRanks. Social Media Marketing: Introduction – To build a Successful Strategy.

Unit-III: Facebook Marketing **(15-Hours)**

Introduction – Facebook for Business- Anatomy of an Ad Campaign – Adverts - Other Marketing Tools - Other Essentials. Twitter Marketing: Introduction – Getting Started with Twitter – Building a Context Strategy – Twitter Usage - Twitter Ads – Twitter Analytics – Twitter Tools and Tips for Marketers. Instagram and Snapchat: Introduction – Instagram-snapchat

Unit-IV: Search Engine Optimisation **(15-Hours)**

Introduction – Search Engine - Concept of Search Engine Optimisation- SEO Phases – On page Optimisation- Off page Optimisation- Social Media Reach – Maintenance.

Unit-V: Web Analytics **(15-Hours)**

Introduction – Data Collection - Key Metrics - Marketing Web Analytics Actionable – Types of Tracking codes – Mobile Analytics.

Book for Study

1. Seema Gupta, *Digital Marketing,* First Edition, Mc-Graw Hill, New Delhi, 2017.
   Unit I *Chapter 1, Chapter 2(pg.26-51)*
   Unit II *Chapter 2 (pg.52- 66), Chapter 3 (pg.73- 83), Chapter 4 (pg.108- 132)*

Unit III *Chapter 5(pg.139- 183), Chapter 7 (pg.221 - 254), Chapter 8 (pg.259-268),*
Unit IV *Chapter 10*
Unit V *Chapter 11(353-382)*

Books for Reference

1. Ian Dodson, *The Art of Digital Marketing*, Wiley, New Jersey, USA, 2018.
2. Prof. Nitin C. Kamat, Mr.Chinmay NitinKamat, *Digital Social Media Marketing*, Himalaya Publishing House Pvt. Ltd., India, 2018.
3. Ryan Deiss & Russ Henneberry, *Digital Marketing for Dummies*, 2nd Edition, John Wiley & Sons, Inc., New Jersey, 2020.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits			
III	21PCS3ES04A	DSE-4: DIGITAL MARKETING					5	4			
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	3	1	2	2	1	3	2	2.1
CO-2	2	1	2	3	3	1	3	2	3	3	2.3
CO-3	2	3	2	1	3	3	3	2	2	1	2.2
CO-4	3	1	3	3	2	2	2	3	3	3	2.5
CO-5	2	2	3	1	2	3	3	1	3	2	2.2
Mean Overall Score											2.26 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	**21PCS3ES04B**	**DSE-4: ETHICAL HACKING**	**5**	**4**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the basic knowledge of security and various attacks to protect the user's data effectively in a real time.	**K1**
CO-2	explain the various foot printing tools to be aware the problems involved in daily lives and ensure protect environment.	**K2**
CO-3	apply the safe ethical techniques in the World Wide Web to be beneficial to the society.	**K3**
CO-4	examine various techniques of Keyloggers and Spyware for protect the private and public data in a real time.	**K4**
CO-5	evaluate the concept of penetration testing and improve testing techniques to solve problems and promote social harmony.	**K5, K6**

Unit-I: Introduction to Hacking (**15-Hours)**

Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research.

Unit-II: Foot Printing **(15-Hours)**

Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range.

Unit-III: Scanning **(15-Hours)**

Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

Unit-IV: Cracking Passwords **(15-Hours)**

Password Cracking Websites – Password Guessing – Password - Cracking Tools – Password Cracking – Counter measures – Escalating Privileges – Executing Applications – Keyloggers and Spyware

Unit-V: Penetration Testing **(15-Hours)**

Introduction to Penetration Testing, Phases of penetration testing, tools.

