SRI SANKARA ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

ENATHUR, KANCHIPURAM – 631 561.

Learning Outcome-based Curriculum Framework (LOCF)

for

B.C.A

Choice Based Credit System (CBCS)

(Effective from the academic year 2022 - 2023)

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Preamble:

The curriculum of BCA comprises with equal importance for theoretical and practical knowledge with career orientation. Each course aims to present learning objective and thus provides learning and teaching strategies and resources. The students are given comprehensive knowledge of subjects as well as the knowledge of IT related applications. Students are equipped to program high level language to solve the computational problems and they are also incorporated in web development technologies. Orientation towards latest technologies such as Data Science, Block chain technologies, Deep Learning and social media analytics. Students are able to think both in abstract and in concrete terms. The graduated students has the employment opportunities in the field of programmer, Web Developer, Software Engineer and Data Scientist.

1. Introduction

Computer has become integral part of life. Tedious manual works are automated/simplified by Computers Machine learning, data science and artificial intelligence allow better decision making. The syllabus focuses on the core fundamentals of computer science, but generally undergoes revision according to the industry requirement with the aim of increasing employment opportunities for students.

BCA programme aims to incorporate the foundation knowledge and advanced concepts such as data science, block chain technology and social media analytics.

The Learning Outcomes-based Curriculum Framework for BCA is structured and developed to facilitate the students to achieve the following:

- To provide thorough understanding of nature, scope and application of computer and computer languages

- Ability to understand the Computing concepts and their applications using the acquired board based knowledge.

- Ability to use the techniques, skills, and modern Software tools for software development.

- Ability to identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

- Ability to design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

- An ability to communicate effectively in diverse groups and exhibit leadership qualities.

2. Learning Outcomes-based Curriculum Framework

2.1 Nature and Extent of the BCA

The undergraduate program in BCA orientation towares logical problem solving and programming. Curriculum of BCA comprises with equal importance for theoretical and practical knowledge with career orientation.

Curriculum and syllabi framework introduces foundation level and takes towards the advanced level. Orientation towards latest technologies such as Data Science, Block chain technologies, Deep Learning and social media analytics. Students are able to think both in abstract and in concrete terms. Syllabus is designed in enhancing the employability and enterprenuership

3. Graduate Attributes:

Graduate Attributes (GA) are the qualities, skills and understandings that students should develop during their graduation. These qualities prove to be the characteristics and defining roles of the graduates. Graduate attribute is a key outcome that underpin curriculum planning and development. The graduate attributes are fostered through meaningful learning experiences made available through the curriculum, college experience and a process of critical and reflective thinking.

The graduate attributes can be viewed as qualities as listed subcategories:

Disciplinary knowledge:

The graduate must demonstrate comprehensive and in-depth knowledge and understanding of the core concepts offered in the curriculum of BCA.

Communication skills:

The Ability to communicate and collaborate with individuals, and with teams in professional and community settings increases the employability of the student.

Problem Solving and Design:

Problem solving skills empower students to find methodical solutions to any real-world problems or real-time problems using computational algorithms and solutions. Problem solvers are most sought-after attributes of the graduates form the field of Computer Science. They should possess the ability to clearly understand the problem, think creatively or out-of-the-box thinking and to convert the problem into a computational model to find a scientific solution backed by the theories.

Ethical Practices:

Ethical practice is a key component of professionalism and needs to be instilled in curricula across courses. Ethical practices give the graduates a sense of discretion and moral responsibility for carrying out their duties in a diverse and fiercely competing society. It shall imbibe cultural diversity, linguistic differences and complex nature of our world.

Critical Thinking:

Critical Thinking gives the capability to apply analytic thought to find a solution to a problem by analysing the problem, evaluating the evidences, identifying the path to the solutions, formulating the methods and procedures to the possible solutions.

3.1 LIST OF GRADUATE ATTRIBUTES FOR BCA:

GA-1: Ability to use a range of programming language and tools develop computer programs and sytems that are effective solutions to problems

GA-2: Ability to demonstrates competence in the practical art of computing in by showing in design an understanding of the practical methods, and using modern design tools competently for comple real-life IT problems.

GA-3: Abilty to identify and to apply relevant problem-solving methodologies.

GA-4: Ability of working in teams to build software systems.

GA-5: Ability to communicate effectively, comprehending and writing effective reports and design documentation, sumarizing information, making effective oral presentations ang giving and   receiving   clear oral instructions.

4. Qualification Descriptors:

Qualification Descriptors are generic statements that define the outcomes of the graduates. The Qualification descriptors are used as metric by two part:

The first part is the designer of academic programmes who can use the qualification metric to measure the achievement of students for the award of the qualification

The second part is the employers of the graduates who can use the qualification descriptors to assess the qualification descriptors to assess the quality and capabilities of the graduates holding the qualification.

4.1 Qualification descriptors for BCA

On Completion of BCA, the expected learning outcomes that a student should be able to demonstrate are the following:

QD01: Study the principles and practise of computing. They learn to program by writing computer code.

QD02: Understand to develop computer based solutions to problems using algorithms and high level programming language

QD03: Have sound knowledge of the fundamentals of computer science and are able to apply these in a context related manner

QDO4: Have ability to evaluate exemplery methods by implementing and analysing them.

QD05: Skills required for identifying problems and issues relating to the disciplinary area and field of study

5. PROGRAM OUTCOMES (PO)

1. Enriching the knowledge in theoretical and practical aspects at the undergraduate level.

2. Developing curiosity in the subject and encouraging them to pursue higher studies.

3. Enabling the students to come out successfully in competitive examinations.

4. Developing students' skills, based on current trends by offering Job oriented, Entrepreneurial, certificate courses and Value-added courses.

5.1 PROGRAM SPECIFIC OUTCOME (PSO) FOR B.C.A DEGREE

1. PSO1: Identify and define the concepts of computer Programming.

2. PSO2: Illustrate the constructs of computer Programming

3. PSO3: Comprehending the technical skill

4. PSO4: Illustrate the technical skills

5. PSO5: Develop practical skills to provide solution to society, industry and business

	PSO1	PSO2	PSO3	PSO4	PSO5
PO1	✔				
PO2		✔			
PO3			✔	✔	
PO4					✔

6. Syllabus and Regulation

Choice Based Credit System.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

Sl.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 the information in a new way
4	K4	Analysis / Analysing	The learner distinguishes among different concepts
5	K5	Evaluation / Evaluating	The learner justifies a stand or decision
6	K6	Synthesis / Creating	The learner creates a new product of point of view

6.1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Computer Application courses shall be required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereof by the Syndicate of the University of Madras is eligible for admission to the first semester. A candidate shall be selected based on a selection test as prescribed by this Institution from time to time. The selection test shall test the general aptitude, logical reasoning and analytical abilities and basic arithmetical skills of the candidate.

6.2 STRUCTURE OF THE COURSE

The course is organized on semester basis with a total of six semesters. Each student will opt for a comprehensive, interactive course with one of the faculty member. The topic of specialization and course content will be determined by the Department/Course Advisor.

Core practical **Laboratory:** Independent system shall be provided for the each student. It is recommended that the practical training be organized as an exercise rather than simple demonstration. The student must actually perform the experiments.

6.3 ELIGIBILITY FOR THE AWARD OF DEGREE

A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in an Autonomous College for a period of not less than three academic years, passed the examinations of all the Six Semesters prescribed earning **140** credits in Parts-I, II, III, IV, V & VI and fulfilled such conditions as have been prescribed therefore.

The parent University will award Degrees to the students evaluated and recommended by Autonomous colleges. The Degree certificates will be in a common format devised by the University. The name of the College will be mentioned in the Degree Certificate, if so desired. The declaration of results was decided by the Examination Committee.

6.4 DURATION:

Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semesters respectively.

The odd semesters shall consist of the period from Junfe to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester exclusive of the days for the conduct of semester examinations.

In each semester, Papers are administered in 15 teaching weeks and another 5 weeks are utilized

for evaluation and grading purposes. Each week has 30 working hours spread over in a 5 day week. Depending upon the content and specialization, a paper may have 1 to 6 credits. Total number of teaching hours in a semester will be 450 hrs. One credit of each theory paper is equal to 15 hrs of lectures or 30 hrs of practical works.

6.5 MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMMES

The candidates shall complete the B.C.A Degree Programmes within 6 years from the date of admission. The term completing the programmes means passing all the prescribed examinations of the programme to become eligible for the Degree. No candidate shall be permitted to appear for the examinations after the prescribed period for completing the programme.

6.6 COURSE OF STUDY

A Bachelor's programme consists of a number of papers. The term Course is used to indicate logical part of a subject matter of the programme. In each of Bacherlor's programmes, there will be a prescription of (i) language –I (Tamil, Sanskrit or other languages), (ii) language – II (English), (iii) a set of compulsory courses (called core subjects), some optional courses (called elective / allied subjects) and projects, (iv) a set of papers recommended by UGC and TANSCHE (Advanced Tamil / Soft skill / Environmental Studies / Value education) and (v) Extension activities.

The detail of the Study for Bachelor Degree Courses shall consist of the following:

PART – I   Language Courses (LC) [Tamil / Other Languages]

PART–II   English Language Courses (ELC)
PART – III   Core Subjects

                  Allied Subjects

                  Projects / Field work

PART – IV

1. (a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil
        Language under Part-I shall take Tamil comprising of two papers (level will be
        at 6th Standard).
   (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language
        under Part- I shall take Advanced Tamil comprising of two papers.
   (c) Others who do not come under a + b can choose non-major elective comprising
        of two papers.

2. Skill Based Subjects - Soft Skills

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed papers on Soft Skills. For three years UG degree Programme, a candidate must undergo a minimum of 4 papers (4 x 2 = 8 credits). Papers will be finalized in due course.

3. Environmental Studies

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed paper on Environmental studies. For three years UG degree Programme, a candidate must undergo environmental studies during third semester of second year (2 credits). Syllabus is common to all UG courses.

4. Value Education

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed paper on value education. For three years UG degree Programme, a candidate must undergo value education during fourth semester of second year (1 credit). Paper will be finalized in duecourse.

PART – V Extension Activities

A candidate shall be awarded a maximum of 1 Credits for Compulsory Extension Service. All the Students shall have to enroll for NSS /NCC/ NSO (Sports & Games) Rotract / Youth Red cross or any other service organizations in the college and shall have to put in Compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 31st March in a year. If a student LACKS 40 HOURS ATTENDANCE in the First year,
he/she shall have to compensate the same during the subsequent years. Students those who complete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT. Literacy and population Education Field Work shall be compulsory components in the above extension service activities. The working hours should not overlaps the normal teaching hours.

Student advisor

All teachers of the Department shall function as student advisors. There will be more or less an equal number of students assigned to each student advisor of a Department. The student advisor will help the students in choosing core and elective papers of study. The student advisor shall be responsible for registration of papers (subjects) by his students. The student advisor will offer all possible student support services

7. CREDITS

The term credit is used to describe the quantum of syllabus for various programmes in terms of periods of study. It indicates differential weightage given according to the contents duration of the courses in the curriculum design. The minimum credit requirement for a three year Bacherlor's programme shall be **140** credits. Each subject (course) is designed variously under lectures / tutorials / laboratory work / seminar / project work etc., to meet effective teaching and learning needs and credits are assigned suitably.

One credit for each lecture / tutorial / project work period per week shall be alloted. One credit for two laboratory hours per week shall be alloted. In practical, each credit should cover minimum of six experiments. Thus normally, in each of the subject, credits will be assigned on the basis of the lectures / tutorials / laboratory work / project work and other forms of learning in a 15 week schedule.

SCHEME OF EXAMINATION

There shall be continuous, comprehensive evaluation of students through internal and external examination. At least 2 internal examinations (Sessional Tests) per semester and 1 semester ending examination should be conducted.

Sessional Test I will he held during sixth week for syllabi covered till then. Sessional Test I will be a combination of a variety of tools such as class test, assignment, papr presentation etc., that would be suitable for the paper. This required an element of openness. The students are to be informed in advance about the nature of assessment and the procedures.

However the tests are compulsory. Test I may be for one hour duration. The pattern of question paper will be decided by the respective board of studies.

Sessional Test I will carry 20% of marks of the entire paper.

Sessional Test II will he held during eleventh week for syllabi covered between seventh and eleventh weeks. Sessional Test I will be a combination of a variety of tools such as class test, assignment, paper presentation etc. that would be suitable for the paper. It will also have an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However the tests are compulsory. Test II may be for one hour duration. The pattern of question paper will be decided by the respective board of studies.

Sessional Test II will carry 20% of marks of the entire paper.

There will be one End Semester examination of 2 - 3 hours duration in each paper. The End semester examination will cover all the syllabi of the paper for 60% of Marks.

A dissertation may be offered in lieu of one / two papers / practicals. It shall be evaluated by two examiners one external and one internal appointed by the Controller of Examination. Wherever there is viva-voce, it shall be conducted by the common Viva Board consisting of the Chairman and internal members of the Board of Examination in the concerned subject, internal guide and one external expert as approved by the Controller of Examinations

End semester practical examinations shall be held before the theory examinations to benefit the students to undertake examinations of other departments.

Every course offered will have three components associated with the teaching-learning process of the course, namely (i) Lecture - L (ii) Tutorial - T (iii) Practicals - P, (iv) Self study - S where

L stands Lecture session. **T** stands Tutorial session consisting participatory discussion / self study / desk work / brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands Practice session and it consists of Hands on experience / Laboratory Experiments / Field Studies / Case studies that equip students to acquire the much required skill component.

S stands Self study session consisting participatory discussion by student with the guidance of faculty. This session is not included in the weekly hour plan.

In terms of credits, every one hour session of L amounts to 1 credit per semester, a minimum of two hour session of T or P amounts to 1 credit per semester and no credits alloted to self study hour, over a period of one semester of 15 weeks for teaching-learning process. The total duration of a semester is 20 weeks inclusive of semester-end examination.

A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P + S. The credit pattern of the course is indicated as L: T: P: S. For example: a theory course with a L-T-P-S schedule of 4-0-0-2 will be assigned 4 credits, and a lab practical

course with a L-T-P-S schedule of 0-0-3-0 will be assigned 3 credits.

For B.C.A courses Part I, Part II and Part IV subjects will be provided to first and second semesters. In third to sixth semesters only part III papers provided. Total of 30 hrs was to be maintained constantly for all semesters.

Projects and Field works might be introduced in the sixth semester of any UG course by utilizing two core papers. Each project work / field work might be awarded with twelve credits and twelve hours per week.

Total credits of 144 attained through three years of their study period.

Provision for Credit Mobility - This can be availed by the students at any time during the course of study. Four weeks of online course is considered as one credit course. Students are expected to produce certificates from Swayam, NPTEL, Spoken Tutorial of IIT Bombay, Coursera and equivalent

8. Question Paper Pattern

SECTION – A (30 words)

10 OUT OF 12   -   10 X 2 marks   = 20 marks

SECTION – B (200 words)

5 out of 7   -   5 x 5   marks   = 25 marks

SECTION – C (500 words)

3 out of 5   -   3x 10 marks   = 30 marks
- - - - - - - - - - - -

TOTAL   **= 75 marks**
- - - - - - - - - - - -

9. SCHEME OF EXAMINATIONS:

SUBJECTS	CREDITS	EXAM HRS	MAX. MARKS		
			Internal	External	TOTAL
PART I Language	3	3	25	75	100
PART II English	3	3	25	75	100
PART III Core Subject	4	3	25	75	100
Core Practical	3	3	40	60	100
Allied Paper	5	3	25	75	100
PART IV 1. (a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two paper (level will be at 6th Standard). (b) Those who have studies Tamil up to XII Std. and taken a Non- Tamil Language under Part-I shall take Advanced Tamil comprising of two papers. (c) Others who do not come under a + b can choose non-major elective comprising of two papers.	2	2	25	75	100
2. Skill based subjects – Soft Skill	3	2	50	50	100
PART V – Extension activities	1				
Total credits : 24					

The following procedure be followed for internal Marks

The offer of an Add-on Courses to the students in various disciplines is to enhance their employability. The number of working hours per week for the students for getting the **140** prescribed credits should not exceed 30 hours of class per week and no faculty member should be allocated extra hours beyond the prescribed 16 lecture hours. The following procedure be followed for Internal Marks

INTERNAL MARKS

Tests (2 out of 3)	= 10
Attendance	= 5
Seminars	= 5
Assignments	= 5
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	25 marks
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*Break-up Details for Attendance

Below 60%	- No marks
60% to 75%	- 2 marks
76% to 90 %	- 3 marks
91% to 100%	- 4 marks

Practice based Continuous Internal Assessment (CIA) – 20 provided based upon the type of the practice recommended by board of studies to the respective paper for example: quiz, report generation, problem solving, etc.,

Practical: Internal Marks   40
Attendance   5 marks
Practical Test best 2 out of 3 30 marks
Record   5 marks

10. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.

ii. Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subject of earlier semesters along the current (subsequent) Semester Subjects.

iii. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Academic Council from time to time. Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any

extraordinary circumstances such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the college, shall be permitted to proceed to the next semester and to complete the Course of study. Such Candidates shall have to repeat the missed Semester by rejoining after completion of Final Semester of the course, after paying the fee for the break of study as prescribed by the Academic Council from time to time.

iv. There shall be examinations at the end of each semester, for odd semesters in the month of October / November, for even semesters in April / May. A candidate who does not pass the examination in any paper(s) shall be permitted to appear in such failed courses in the subsequent examinations to be held in October / November or April / May.

v. The results of all the examinations will be published through the college Website.

11. PASSING MINIMUM

A candidate shall be declared to have passed:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 40 % (Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.

c) In the aggregate (External + Internal) the passing minimum shall be of 40%. d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning **140** CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree. He/She shall also complete two certificate courses to qualify for the Degree.

12. CLASSIFICATION OF SUCCESSFUL CANDIDATES

PART- I TAMIL / OTHER LANGUAGES

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (1) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

PART – II ENGLISH

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be

declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

PART – III consisting of CORE SUBJECTS, ALLIED SUBJECTS, PROJECT with three papers: Successful candidates passing the examinations for Core papers together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core papers together shall be declared to have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the THIRD Class.

PART – IV consisting of sub items 1 (a), (b) & (c), 2, 3 and 4
Successful Candidate earning of 2 credits for each paper SHALL NOT BE taken into consideration for Classification / Ranking / Distinction.

PART – V EXTENTION ACTIVITIES
Successful Candidate earning of 1 credit for extension activities SHALL NOT BE taken into consideration for Classification / Ranking / Distinction.

13. RANKING
Candidates who pass all the examinations prescribed for the Course in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking / Distinction.
Provided in the case of Candidates who pass all the examinations prescribed for the Course with a break in the First Appearance due to the reasons as furnished in the Regulations 8(iii) category are only eligible for Classification.

14. APPEARANCE FOR IMPROVEMENT
Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper / papers only once in order to improve his/her marks, by paying the fee prescribed from time to time. Such candidates are allowed to improve within a maximum period of 12 semesters counting from his/her first semester of his / her admission. If candidate improve his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration. No candidate will be allowed to improve marks in the Practical, Project, Viva-voce, and Field work.

15. CONDONATION

Students must have 75% of attendance in each paper for appearing the examination. Students who have 74% to 70% of attendance shall apply for condonation in the prescribed form with the prescribed fee Rs. 200/-. Students who have 69% to 60% of attendance shall apply for condonation in prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 60% of attendance are not eligible to appear for the examination. They shall re-do the semester(s) after completion of the programme.

16. RETOTALING

Candidates are permitted to apply for retotaling within 10 days from the date of publication of results. The student should submit request for retotaling in the prescribed format and pay a fee of Rs.100/-.

PHOTOCOPY OF ANSWER SCRIPT

Candidates are permitted to apply for obtaining a photocopy of answer paper within 20 days from the date of publication of results. The student should submit request for photocopy of answer script in the prescribed format.

17. REVALUATION

Candidates are permitted to apply for revaluation after obtaining a photocopy of answer paper within 30 days from the date of publication of results. The student should submit request for revaluation in the prescribed format and pay a fee of Rs.500/- per paper.

18. MALPRACTICE

Any malpractice by the students debars them from subsequent appearance based on the decision of the examination committee. In all cases of malpractice their conduct certificates will indicate malpractice.

19. EVALUATION AND GRADING SYSTEM

The performance of a student in each paper is evaluated in terms of percentage of marks with a provision for conversion to grade points (GP). Evaluation for each paper shall be done by a continuous internal assessment by the concerned paper teacher as well as by an end semester examination and will be consolidated at the end of the course.

The term grading system indicates a Ten Point Scale of evaluation of the performances of students

in terms of marks obtained in the Internal and External Examination, grade points and letter grade.

Once the marks of the Internal and end-semester examinations for each of the papers are available, they will be added. The marks thus obtained will then be graded as per details provided in Table.

The sum of total performance in each semester will be rated by **Grade Point Average (GPA)** while the continuous performance from the second semester onwards will be marked by **Cumulative Grade Point Average (CGPA).** These two are calculated by the following formulae.

$$GPA = \frac{\text{Sum of [Credits acquired x Grade points]}}{\text{Sum of Credits acquired}}$$

For the calculation of Grade Point Average (GPA), Gi is the grade point awarded; Ci is the credit

$$CGPA = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

units earned for the ith paper.

where 'Ci' is the Credit earned for the paper i in any semester ; 'Gi' is the Grade Point obtained by the student for the paper i and 'n' is the number of papers **passed** in that or **CGPA** = GPA of all the papers starting from the first semester to the current semester.