Book for Study

1. Ec-Council, *Ethical Hacking and Countermeasures: Attack Phases*, Delmar Cengage Learning, USA, 2009.
   Unit I *Chapter 1 (Sec: 1.1 to 1.10)*
   Unit II *Chapter 2(Sec: 2.1 to 2.29)*
   Unit III *Chapter 3(Sec: 3.1 to 3.46), Chapter 4 (Sec: 4.1 to 4.35)*
   Unit IV *Chapter 5(Sec: 5.1 to 5.37)*
   Unit V *Chapter 6(Sec: 6.1 to 6.27)*

Books for Reference

1. Gary Hall, *Hacking, Computer Hacking, Security Testing, Penetration Testing, and Basic Security*, Kindle Edition, Kindle Direct Publishing, USA, 2016.
2. Alan T. Norman, *Computer Hacking Beginners Guide*, Kindle Edition, Kindle Direct Publishing, USA, 2016.
3. Andrew Huang, *The Hardware Hacker*, 1st Edition No Starch Press, USA, 2017.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3ES04B	DSE-4: ETHICAL HACKING	5	4

Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	1	3	3	1	2	3	3	2	2.4
CO-2	2	2	3	3	3	2	1	3	2	3	2.4
CO-3	2	1	3	3	2	1	3	2	3	2	2.2
CO-4	2	1	3	1	2	3	2	3	3	3	2.3
CO-5	3	3	1	3	3	3	3	2	2	2	2.5
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3EG02	GE-2 (BS): ADVANCES IN COMPUTER SCIENCE	4	3

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	understand the basic concepts of Cloud Computing.	K1
CO-2	comprehend the basic concepts of IoT and its applications.	K2
CO-3	identify the types of Clouds, Architecture and its applications.	K3
CO-4	analyze the concept of Smart-X applications.	K4, K5
CO-5	formulate optimal solutions to IoT Related problems.	K6

Unit-I: Cloud Computing (12-Hours)

Cloud Computing at a Glance - Historical Developments – Building Cloud Computing Environments – Computing Platforms and Technologies. CLOUD COMPUTING ARCHITECTURE: Cloud Reference Model – Types of Clouds – Economics of the Cloud.

Unit-II: Cloud Platforms in Industry (12-Hours)

Amazon Web Services: Compute Services – Storage Services – Communication Services – Additional Services. Google AppEngine: Architecture and Core Concepts – Application Life Cycle – Cost Model. Microsoft Azure: Azure core Concepts – SQL Azure.

Unit-III: Cloud Applications (12-Hours)

Scientific Applications – Healthcare – Biology – Geoscience – Business and Consumer Applications: CRM and ERP – Productivity – Social Networking – Media Applications. Advanced Topics in Cloud Computing: Energy Efficiency in Clouds**.** Federated Clouds / Inter Cloud: Characterization and Definition – Cloud Federation Stack – Aspects of Interest – Technologies for Cloud Federations.

Unit-IV: Internet of Things (12-Hours)

Introduction- Putting the Internet of Things to the Next Level- Strategic-RESEARCH AND INNOVATION AGENDA: Internet of Things Vision - IoT Strategic Research and Innovation Directions.

Unit-V: IoT Smart- X Application (12-Hours)

Smart Cities- Smart Energy and Smart Grid - Smart Mobility and Transport - Smart Home, Smart Buildings and Infrastructure- Smart Factory and Smart Manufacturing- Smart Health - Food and Water Tracking Security- Participatory Sensing - Smart Logistics and Retail. IoT RELATED STANDARDIZATION: The Role of Standardization Activities - Current situation- Areas for additional Consideration- Interoperability in the Internet of Things.