      Note: The GPA and CGPA shall be calculated separately for the following five parts: Part I: Language Course; Part II: English Language Course and Part III: Core Cs, Allied Cs, Part IV: NME, SBC, ES, VE, Part V: Extension activities.

Marks	Grade Point	CGPA	Letter Point	Classification of Final Result
96 and above	10	9.51 and above	S^+	First Class with Exemplary
91 – 95	9.5	9.01 – 9.50	S	
86 – 90	9.0	8.51 – 9.00	D^{++}	First Class with Distinction
81 – 85	8.5	8.01 – 8.50	D^+	
76 – 80	8.0	7.51 – 8.00	D	
71 – 75	7.5	7.01 – 7.50	A^{++}	First Class
66 – 70	7.0	6.51 – 7.00	A^+	
61 – 65	6.5	6.01 – 6.50	A	
56 – 60	6.0	5.51 – 6.00	B^+	Second Class
51 – 55	5.5	5.01 – 5.50	B	
46 – 50	5.0	4.51 – 5.00	C^+	Third Class
40 – 45	4.5	4.00 – 4.50	C	
Below 40	0	Below 4.00	F	Fail

The grade card / mark sheet issued at the end of the semester to each student will contain the following:

a. the marks obtained for each paper registered in the semester

b. the credits earned for each paper registered for that semester

c. the performance in each paper by the letter grade point obtained

d. the Grade Point Average (GPA) of all the papers registered for that semester and

e. from the second semester onwards, the Cumulative Grade Point Average (CGPA) of all the papers and

f. the class and grade of the student in the final CGPA

20. TRANSITORY PROVISION

Candidates who have undergone the course of study prior to the academic year 2015-2016 will be permitted to appear for the examinations under those Regulations for a period of TWO years i.e. upto and inclusive of April - May 2017 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

21. INSTANT EXAMINATION

Candidates who have passed all the theory papers upto 5th semester and failed in only one paper pertaining to the 6th semester can apply for Instant Examination. Application form with a demand draft for Rs.300/-, drawn in favour of "The Principal, Sri Sankara Arts and Science College, Enathur" should be submitted on or before 10 days after the publication of results. The results are published within 15 days after the date of examinations.B.C.A Syllabus

First Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks	
					CIA	UE
PART I	Tamil / Sanskrit	I	3	3	25	75
PART II	Communicative English I	I	3	3	25	75
PART III	Allied I: Mathematics – I	I	5	3	25	75
PART III	Web Programming	I	4	3	25	75
PART III	Web Programming Lab	I	3	3	40	60
PART IV	Soft Skill I (English for Physical Sciences I)	I	3	2	50	50
PART IV	Non-Major Elective – I	I	2	2	25	75
	Total Credits		**23**			

Second Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks	
					CIA	UE
PART I	Tamil / Sanskrit	II	3	3	25	75
PART II	Communicative English II	II	3	3	25	75
PART III	Allied II: Mathematics – II	II	5	3	25	75
PART III	Python Programming	II	4	3	25	75
PART III	Python Programming Lab	II	3	3	40	60
PART IV	Non-Major Elective –Lab	II	2	2	40	60
PART IV	Soft Skill II (English for Physical Sciences II)	II	3	2	50	50
	Total Credits		**23**			

Third Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks CIA	UE
PART III	Java Programming	III	4	3	25	75
PART III	Operating System	III	4	3	25	75
PART III	Data Structures	III	4	3	25	75
PART III	Allied III - Financial Accounting	III	5	3	25	75
PART III	Java Programming Lab	III	2	3	40	60
PART IV	ENVIRONMENTAL STUDIES	III	Examinations will be held in Semester IV			
PART IV	Soft skill – 3	III	3	2	50	50
	Total Credits		**22**			

Fourth Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks CIA	UE
PART III	Data Communication and Networking	IV	4	3	25	75
PART III	Relational Database Management System	IV	4	3	25	75
PART III	Software Engineering	IV	4	3	25	75
PART III	Allied IV - Cost and Management Accounting	IV	5	3	25	75
PART III	RDBMS Lab	IV	2	3	40	60
PART IV	Soft skill – 4	IV	3	2	50	50
PART IV	ENVIRONMENTAL STUDIES	IV	2	3	25	75
	Total Credits		**24**			

Fifth Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks	
					CIA	UE
PART III	Elective – I	V	5	3	25	75
PART III	PHP Programming	V	4	3	25	75
PART III	R Programming	V	4	3	25	75
PART III	Data Mining	V	4	3	25	75
PART III	PHP Programming Lab	V	2	3	40	60
PART III	R Programming Lab	V	2	3	40	60
PART IV	Value Education	IV	2	2	25	75
	Total Credits		**23**			

Sixth Semester

Course components	Name of Course	semester	credits	Exam Duration	Max. Marks	
					CIA	UE
PART III	Software Project Management	VI	4	3	25	75
PART III	Advanced Python Programming	V	4	3	25	75
PART III	Introduction to Data Science	VI	4	3	25	75
PART III	Elective – II	VI	5	3	25	75
PART III	Advanced Python Programming Lab	VI	2	3	25	75
PART III	Mini Project	VI	5	3	40	60
PART V	**Extension Activities**		1			
	Total Credits		**25**			
	Total credits (Core, Elective, SBS)		**140**			

Elective - I

1. Resource Management Techniques
2. Introduction to Cloud Computing
3. Introduction to Blockchain Technology

Elective – II

1. Introduction to Deep Learning
2. Introduction to Web Analytics
3. Social Media Analytics

Non –Major Elective: Semester - I

1. LaTex
2. Web Office
3. Fundamentals of Programming

Non –Major Elective: Semester - II

1. LaTex Lab
2. Web Office Lab
3. Fundamentals of Programming Lab

Core Paper Theory – 1			
Title of the paper with subject code	**Web Programming**		
Category of the course	Year	Semester	Credits
Core	I	I	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ Develop the Web Programming Skills through Mark-up and Scripting languages.

➢ Understand the importance of CSS in Web development.

➢ Write Client-Side Scripts to validate data

COURSE OUTCOME:

CO1: To work with basic tags of HTML

CO2: To Illustrate the application of List and Tables

CO3: To Explain various basic elements of JavaScript

CO4: To Understand various Event Handling Procedures

CO5: To Demonstrate form handling

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	HTML: Introduction – Structure of HTML – Text Formatting – Image – Hyperlink – Audio – Video	12	CO-1	K1
II	HTML List – Tables – Styles – Forms – using CSS	12	CO-2	K2
III	Introduction to Java Script – Adding JavaScript to XHTML Documents – Common uses of JavaScript – Basic Data Types – Composite Types – Operators - Flow Controls – Loops	12	CO-3	K3
IV	Functions – Object – properties – JavaScript object Models – Document object – Document Trees – Basic Element access – other access methods – DOM and HTML elements – Event Handling: Overview of Events and Event Handling – Traditional Event Model – Event Types	12	CO-4	K4, K5
V	Dialog – Controlling Windows – Manipulating a window's History – Form Handling: Form basics – Form fields – Form usability – Form validation	12	CO-5	K6

RECOMMENDED TEXTBOOKS

1. Steve Holznere, HTML Black Book, dreamtech press

2. Thomas A. Powell, Fritz Schneider ,The Complete eference JavaScript, 3rd Edition, TMH Education

3. Ivan BayRoss, HTML, JavaScript, DHTML and PHP, BPB Publication.

REFERENCE BOOKS

1. Thomas A. Powell, The Complete Reference HTML & CSS, McGraw Hill Education

2. Jerry Bradenbaugh, JavaScript Application Cookbook, O′Reilly Publication

WEB LINKS

1. https://developer.mozilla.org/en-US/docs/Web/HTML

2. https://developer.mozilla.org/en-US/docs/Web/JavaScript

3. https://www.w3schools.com/html/

4. https://www.geeksforgeeks.org/html-tutorials/

5. https://www.w3schools.com/js/

6. https://www.geeksforgeeks.org/javascript-tutorial/

Core Practical – 1			
Title of the paper with subject code	**Web Programming Lab**		
Category of the course	Year	Semester	Credits
Core	I	I	3
Course Type	**Employability**		

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Write an HTML code to display information in a webpage.	CO-1	K1
2	Write an HTML code with Text Formatting Tags.		
3	Write an HTML code to create a Home page having three links and Create separate web pages for the three links.		K2
4	Write an HTML code to illustrate the use of the following: • Ordered List • Unordered List • Definition List	CO-2	
5	Write an HTML code to create a Time Table for your Class.		
6	Write an HTML code to illustrate Image Mapping.		K3
7	Write an HTML code to add Multimedia to your page.		
8	Write an HTML code to create a Registration Form.		
	JavaScript		
9	Write a JavaScript program to print the contents of the current window.	CO-3	K4
10	Write a JavaScript program to get the current date.		
11	Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit.		
12	Write a JavaScript exercise to create a variable using a user-defined name.		K5
13	Write a JavaScript program to calculate multiplication and division of two numbers (input from user)		
14	Write a JavaScript program to set the background color of a paragraph.	CO-4	
15	Write a JavaScript function to get the values of First name and Last name and print the result.		
16	Write a JavaScript program to highlight the bold words of the following paragraph, on mouse over a certain link.		
17	Write a JavaScript function that creates a table by accepting the number of rows & column from the user.	CO-5	K6
18	Write a JavaScript program to get the width and height of the window (any time the window is resized).		

Core Paper Theory – 2			
Title of the paper with subject code	**Python Programming**		
Category of the course	Year	Semester	Credits
Core	I	II	4
Course Type	**Employability**		

COURSE OBJECTIVE:

- ➢ Describe the core syntax and semantics of Python programming language.
- ➢ Discover the need for working with the strings and functions.
- ➢ Illustrate the process of structuring the data using lists, dictionaries, tuples and sets**.**

COURSE OUTCOME:

CO1: To Understand the principles of Python and acquire skills in programming in python

CO2: To develop the emerging applications of relevant field using Python

CO3: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python

control flow statements.

CO4: Demonstrate the concepts of List and Tuples

CO5: Illustrate Dictionaries

UNIT NO	CONTENTS	HOURS	COs	COGNITIVE LEVEL
I	Introduction: Keywords - Identifiers - Comments - Data types - Operators - Statements - Expressions - Input and Output - type conversion	12	CO-1	K1
II	Flow Control: Selection Statements - Repetition statements - break and continue statements - Nesting of Selection and repetition statements	12	CO-2	K2
III	Functions: Need of functions - Python math library - User defined functions - Scope of a variable - built-in function versus user defined functions - exception handling	12	CO-3	K3
IV	String: String Operations - Traversing a String - String methods and built-in functions - Handling string. List: List Operations - Traversing a List - List methods and build-in functions - Nested List - Copying list - List Manipulation - List as arguments to function	12	CO-4	K4, K5
V	Tuples: Operations - Methods and built-in functions - Assignment - Nested tuples. Dictionaries: Dictionaries are mutable - Operations - traversing a dictionary - methods and built-in functions -	12	CO-5	K6

	manipulation dictionaries			

RECOMMENDED TEXTBOOKS
1. Martin C Brown, Python: The Complete Reference, McGraw Hill Education

2. Yashavant Kanetkar, Let Us Python, BPB Publications

3. Sheetal Taneja, Python Programming A Modular approach, Pearson Education Publication.

REFERENCE BOOKS
1. Y. Daniel Liang, Introduction to Programming using Python, Pearson Education

2. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.

3. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited, 1st Edition, 2011

4. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to think like a computer scientist: learning with Python", 2012.

5. Sheetal Taneja & Naveen kumar, "Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications", Pearson, 2017.

WEB LINKS
NPTEL Material / Courses
1. https://nptel.ac.in/courses/106/106/106106182/
2. https://docs.python.org/3/
3. https://www.w3schools.com/python/
4. https://www.geeksforgeeks.org/python-programming-language/

Core Practical – 2			
Title of the paper with subject code	**Python Programming Lab**		
Category of the course	Year	Semester	Credits
Core	I	II	3
Course Type	**Employability**		

COURSE OBJECTIVE:

- ➢ To implement the python programming features in practical applications.
- ➢ To write, test, and debug simple Python programs.
- ➢ To implement Python programs with conditionals and loops.
- ➢ Use functions for structuring Python programs.
- ➢ Represent compound data using Python lists, tuples, dictionaries

COURSE OUTCOME:

CO1: Understand the numeric or real life application problems and solve them.

CO2: Apply a solution clearly and accurately in a program using Python.

CO3: Apply the best features available in Python to solve the situational problems.

CO4: Illustrate list and tuple

CO5: Demonstrate the concept of application of Dictionaries

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Write a program to generate the following output (without using loop) a. ***** ***** ***** ***** b. * ** *** **** ***** c. aaaaa bbbbb ccccc ddddd	CO-1	K1

2	Write a program to swap values of two variables		
3	Write a program to calculate the area and perimeter of a square	CO-2	K2
4	Write a program to calculate the area and perimeter of a rectangle		
5	Write a program to calculate the area and perimeter of a right angled triangle		
6	Write a program to read four number and calculate the sum and average		
7	Write a program to print your name 20 times		K3
8	Write a program to print 5th table (upto 5 * 10)		
9	Write a program to generate and print 10 random numbers	CO-3	
10	Write a program to generate 50 random numbers between 0 to 100 and count the number of values between the range i. 0 – 25 ii. 26 – 50 iii. 51 - 75 and iv. 76 - 100		
11	Write a program to calculate sum = $(1 + \frac{1}{2} + \frac{1}{3} + \ldots + 1/n)$		
12	Write a program to calculate factorial value for the given number		
13	Write a program to generate fibonacci series for the given number		K4
14	Write a program to read 20 Student marks of a particular subject. Compute the following a. Find the Maximum mark secured by the student. b. Find the Minimu mark secured by the student. c. Find the average score of the given subject marks.		
15	Write a program to read a string and perform the following operations a. print the total number of characters in the string b. print the first character in the string c. print the last character in the string d. print the first three characters in the string e. print the last three characters in the string f. print the string in upper case g. print the string in reverse	CO-4	
16	Write a program to check whether the given string is palindrome or not		
17	Write a program that asks the user to enter a list of 10 integers. Do the following: a. print the list in reverse order b. Print Yes if the list contains a 5 and No otherwise. c. Print the number of fives in the list. d. Remove the first and last items from the list, sort the remaining items, and print the result e. Print how many integers in the list are less than 5.		K5
18	Write a program that rotates the elements of a list so that the element at the first index moves to the second index, the element in the second index moves to the third index, etc., and		

	the element in the last index moves to the first index.		
19	Write a program to enter a list containing numbers between 1 and 12. Then replace all of the entries in the list that are greater than 10 with 10	CO-5	K6
20	Write a program that asks the user to enter some text and then counts how many articles are in the text. (Articles - 'a', 'an', 'the')		
21	Write a simple quote-of-the-day program. The program should contain a list of quotes, and when the user runs the program, a randomly selected quote should be printed.		
22	Write a program that uses list and range to create the list [3,6, 9, . . . , 99].		
23	Write a program that asks the user to enter 5 product names and prices. Store all of these in a dictionary whose keys are the product names and whose values are the prices and then print the values.		
24	Write a program to create a dictionary with Month name as a key and number of days in the month as value. Print the values in the dictionary		
25	Write a program to create a dictionary with 5 username as a key and password as value. Get a username and password as input and print login is successful or not		

Core Paper Theory – 3			
Title of the paper with subject code	**Java Programming**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To understand the concepts of Object Oriented Programming.

➢ To learn about the control structures, class with attributes and methods used in Java.

COURSE OUTCOME:

CO1: Understand the concept of Object Oriented Programming

CO2: To Work with control Structures

CO3: Creating classes and implementing inheritance

CO4: Describe and construct Package, Interface

CO5: To Work with Exception

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Object – Oriented Paradigm – Basic concepts of Object – Oriented Programming – Benefits of OOP – Applications of OOP – Java history – features – java environment – simple java program – java tokens – java statements – java virtual machine – Command line arguments	12	CO-1	K1
II	Constants – variables – data types - type casting – operators – Arithmetic expression – precedence of arithmetic operators – if statement – switch statement- looping – continue – break	12	CO-2	K2
III	Classes and Objects: Defining a class fields declaration, methods declarations, creating objects, accessing class members – constructor – method overloading, static members – Inheritance: overriding methods, final variables and methods – final classes – abstract methods and classes – visibility controls – String and Vector Class	12	CO-3	K3, K4
IV	Arrays: Introduction – one dimensional arrays – creating an array – two dimensional arrays. Interfaces: Introduction – Defining Interface – Extending Interfaces – Implementing Interfaces – Accessing Interface variables. Packages:	12	CO-4	K5

	Introduction - Java API Packages - Using system packages – Naming conventions – Creating Packages – Accessing a Package – Using a Package – Adding class to a Package			
V	Multi Thread: Introduction – creating threads – extending the thread classes – using thread methods – Thread Priority – synchronization – Implementing the runnable interface – Exceptions: Introduction – Types of Errors – Exceptions – Multiple catch statements – using finally statements – Throwing our own exception.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. E. Balagurusamy, Programming with Java A Primer, 4th Edition, TMH Education

2. Herbert Schildt, Java: The Complete Reference, McGraw Hill Education

REFERENCE BOOKS
1. Patrick Naughton, The Java Handbook, McGraw Hill Education

2. Harvey M. Deitel and Paul J. Deitel, Java How to Program, Pearson Publication

WEB LINKS
NPTEL Material / Courses
1. https://nptel.ac.in/courses/106/105/106105191/
2. https://nptel.ac.in/courses/106/105/106105225/
3. https://docs.oracle.com/en/java/
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

Core Paper Theory – 4			
Title of the paper with subject code	**Operating System**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Skill Development**		

COURSE OBJECTIVE:

➢ To understand the fundamental concepts and role of Operating System.

➢ To learn the Process Management and Scheduling Algorithms

➢ To understand the Memory Management policies

➢ To gain insight on I/O and File management techniques

COURSE OUTCOME:

CO1: Understand the basic functionality of the operating system

CO2: Summarize Memory Management

CO3: Describe Scheduling

CO4: Illustrate Device Management

CO5: Understand File System

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction: Views - Types of System - OS Structure – Operations - Services – Interface-System Calls System Structure - System Design and Implementation. Process Management: Process - Process Scheduling - Inter-process Communication. CPU Scheduling: CPU Schedulers - Scheduling Criteria - Scheduling Algorithms.	12	CO-1	K1, K2
II	Process Synchronization: Critical- Section Problem - Synchronization Hardware Semaphores - Classical Problems of Synchronization - Monitors. Deadlocks: Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Avoidance - Detection - Recovery.	12	CO-2	K3
III	Memory Management: Hardware - Address Binding – Address Space - Dynamic Loading and Linking – Swapping – Contiguous Allocation - Segmentation - Paging – Structure of the Page Table.	12	CO-3	K4

IV	Virtual Memory Management: Demand Paging - Page Replacement Algorithms - Thrashing. File System: File Concept -. Access Methods - Directory and Disk Structure - Protection - File System Structures - Allocation Methods - Free Space Management.	12	CO-4	K5
V	I/O Systems: Overview - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem - Transforming 1/0 Requests to Hardware Operations - Performance. System Protection: Goals - Domain - Access matrix. System Security: The Security Problem - Threats – Encryption- User Authentication.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, "Operating System Concepts", Wiley India Pvt. Ltd 2018, 9 th Edition

REFERENCE BOOKS
1. William Stallings, "Operating Systems Internals and Design Principles", Pearson, 2018, 9 th Edition.
2. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", Pearson 2014, 4 th Edition
3. Ekta Walia, Operating Systems, Khanna Publishing House, Delhi
4. Operating Systems A Concept-Based Approach, Dhananjay M. Dhamdhere, McGraw Hill

WEB LINKS
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1. https://nptel.ac.in/courses/106/105/106105214/
2. https://nptel.ac.in/courses/106/106/106106144/
3. https://nptel.ac.in/courses/106/102/106102132/
4. https://nptel.ac.in/courses/106/108/106108101/
5. https://www.w3schools.in/operating-system-tutorial/intro/
6. https://www.geeksforgeeks.org/operating-systems/

Core Paper Theory – 5			
Title of the paper with subject code	**Data Structures**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Skill Development**		

COURSE OBJECTIVE:

➢ To understand the concepts of ADTs

➢ To learn linear data structures-lists, stacks, queues

➢ To apply Tree and Graph structures

➢ To understand sorting, searching and hashing.

COURSE OUTCOME:

CO1: Use linked list in various applications

CO2: Illustrate stack and queue data structures

CO3: Work with different types of tree

CO4: Write applications using Graph

CO5: Compare and Contrast various sorting and searching Algorithm

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation - singly linked lists - circular linked lists - doubly-linked lists - applications of lists - Polynomial Manipulation - All operations - Insertion - Deletion - Merge - Traversal.	12	CO-1	K1
II	Stack ADT - Operations - Applications - Evaluating arithmetic expressions – Conversion of infix to postfix expression - Queue ADT - Operations - Circular Queue - Priority Queue - deQueue - applications of queues.	12	CO-2	K2
III	Tree ADT - tree traversals - Binary Tree ADT - expression trees - applications of trees - binary search tree ADT - Threaded Binary Trees - AVL Trees - B-Tree - B+ Tree – Heap - Applications of heap.	12	CO-3	K3
IV	Definition - Representation of Graph - Types of graph - Breadth first traversal – Depth first traversal - Topological sort - Bi-connectivity – Cut vertex - Euler circuits - Applications of graphs.	12	CO-4	K4, K5

V	Searching: Linear search - Binary search - Sorting: Bubble sort - Selection sort - Insertion sort - Shell sort - Radix sort - Hashing: Hash functions - Separate chaining - Open Addressing - Rehashing - Extendible Hashing.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2. Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition

REFERENCE BOOKS
1. Thomas H.Cormen,Chales E.Leiserson,Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.