Books for Study

1. Raj Kumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, *Mastering Cloud Computing*, 1st Reprint, McGraw Hill Education (India) Private Limited Publications, India ,2013.
   Unit-I *Chapter 1, Chapter 2*
   Unit-II *Chapter 4, Chapter 5, Chapter 6*
   Unit-III *Chapter 7, Chapter 8, Chapter 9*

2. Ovidie Vermesan, Peter Friess, *Internet of Things – From Research and Innovation to Market Deployment*, River Publisher, UK, 2018.
   Unit –IV *Chapter 1, Chapter 2, Chapter 3*
   Unit – V *Chapter 6, Chapter 7, Chapter 9*

Books for Reference

1. Rajkumar Buyya, James Bromberg and Andrzej Goscinski, *Cloud Computing Principles and Paradigms*, Wiley Publications, USA, 2016
2. Michael Miller, *Cloud Computing Web Based Applications that change the way you work and collaborate online,* Pearson Education, USA, 2014.
3. Arshdeep Bahga*, Internet of Things*, Universities Press in India Private Limited, India, 2015.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3EG02	GE-2 (BS): ADVANCES IN COMPUTER SCIENCE	4	3

Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	3	2	3	3	3	3	3	3	2.3
CO-2	3	2	2	3	3	2	3	2	1	2	2.2
CO-3	2	3	2	2	1	2	3	2	3	2	2.2
CO-4	3	2	3	2	1	3	3	2	2	3	2.3
CO-5	2	3	3	3	2	3	2	3	3	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21PCS3CE01	COMPREHENSIVE EXAMINATION	-	2

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	comprehend the basic functionalities of PHP and MongoDB	K1, K2
CO-2	apply Python programming to real life problems	K3
CO-3	demonstrate the use of development tools in the Android development environment	K4
CO-4	explain the rich GUI web applications using Visual Studio.NET	K5
CO-5	develop solutions for a range of problems using object-oriented programming	K6

Unit-I
Programming in JAVA, Data Science using Python.

Unit-II
Programming with C# using ASP.NET, NoSQL with MongoDB.

Unit-III
Web Design using PHP, Smart Device programming using ANDROID.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course						Hours	Credits
III	21PCS3CE01			COMPREHENSIVE EXAMINATION						-	2
Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	1	1	2	3	2	3	3	3	2	3	2.3
CO-2	3	3	2	2	1	3	3	3	2	3	2.5
CO-3	3	3	2	3	2	3	3	2	3	3	2.7
CO-4	1	1	3	3	3	3	3	2	3	3	2.5
CO-5	3	3	3	3	2	2	3	3	2	3	2.7
Mean Overall Score											2.54 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	**21PCS3PW01**	**MINI PROJECT WORK**	**-**	**7**

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	comprehend the meaning of small scale projects.	**K1, K2**
CO-2	apply the Software Development Life Cycle for the simple problems.	**K3**
CO-3	discover an appropriate tool for given problem.	**K4**
CO-4	develop Interpersonal Communication.	**K5**
CO-5	apply critical thinking, reasoning and creative thinking for Software Design.	**K6**

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credits
III	**21PCS3PW01**			**MINI PROJECT WORK**				**-**		**7**
Course Outcomes (COs)↓	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	**3**	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	2.6
CO-2	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	2.6
CO-3	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	2.7
CO-4	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	2.5
CO-5	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**2**	**3**	2.4
Mean Overall Score											**2.56 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PCS4PW02	MAJOR PROJECT WORK & VIVA VOCE	30	20

CO No.	CO- Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	comprehend the state-of-the-art requirements of the Industry.	K1, K2
CO-2	apply critical thinking, reasoning and creative thinking for Software Design in an industry as an individual or as a part of a team.	K3
CO-3	analyze the problem and provide Solution by Decision Making.	K4
CO-4	develop Interpersonal, Communication and Presentation skills.	K5
CO-5	build the modules for a specific problem.	K6

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PCS3PW02	MAJOR PROJECT WORK & VIVA VOCE	30	20

Course Outcomes (COs)↓	Programme Outcomes (POs)					Programme Specific Outcomes(PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	3	3	3	3	2	3	2.9
CO-2	3	3	3	3	3	3	3	3	2	3	2.9
CO-3	3	2	3	1	3	3	3	2	3	3	2.6
CO-4	3	2	3	2	3	3	3	2	3	3	2.7
CO-5	3	2	3	2	3	2	3	3	2	3	2.6
Mean Overall Score											2.74 (High)