2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003.

3. Sartaj Sahni, Fundamentals of Data Structures, University Press

4. RS Salaria, Data Structures, Khanna Publishing House

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2. https://nptel.ac.in/courses/106/106/106106130/
3. https://nptel.ac.in/courses/106/106/106106127/
4. https://nptel.ac.in/courses/106/102/106102064/
5. https://nptel.ac.in/courses/106/103/106103069/
6. https://www.w3schools.in/data-structures-tutorial/intro/
7. https://www.geeksforgeeks.org/data-structures/

Core Practical - 3			
Title of the paper with subject code	**Java Programming Lab**		
Category of the course	Year	Semester	Credits
Core	II	III	2
Course Type	**Employability**		

COURSE OBJECTIVE:

> To implement Object Oriented Class
> To implement linear and non-linear data structures
> To understand the various operations of search trees
> To implement Graph Traversal algorithms
> To get acquainted with sorting and searching algorithms

COURSE OUTCOME:

CO1: To work with simple problems

CO2: To implement Class, object and use methods

CO3: Suggest appropriate linear and non-linear data structure operations for solving a given

problem.

CO4: Analyze various sorting methods.

CO5: Illustrate Tree and Graph

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Write a program to calculate the absolute value of given number	CO-1	K1
2	Write a program to read a number and to print the given number is positive, negative or zero		
3	Write a program to read 10 random numbers using Random class and count and print the number of odd and even numbers in the random numbers		

4	Write a program to demonstrate function overloading
	        a.swapping (integer number swapping, real number swapping and character swapping)
	        b. addition (integer addition and real addition)
			K2

5	Write a program to calculate the sum of digit		

6	Write a program to reverse a integer number	CO-2	K3
7	Write a program to reverse and print an integer array		
8	Write a program to add two 3 X 3 Matrix		
9	Write a program to subtract two 3 X 3 Matrix		
10	Write a program to transpose a 3 X 3 Matrix		

11	Write a program to
	    a.Create a class with a register number, name, tamil, english, math, science, social science, total and result as members
	    b. Read register number, name and marks.
	    c.Calculate the total and print whether he/she is pass or fail
		CO-3	

12	Write a program to
	    a.Create a class Shape with area and perimeter as member
	    b. Inherit the class Shape and create a class Rectangle with length and breadth as member. Calculate and print the area and perimeter
	    c. inherit the class Shape and create a class Square with side as member. Calculate and print the area and perimeter
			K4

13	Write a program to demonstrate any 5 methods in String class		
14	Write a program to demonstrate exception handling		

15	Write a program using Vector class with following functionality
	    a. insertion
	    b. deletion and
	    c. display the Vector elements
		CO-4	K5

16	Write a program for linear search		
17	Write a program for binary search		
18	Write a program for bubble sort		
19	Write a program for selection sort		
20	Write a program for insertion sort		K6
21	Write a program to implement singly linked list	CO-5	
22	Write a program to implement Stack operation		
23	Write a program to implement Queue operation		
24	Write a program to demonstrate tree traversal		
25	Write a program to demonstrate BFS and DFS		

Fourth Semester

Core Paper Theory - 6			
Title of the paper with subject code	**Data Communication and Networking**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To understand the concept of Networking basics.

➢ To impart knowledge on working Principles of Networking

COURSE OUTCOME:

CO1: Describe the layers in OSI Model and TCP/IP protocol

CO2: Understand various guided media

CO3: Summarize Data link control

CO4: Appraise the Addressing in IPV4 & IPV6

CO5: Articulate TCP and UDP

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Data Communication: Data representation - Networks - Protocols and Standards - Network Model: OSI Model - Layers in OSI model - TCP/IP protocol, Addressing	12	CO-1	K1
II	Transmission media: guided media - twisted pair - coaxial cable - fiber optic cable - unguided media: radio waves - microwaves - infrared - Switching: circuit switched networks - datagram networks - virtual circuit networks	12	CO-2	K2
III	Data link control: framing - fixed size framing - variable size framing - flow and error control - protocols - noiseless channels - HDLC - Point to Point Protocol	12	CO-3	K3
IV	Connecting LAN: Connecting devices - backbone networks - virtual LAN - Network Layer: IPV4 address - address space - notions - classful addressing - classless addressing - IPV6 address - structure address space	12	CO-4	K4, K5
V	Transport layer: User Datagram Protocol(UDP) - user datagram - checksum - UDP operation - use of UDP. TCP: TCP services - TCP features - segment - a TCP connection - flow control - error	12	CO-5	K6

	control - congestion control.			

RECOMMENDED TEXTBOOKS
1. Behrouz A. Forouzan, Introduction to data communications and networking, McGraw-Hill Education, 5th Edition
2. Andre S. Tanenbaum, Computer Networks, Pearson Publication

REFERENCE BOOKS
1. William Stallings, Data and Computer Communications, Pearson Education
2. Computer Networks: Principles, Technologies and Protocols for Network design, Wiley Publication
3. M. Dave, Computer Networks, Cengage
4. Keshav, An Engineering Approach to Computer Networking, Pearson
5. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publications.

WEB LINKS
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1. https://nptel.ac.in/courses/106/105/106105082/
2. https://nptel.ac.in/courses/106/108/106108098/
3. https://nptel.ac.in/courses/106/105/106105080/
4. https://nptel.ac.in/courses/106/105/106105081/
5. https://nptel.ac.in/courses/106/106/106106091/
6. https://www.geeksforgeeks.org/computer-network-tutorials/

Core Paper Theory - 7			
Title of the paper with subject code	**Relational Database Management System**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ Gain a good understanding of the architecture and functioning of Database Management Systems

➢ Understand the use of Structured Query Language (SQL) and its syntax.

➢ Apply Normalization techniques to normalize a database.

COURSE OUTCOME:

CO1: Understand the purpose and need for Database Management System

CO2: Demonstrate the applicability of Codd's Rules

CO3: Illustrate the neeed and necessity of Normalization concepts

CO4: Effective use of DDL, DML & TCL commands

CO5: Able to implement features like Database connectivity with programming languages

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction to DBMS– Data and Information - Database – Database Management System – Objectives - Advantages – Components - Architecture. ER Model: Building blocks of ER Diagram – Relationship Degree – Classification – ER diagram to Tables – ISA relationship – Constraints – Aggregation and Composition – Advantages	12	CO-1	K1, K2
II	Relational Model: CODD's Rule- Relational Data Model - Key - Integrity – Relational Algebra Operations – Advantages and limitations – Relational Calculus – Domain Relational Calculus -QBE	12	CO-2	K3
III	Structure of Relational Database. Introduction to Relational Database Design - Objectives – Tools – Redundancy and Data Anomaly – Functional	12	CO-3	K4

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	Dependency - Normalization – 1NF – 2NF – 3NF – BCNF. Transaction Processing – Database Security.			
IV	SQL: Commands – Data types – DDL - Selection, Projection, Join and Set Operations – Aggregate Functions – DML – Modification - Truncation - Constraints – Subquery.	12	CO-4	K5
V	Java Database Connectivity: Connecting to and Querying a Database - RowSet Interface - PreparedStatements - Stored Procedures - Python Database Connectivity: Installing required packages - Connecting database - inserting - deleting - displaying.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
  1. S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management System", Springer International Edition 2007

REFERENCE BOOKS
  1. Abraham Silberchatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGrawHill 2019, 7th Edition

  2. Alexis Leon & Mathews Leon, "Fundamentals of DBMS", Vijay Nicole Publications, 2nd Edition

  3. Harvey M. Deitel and Paul J. Deitel, Java How to Program, Pearson Publication

  4. Martin C Brown, Python: The Complete Reference, McGraw Hill Education.

WEB LINKS
NPTEL Material / Courses
  1. https://nptel.ac.in/courses/106/106/106106220/
  2. https://nptel.ac.in/courses/106/104/106104135/
  3. https://nptel.ac.in/courses/106/106/106106093/
  4. https://nptel.ac.in/courses/106/106/106106095/
  5. https://docs.oracle.com/javase/tutorial/jdbc/basics/index.html
  6. https://www.python.org/dev/peps/pep-0249/- Python Database API Specification
  7. https://docs.python.org/3/library/sqlite3.html
  8. https://www.geeksforgeeks.org/dbms/

Core Paper Theory – 8			
Title of the paper with subject code	**Software Engineering**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Entrepreneurship**		

COURSE OBJECTIVE:

> ➢ To introduce the software development life cycles
> ➢ To introduce concepts related to structured and objected oriented analysis & design co
> ➢ To provide an insight into UML and software testing techniques.

COURSE OUTCOME:

CO1: Understand various software development models

CO2: To write the specification for software development

CO3: Work with various design principles

CO4: Understand Object Oriented design principles

CO5: Describe various testing techniques

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction – Evolution – Software Development projects – Emergence of Software Engineering. Software Life cycle models – Waterfall model – Rapid Application Development – Agile Model – Spiral Model	12	CO-1	K1
II	Requirement Analysis and Specification – Gathering and Analysis – SRS – Formal System Specification	12	CO-2	K2
III	Software Design – Overview – Characteristics – Cohesion & Coupling – Layered design – Approaches Function Oriented Design – Structured Analysis – DFD – Structured Design – Detailed design	12	CO-3	K3, K4
IV	Object Modeling using UML – OO concepts – UML – Diagrams – Use case, Class, Interaction, Activity, State Chart – Postscript	12	CO-4	K5
V	Coding & Testing – coding – Review – Documentation – Testing – Black-box, White-box, Integration, OO Testing, Smoke testing.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. Rajib Mall, "Fundamentals of Software Engineering", PHI 2018, 5th Edition

REFERENCE BOOKS
1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach", McGraw Hill 2010, 7th Edition 2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House 2011, 3rd Edition   3. Pankaj Jalote, A concise introduction to software Engineering, Springer 4. Nasib Singh Gill, Software Engineering, Khanna Publishing House   5. K.K. Aggarwal & Yogesh Singh, Software Engineering, New Age International.

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1. https://nptel.ac.in/courses/106/101/106101235/ 2. https://nptel.ac.in/courses/106/105/106105182/ 3. https://nptel.ac.in/courses/106/101/106101061/ 4. https://nptel.ac.in/courses/106/105/106105087/ 5. https://www.w3schools.in/sdlc-tutorial/software-development-life-cycle-sdlc/ 6. https://www.geeksforgeeks.org/software-engineering/

Core Practical – 9			
Title of the paper with subject code	**RDBMS LAB**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ Learn the various DDL and DML commands

➢ Understand queries in SQL to retrieve information from database

COURSE OUTCOME:

CO1: Implement the DDL , DML Commands and Constraints

CO2: Create, Update and query on the database

CO3: Work Interaction between front end and back end

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Create a Electricity_Consumption table with following columns - Consumer number, name, last reading, new reading, reading taken date, last date, Status(Paid/ Not Paid)	CO-1	K1
2	Create a Account table with following columns - account no., name, account type(Saving , Current, Fixed Deposit, Recurring Deposit), balance and insert data into the table	CO-2	K2
3	Create a Transaction table with following columns - account number, transaction (deposit/withdraw), amount and implement the foreign key concept and insert data into the table		
4	Create a Mark_Statement table with following columns - register number, name, 5 subject marks, total and result and insert data into the table		
5	Create a Pay_Roll table with suitable columns and insert data into the table	CO-3	K3
6	Create a Inventory table with following columns - item number, item description, quantity in hand, unit price, total cost and insert data into the table		
7	Perform the following in the Account table and transaction table a. count the number of accounts with balance		

	less 500 　　　b. print the account details of the accounts with account type as Current account 　　　c. Print the account numbers with more than 5 transactions in the transaction table 　　　d. Count the total number of deposit in the transaction table	CO-4	K4, K5
8	Write a Java/Python program to print the rows in the Account table		
9	Write a Java/Python program to insert data into the Account table		
10	Write a Java/Python program to calculate the units consumed by the consumer in Electricity_Consumption table and 　　　a. print Consumer number, Consumer name and unit consumed 　　　b. print Consumer number, Consumer name and unit consumed who have not paid electricity bill		
11	Write a Java/Python program to calculate net_salary and print employee id, name, earnings, deduction and net salary	CO-5	K6
12	Write a Java/Python Program to perform result analysis for Mark_Statemet table		
13	Write a Java/Python Program to 　　　a. implement sales and purchase transactions in the table Inventory 　　　b. to print the item number, item description and quantity in hand, total cost for a given item number		

Core Paper Theory – 9			
Title of the paper with subject code	**PHP Programming**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To provide a basic idea of Server-Side Scripting

➢ To Understand the role and future of open source software in the industry

➢ To Analyse the impact of legal, economic and social issues for PHP software.

COURSE OUTCOME:

CO1: To understand the major elements of the PHP & MySQL

CO2: Analyze the basic structure of a PHP web application

CO3: Learn different ways of connecting to MySQL through PHP

CO4: Understand the File Structure Concepts in PHP

CO5: Understand the implementation of OOP Concepts in PHP

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introducing PHP - Basic development Concepts - Creating first PHP Scripts - Using Variable and Operators - Storing Data in variable - Understanding Data types - Setting and Checking variables Data types - Using Constants - Manipulating Variables with Operators.	12	CO-1	K1, K2
II	Controlling Program Flow - Writing Simple Conditional Statements - Writing More Complex Conditional Statements - Repeating Action with Loops - Working with String and Numeric Functions.	12	CO-2	K3
III	Working with Arrays: Storing Data in Arrays - Processing Arrays with Loops and Iterations - Using Arrays with Forms - Working with Array Functions - Working with Dates and Times.	12	CO-3	K4
IV	Using Functions and Classes: Creating User-Defined Functions - Creating Classes - Using Advanced OOP Concepts. Working with Files and Directories: Reading Files - Writing Files - Processing Directories.	12	CO-4	K5
V	Working with Database and SQL: Introducing Database and SQL - Using MySQL-Adding and modifying Data - Handling Errors - Using SQLite Extension and PDO Extension. Introduction XML -	12	CO-5	K6

	Simple XML and DOM Extension.			

RECOMMENDED TEXTBOOKS

1. Vikram Vaswani, "PHP A Beginner's Guide", Tata McGraw Hill, 2008

REFERENCE BOOKS

1. Steven Holzner , "The PHP Complete Reference", Tata McGraw Hill, 2007.

2. R. Nixon, "Learning PHP, MySQL, JavaScript, and CSS", O'Reilly Media, 2nd Edition, 2012.

3. Lynn Beighley & Michael Morrison, Head First PHP & MySQL, First Edition, O'Reilly

4. Daginn Reiersol, Chris Shiflett, and Marcus Baker, PHP In Action: Objects, Design, Agility, 1st Edition,Manning Publications

WEB LINKS

1. https://www.php.net/docs.php

2. https://www.w3schools.com/php/

3. https://www.geeksforgeeks.org/php-tutorials/

Core Paper Theory – 10			
Title of the paper with subject code	**R Programming**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OBJECTIVE:

1. To implement the R programming features for Data Analysis.

2. To write, test, and debug simple R programs.

3. To implement R programs with conditionals and loops.

4. Use functions for structuring R programs.

COURSE OUTCOME:

CO1: Understand basic concepts such as data type and index and to use them

CO2: Understand the R data structures – vector and Data Frame.

CO3: Conceptualize and create loops to solve different types of problems.

CO4: Construct tables and figures for descriptive statistics

CO5: Apply R graphical packages for visual representation of data.

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction to R – Data Types – Variables – Operators – Data Inputting in R – C( ), scan( ), Reading a File of Data from a Disk, Reading Data from Tabular Data Files – Reading Data from CSV files – Writing data	12	CO-1	K1
II	Data Manipulation in R – List Manipulation - Vector Manipulation – Matrix Manipulation – Matrix Addition, Matrix Subtraction, Matrix Multiplication, Transpose of a Matrix ,Inverse of a Matrix, Determinant of a Matrix – Data Frame Manipulation.	12	CO-2	K2
III	Programming in R – Conditional Statements – Looping Statements – Functions - User - defined Functions – Built-in Functions – Generating sequence of Random numbers from Uniform Distribution, Normal Distribution, Binomial Distribution, Poisson Distribution, Exponential Distribution and Gamma Distribution.	12	CO-3	K3, K4

IV	Computing Basic Statistics – Mean, Median, Mode, Quartile, Percentile, Maximum, Minimum, Range, InterQuartile Range, Variance, Standard deviation, Correlation Coefficient, Covariance, Central Moment, Skewness, Kurtosis - Simple Hypothesis Testing - Using the Student's t-test, Paired t-test, Chi-Square test for Goodness of Fit, ANOVA – One-Way, Two-Way	12	CO-4	K5
V	Graphical Analysis in R – Box Plot – Scatter Plot – Pair Plot – Line Charts – Bar Charts – Histogram – Adding Text to Graphs – Adding Various lines to Graphs- Matrix Plot – Exporting Graphs.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. Gardener M. Beginning R: The statistical programming language. John Wiley & Sons

REFERENCE BOOKS
1. Matloff N, The art of R programming: A tour of statistical software design ,StarchPress;
2. Chambers J,Software for data analysis: programming with R,Springer Science & Business Media
3. Jones, O, Maillardet, R, and Robinson, A 2014, Introduction to Scientific Programming and Simulation Using R, 2nd edition, Chapman and Hall/CRC
4. Wickem, H 2019, Advanced R, 2nd edition, Chapman and Hall/CRC.

WEB LINKS
NPTEL Material / Courses
1. https://nptel.ac.in/courses/111/104/111104100/
2. https://cran.r-project.org/manuals.html
3. https://www.w3schools.com/r/
4. https://www.geeksforgeeks.org/r-programming-language-introduction/

Core Paper Theory – 11			
Title of the paper with subject code	**Data Mining**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To learn about Data Mining Concepts

➢ To study the different Data Mining Techniques

➢ To learn about Data Preprocessing and Data Quality

➢ Understanding Algorithms for Data Mining

➢ To apply knowledge of data mining in solving real time problems.

COURSE OUTCOME:

CO1: To have knowledge in Data mining concepts.

CO2: To apply Data mining concepts in different fields

CO3: Ability to apply acquired knowledge for understanding data and select suitable methods

for Data Analysis.

CO4: Ability to identify appropriate Data Mining Algorithm to solve different applications.

CO5: Ability to conceptualize basic applications, concepts and techniques of Data Mining.

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction: Data Mining tasks – Data Mining versus Knowledge Discovery in Databases – Database Types - Data Preprocessing: Why preprocess the data – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization.	12	CO-1	K1
II	Data Mining Techniques: Association Rule Mining – The apriori Algorithm – Multilevel Association Rules – Multidimensional Association Rules – Constraint Based Association Mining.	12	CO-2	K2
III	Classification – Decision Tree Induction – Bayes Classification Methods – Bayesian Belief Networks – Classification by Backpropagation – Support Vector Machines – Lazy Learners – Other Classification Methods – Model Evaluation and Selection – Techniques to Improve Classification Accuracy.	12	CO-3	K3, K4
IV	Clustering Techniques: Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering.	12	CO-4	K5

V	Outlier Detection – Outliers and Outlier Analysis – Outlier Detection Methods – Statistical Approaches – Proximity-Based Approaches – Clustering-Based Approaches – Classification-Based Approaches – Outlier Detection in High-Dimensional Data – Data Mining Applications.	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. J.Han and M. Kamber,2001,Data Mining Concepts and Techniques,Harcourt India Pvt. Ltd - New Delhi.

REFERENCE BOOKS
1. K.P. Soman , Shyam Diwakar, V.Ajay ,2006, Insight into Data Mining Theory and Practice, Prentice Hall of India Pvt. Ltd - New Delhi.

2. Margaret H.Dunbam, "Data Mining Introductory and Advanced Topics", Pearson Education 2003

3. Pang-Ning Tan Michael Steinbach Anuj Karpatne Vipin Kumar, Introduction to Data Mining,2nd Edition, Pearson Education

WEB LINKS
NPTEL Material / Courses
1. https://nptel.ac.in/courses/106/105/106105174/

Core Practical Paper – 5			
Title of the paper with subject code	**PHP Programming Lab**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To implement the PHP programming features in practical applications.

➢ To write, test, and debug simple PHP programs.

➢ To implement PHP programs with conditionals and loops.

➢ Use functions for structuring PHP programs.

COURSE OUTCOME:

CO1: To Write PHP scripts to handle HTML forms.

CO2: To Create PHP programs that use various PHP library functions.

CO3: To Analyze and solve various database tasks using the PHP language

CO4: To Analyze and solve common Web application tasks by writing PHP programs

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Display strings and variables with the echo command	CO-1	K1
2	Display strings and variables with the print command		
3	Create a simple HTML form and accept the user name and display the name through echo command.	CO-2	K2
4	Write a PHP script, which changes the color of the first character of a word.		
5	Write a PHP script, which will return the following components of the url		
6	Write a PHP script to a. Get the first element of an array. b. Insert a new item in an array on any position. c. Sort an array d. Merge two arrays.	CO-3	K3
7	Write a program to calculate and print the factorial of a number.		

8	Write a PHP program to generate and display the first n lines of a Floyd triangle.		K4, K5

9	Write a PHP script to
	
	      a. Transform a string to all uppercase letters.
	
	      b. Transform a string to all lowercase letters.
	
	      c. Reverse a string
	
	      d. Count lines in a file.
		CO-4	

10	Write a PHP script to
	
	      a. Print the current date
	
	      b. Calculate the difference between two dates.
	
	      c. Calculate number of days between two dates.
		CO-5	K6

11	Write a PHP program to demonstrate the concept of Session.		
12	Write a PHP program to demonstrate establishing connection with MySQL Database		

Core Practical Paper – 6			
Title of the paper with subject code	**R Programming Lab**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OBJECTIVE:

1. To implement R programming features in practical applications.

2. To write, test, and debug simple R programs.

3. To implement R programs with conditionals and loops.

4. Use functions for structuring R programs.

COURSE OUTCOME:

CO1: Import external data into R for data processing and statistical analysis

CO2: To learn the R data structures – vector and Data Frame.

CO3: To compute basic summary statistics

CO4: To display data visualizations using R Graphical Package

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Write an R Script to implement the concept of R Operators.	CO-1	K1
2	Write an R Script to implement the concept of Arrays.		
3	Write an R Script to implement the concept of Lists.		
4	Write an R Script to implement the concept of Built-in Functions		K2
5	Write an R Script to implement the concept of Functions		
6	Write an R Script to implement the concept of Vectors.	CO-2	
7	Write an R Script to perform Matrix Addition and Matrix Subtraction.		
8	Write an R Script to perform Matrix multiplication and Transpose of a Matrix		K3
9	Write an R Script to compute Mean and Median.		
10	Write an R Script to compute Quartile, Range and Interquartile Range.		
11	Write an R Script to compute Maximum, Minimum and Percentile	CO-3	

12	Write an R Script to compute Standard deviation, Variance and Covariance.		K4
13	Write an R Script to compute Central Moments, Skewness and Kurtosis.	CO-4	K5
14	Write an R Script to compute Correlation Coefficient.		
15	Write an R Script to implement the concept of Box Plot, Scatter Plot, Pair Plot		
16	Write an R Script to implement the concept of Line Charts and Bar Charts		
17	Write an R Script to implement the concept of Linear Regression.		
18	Write an R Script to implement the concept of Logistic Regression.	CO-5	K6
19	Write an R Script to implement the concept of Normal Distribution		
20	Write an R Script to implement the concept of Binomial Distribution		

Elective Paper Theory – 2			
Title of the paper with subject code	**Introduction to Cloud Computing**		
Category of the course	Year	Semester	Credits
Elective	III	V	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To understand the concepts in Cloud Computing and its Security

➢ To understand the evolving computer model caned cloud computing.

➢ To introduce the various levels of services that can be achieved by cloud.

COURSE OUTCOME:

CO1: To explain and apply levels of services of Cloud

CO2: To describe the security aspects in the cloud.

CO3: Understand cloud storage

CO4: Compare various cloud tools and technologies

CO5: Use various Cloud services

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Cloud Computing Foundation: Introduction to Cloud Computing – Move to Cloud Computing – Types of Cloud – Working of Cloud Computing	12	CO-1	K1
II	Cloud Computing Architecture : Cloud Computing Technology – Cloud Architecture – Cloud Modeling and Design - Virtualization : Foundation – Grid, Cloud and Virtualization – Virtualization and Cloud Computing	12	CO-2	K2
III	Data Storage and Cloud Computing : Data Storage – Cloud Storage – Cloud Storage from LANs to WANs – Cloud Computing Services : Cloud Services – Cloud Computing at Work	12	CO-3	K3
IV	Cloud Computing and Security : Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services – Cloud Computing Tools : Tools and Technologies for Cloud – Cloud Mashaps – Apache Hadoop – Cloud Tools	12	CO-4	K4, K5
V	Cloud Applications – Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services – Cloud	12	CO-5	K6

	Applications			

RECOMMENDED TEXTBOOKS

1. A.Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications 2014.

REFERENCE BOOKS

1. Rajkumar Buyya, James Broberg, Andrzej , "Cloud Computing: Principles and Paradigms", Wiley India Publications 2011

2. Arshdeep Bahga and Vijay Madisetti ,"Cloud Computing – A Hands on Approach", Universities Press (India) Pvt Ltd. 2014.

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2. https://nptel.ac.in/courses/106/105/106105167/
3. https://nptel.ac.in/courses/106/105/106105223/
4. https://www.w3schools.in/cloud-computing/cloud-computing/
5. https://www.geeksforgeeks.org/cloud-computing/

Elective Paper Theory – 3			
Title of the paper with subject code	**Introduction to Blockchain Technology**		
Category of the course	Year	Semester	Credits
Elective	III	V	5
Course Type	**Employability**		

COURSE OBJECTIVE:

➢   To understand the concepts of block chain technology

➢   To understand the consensus and hyper ledger fabric in block chain technology**.**

COURSE OUTCOME:

CO1: State the basic concepts of block chain

CO2: Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger
     Fabric

CO3: Implement SDK composer tool and explain the Digital identity for government

CO4: Study the avenues for of Blockchain Applications in various domains.

CO5: Understand the Privacy issues prevailing in Blockchain Applications.

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	History: Digital Money to Distributed Ledgers - Design Primitives: Protocols, Security, Consensus, Permissions, Privacy : Block chain Architecture and Design - Basic crypto primitives: Hash, Signature - Hash chain to Block chain - Basic consensus mechanisms.	12	CO-1	K1
II	Requirements for the consensus protocols - Proof of Work (PoW) - Scalability aspects of Block chain consensus protocols: Permissioned Block chains - Design goals - Consensus protocols for Permissioned Block chains.	12	CO-2	K2
III	Decomposing the consensus process - Hyper ledger fabric components - Chain code Design and Implementation: Hyper ledger Fabric II: Beyond Chain code: fabric SDK and Front End - Hyper ledger composer tool	12	CO-3	K3
IV	Block chain in Financial Software and Systems (FSS): - Settlements, - KYC, - Capital markets - Insurance - Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.	12	CO-4	K4

V	Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain.	12	CO-5	K5, K6

RECOMMENDED TEXTBOOKS
1. Mark Gates, "Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.

REFERENCE BOOKS
1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", O'Reilly Media, Inc. 2014.
2. Melanie Swa, "Block chain ",O'Reilly Media 2014.

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1. https://nptel.ac.in/courses/106/105/106105235/
2. https://nptel.ac.in/courses/106/104/106104220/
3. https://nptel.ac.in/courses/106/105/106105184/

Core Theory – 10	
Title of the paper with subject code	**Software Project Management**

Category of the course	Year	Semester	Credits
Elective	III	VI	4
Course Type	**Entrepreneurship**		

COURSE OBJECTIVE:

➢ To define and highlight the importance of software project management.

➢ To formulate and define the software management metrics & strategy in managing projects.

COURSE OUTCOME:

CO1: Understand software project management issues and learn project planning.

CO2: Identify the critical path and critical activities using activity-on-arrow networks to estimate the cost of the project.

CO3: Analyze risks associated with the given project using PERT technique

CO4: Understand the techniques for resources allocation and cost monitoring

CO5: Describe the techniques of software configuration management and quality assurance policies for a project.

UNIT NO	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organisation for Standardisation	12	CO-1	K1
II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	12	CO-2	K2, K3
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organisational Planning - Project Roles and Skills	12	CO-3	K4

	Needed.			
IV	Project Management Resource Activities - Organisational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	12	CO-4	K5
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organising - Tools - Benefits - Legal Issues in Software - Case Study	12	CO-5	K6

RECOMMENDED TEXTBOOKS
1. Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.

REFERENCE BOOKS
1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Royce, "Software Project Management", Pearson Education.
3. Jalote, "Software Project Manangement in Practive", Pearson Education, 2002.
4. Bob Hughes, Mikecotterell, "Software Project Management", 3rd Edition, TMH, 2004.

WEB LINKS
NPTEL Material / Courses
1. https://nptel.ac.in/courses/106/105/106105218/
2. https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/

Core Paper Theory – 11

Title of the paper with subject code	**Advanced Python Programming**		
Category of the course	Year	Semester	Credits
Core	III	VI	4
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ To work with python's packages numpy, pandas and matplotlib

➢ Analyse the visualize the data

COURSE OUTCOME:

CO1: To perform numeric computing with numpy elements

CO2: Understand Panda Data structure

CO3: Interact with various types of data and file formats

CO4: Analyze Data through Data Preparation and Manipulation.

CO5: To visualize the data using various Graphical Modules

UNIT NO.	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Numpy: Introduction - Ndarray - create an array - types of data - intrinsic creation of array - Basic operations: arithmetic operators - matrix product - increment and decrement operators - Universal functions - Aggregate functions - Indexing - slicing - Iterating an array - Conditions and boolean arrays - Shape manipulation - Array Manipulation - Reading and Writing array data on files	12	CO-1	K1, K2
II	Pandas: Introduction - Installation of panda - Introduction to pandas data structures: the series - DataFrame - Index objects - Reindexing - dropping - Arithmetic and data alignment - Operations between data structures - function application and mapping - sorting and ranking - Not a Number data	12	CO-2	K3

III	I/O API tools - CSV and Textual files - reading data in CSV or Text Files - Reading and writing HTML Files - Reading Data from XML - Reading data on Microsoft Excel Files - Interacting with Databases - Reading and Writing data with a NoSQL Database	12	CO-3	K4
IV	Data Manipulation: Data preparation - concatenation - Data Transformation - Discretization and Binning - Permutation - String Manipulation - Data Aggregation - Group Aggregation	12	CO-4	K5
V	Data Visualisation: matplotlib library - matplotlib architecture - pyplot - pyplot - the plotting window - using the kwargs - adding elements to the chart - saving your charts - handling date values - chart typology - line charts - histograms - bar charts - pie charts advanced charts	12	CO-5	K6

RECOMMENDED TEXTBOOK

1. Fabio Nelli, Python Data Analytics with Pandas, Numpy and Matplotlib, APress

REFERENCE BOOKS

1. Purna Chander Rao. Kathula, Hands-on Data Analysis and visualization with Pandas, BPB Publications

2. William McKinney, Python for Data Analysis, O'Reilly Publication

3. Daniel Y. Chen, Pandas for Everyone, Pearson Education Publication.

WEB LINKS:

NPTEL Material / Courses

1. https://nptel.ac.in/courses/106/107/106107220/

2. https://nptel.ac.in/courses/106/106/106106212/

3. https://nptel.ac.in/courses/115/104/115104095/

4. https://numpy.org/doc/ - numpy documentation

5. https://pandas.pydata.org/docs/ - pandas documentation

6. https://matplotlib.org/stable/users/index.html - matplotlib documentation

7. https://www.w3schools.com/python/numpy/numpy_intro.asp

8. https://www.geeksforgeeks.org/python-numpy/

9. https://www.w3schools.com/python/pandas/default.asp

10. https://www.geeksforgeeks.org/pandas-tutorial/

11. https://www.w3schools.com/python/matplotlib_intro.asp

12. https://www.geeksforgeeks.org/matplotlib-tutorial/

Core Paper Theory - 12			
Title of the paper with subject code	**Introduction to Data Science**		
Category of the course	Year	Semester	Credits
Core	III	VI	4
Course Type	**Skill Development**		

COURSE OBJECTIVE:

➢ To introduce the concepts, techniques and tools with respect to the various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling and effective communication.

COURSE OUTCOME:

CO1: Evaluate the data analysis techniques for applications handling large data and

CO2: Demonstrate the concept of Data Science process.

CO3: Understand the application of Machine Learning in the Data Science process.

CO4: Visualize and present the inference using various tools.

CO5: Learn to assess the ethics surrounding privacy, Data sharing.

UNIT NO.	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction to Data Science – Benefits and uses – Facets of data – Data science process – Big data ecosystem and data science.	12	CO-1	K1
II	The Data science process – Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building.	12	CO-2	K2
III	Algorithms - Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised.	12	CO-3	K3
IV	Introduction to Hadoop – framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types.	12	CO-4	K4

V	Case Study – Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation	12	CO-5	K5, K6

RECOMMENDED TEXTBOOK

1.Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications.

REFERENCE BOOKS

1.Roger Peng, "The Art of Data Science", lulu.com

2.MurtazaHaider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book.

3.Davy Cielen, Arno D.B. Meysman, Mohamed Ali,"Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press

4.Annalyn Ng, Kenneth Soo, "Numsense! Data Science for the Layman: No Math Added", 1st Edition.

5.Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media

6.Lillian Pierson, "Data Science for Dummies", 2nd Edition

WEB LINKS:
NPTEL Material / Courses

1. Data Science for Engineers - https://nptel.ac.in/courses/106106179/

Core Practical Paper – 7			
Title of the paper with subject code	**Advanced Python Programming Lab**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OBJECTIVE:

➢ Work with data to analyze and visualize them.

COURSE OUTCOME:

CO1: To work with numpy elements

CO2: To store and work with matrix using numpy

CO3: To process the data from the file

CO4: To analyse the data

CO5: To visualize the data

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	1.Write a program to a. Create a null vector of size 10 b. Create a vector with values ranging from 10 to 49 c. Reverse a vector d. Find indices of non - zero elements form [1, 2, 0, 0, 4, 0]	CO-1	K1
2	Write a program to a. Create a 3 X 3 matrix with values ranging from 0 to 8 b. Create a 3 X 3 identity matrix		

	c. Create a 3 X 3 X 3 array with random values d. Create a 10 X 10 array with random values and find the minimum and maximum values e. Normalize a 5 X 5 random matrix		

3	Write a program to
	    a. Create a random vector of size 10 and sort it
	    b. Create two random array A and B, Check if they are equal
	    c. Make an array immutable
	    d. Create a random vector of size 10 and replace the maximum value by 0
	    e. Find the most frequent value in the array from a random array
		CO-2	K2

4	Write a program to create data type object and use sum, sqrt and Transpose on the object		K3
5	Write a program to demonstrate Stacking in numpy		
6	Write a program to create series from scalar values, Dictionary and Ndarray	CO-3	
7	Write a program to create dataframe from dictionary, series and 2D-numpy ndarray		
8	Write a program to read and write data from a csv file using pandas		
9	Write a program to read and write data from a xlsx file using pandas		K4
10	Write a program to view the top rows, borrow rows of the frames and view the statistical details of the dataframe		
11	Create a csv file with roll no, name , 5 marks. write a program to select the student who are secured 60 marks and above in all the subject	CO-4	
12	Write a program to generate a 100 random numbers and create a scatter diagram for the random number		K5

13	Create a csv file storing the temperature of the last 10 days and create line chart using matplotlib		
14	Write a program to generate a 100 random numbers in range 1 to 100 and classify the number into frequency (1 - 10, 11 - 20, …., 90 - 100) and create a histogram for the random numbers	CO-5	K6
15	Create a csv file storing the attendance of the last month and create a pie chart by classifying attendance percentage into 0 - 50, 51 - 60, 61 - 75 , 75 and above		

Core Practical Paper – 8			
Title of the paper with subject code	**Mini Project & Viva Voce**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Entrepreneurship**		

COURSE OBJECTIVE:

The aim of the mini project is that the student has to understand the real time software development environment. The student should gain a thorough knowledge in the problem, he/she has selected and the language / software, he/she is using.

COURSE OUTCOME:

CO1: To practice acquired knowledge within the chosen area of technology for project development.

CO2: Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

CO3: Reproduce, improve and refine technical aspects for engineering projects.

CO4: Work as an individual or in a team in development of technical projects.

CO5: Communicate and report effectively project related activities and findings

Project planning:

B.C.A mini Project is an involved exercise, which has to be planned well in advance. The topic should be chosen in the beginning of final year itself. Related reading training and discussions of first internal project viva voce should be completed in the first term of final year.

I Selection of the Project Work

Project work could be of three types.

a) **Developing solution for Real Life Problem**

In this case a requirement for developing a computer-based solution already exists and the different stages of system development life cycle is to be implemented successfully. Examples are accounting software for particular organization, computerization of administrative function of an organization, web based commerce etc.

b) **System Software Project**

Projects based on system level implementation. An example is a Tamil language editor with spell checker, compiler design.

b) **Research Level Project**

These are projects which involve research and development and may not be as a structured and clear cut as in the above case. Examples are Tamil character recognition, neural net based

speech recognizer etc. This type of projects provides more challenging opportunities to students.

II Selection of Team

To meet the stated objectives, it is imperative that mini project is done through a team effort. Though it would be ideal to select the team members at random and this should be strongly recommended, due to practical consideration students may also be given the choice of forming themselves into teams with three members. A team leader shall be selected. Team shall maintain the minutes of meeting of the team members and ensure that tasks have been assigned to every team member in writing. Team meeting minutes shall form a part of the project report. Even if students are doing project as groups, each one must independently take different modules of the work and must submit the report.

III Selection of Tools

No restrictions shall be placed on the students in the choice of platform/tools/languages to be utilized for their project work, though **Open Source is strongly recommended**, wherever possible. No value shall be placed on the use of tools in the evaluation of the project.

IV Documentation

Three copies of the project report must be submitted by each student (one for department library, one for the organization where the project is done and one for the student himself/herself). The final outer dimensions of the project report shall be 21cm X 30 cm. The color of the flap cover shall be light blue. Only hard binding should be done. The text of the report should be set in 12 pt, Times New Roman, 1.5 spaced.

Headings should be set as follows: CHAPTER HEADINGS 16 pt, Arial, Bold, All caps, Centered.

1. Section Headings 14 pt Bookman old style, Bold, Left adjusted.

1.1 Section Sub-heading 12 pt, Bookman old style.

Title of figures tables etc are done in 12 point, Times New Roman, Italics, centered.

Content of the Project should be relevant and specify particularly with reference to the work. The report should contain the requirement specification of the work, Analysis, Design, Coding, testing and Implementation strategies done.

• Organizational overview (of the client organization, where applicable)

• Description of the present system

• Limitations of the present system

• The Proposed system - Its advantages and features

• Context diagram of the proposed system

• Top level DFD of the proposed system with at least one additional level of expansion

• Program List (Sample code of major functions used)

• Files or tables (for DBMS projects) list. List of fields or attributes (for DBMS projects) in each file or table.

• Program – File table that shows the files/tables used by each program and the files are read, written to, updated, queried or reports were produced from them.

• Screen layouts for each data entry screen.

• Report formats for each report.

Some general guidelines on documentation are:

1. Certificate should be in the format: "Certified that this report titled……………………….is a bonafide record of the project work done by Sri/ Kum ……………………….under our supervision and guidance, towards partial fulfillment of the requirement for award of the Degree of B.C.A of Sri Sankara Arts And Science College, Enathur, Kanchipuram" with dated signature of internal guide, external guide and also Head of the Department/ College.

2. If the project is done in an external organization, another certificate on the letterhead of the organization is required: "Certified that his/her report titled …………………………….is a bonafide record of the project work done by Sri/Kum…………….under my supervision and guidance, at the ……………..department of……………………… (Organization) towards partial fulfillment of the requirement for the award of the Degree of B.C.A of Sri Sankara Arts And Science College, Enathur, Kanchipuram.

3. Page numbers shall be set at right hand bottom, paragraph indent shall be set as 3.

4. Only 1.5 space need be left above a section or subsection heading and no space may be left after them.

5. References shall be IEEE format (see any IEEE magazine for detail) While doing the project keep note of all books you refer, in the correct format and include them in alphabetical order in your reference list.

V Project Evaluation:

Internal Assessment

There shall be six components that will be considered in assessing a project work with weightage as indicated.

1. Timely completion of assigned tasks as evidenced by team meeting minutes 20%

2. Individual involvement, team work and adoption of industry work culture 10%

3. Quality of project documentation (Precision, stylistics etc) 10%

4. Achievement of project deliverables 20%

5 Effective technical presentation of project work 10%

6. Viva 30%

Based on the above 6 components internal mark (40) can be awarded.

External Assessment

Dissertation/Project submitted at the end of third year shall be valued by two examiners appointed by the Controller for the conduct of practical exam. The board of examiners shall award 40 marks based on the following components.

1. Achievement of project deliverables - 20 Marks

2. Effective technical presentation of project work - 20 Marks

3. Project Viva - 20 Marks

There shall be a common written examination conducted for all the candidates in each group together for a minimum of 10 minutes.

(i) Requirement Specification of Project

(ii) Design of Project

(iii) Testing and Implementation of Project

Elective Paper Theory – 4			
Title of the paper with subject code	**Introduction to Deep Learning**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Skill Development**		

COURSE OBJECTIVE:

● Understand the context of Deep learning

● Understand the data needs of Deep learning.

COURSE OUTCOME:

CO1: Understand Neural Networks and to traverse the layers of data abstraction.

CO2: Learn topics such as CNN, RNN, training deep networks and high-level interfaces

CO3: Build Deep Learning Models and interpret the results

CO4: Understand the fundamental concepts of Artificial Neural Networks

CO5: Differentiate between Machine Learning, Deep learning and Artificial Intelligence

UNIT NO.	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction to Artificial Neural Networks : Artificial Neural Networks, Feed-forward Neural Networks, Gradient Descent and the Back Propagation Algorithms, Regularization and Optimization. Difference between typical Machine Learning and Deep Learning	12	CO-1	K1, K2
II	Convolutional Neural Networks: Convolutional Neural Network (CNN), Convolution/Pooling layers, Activation maps, CNN as a Feature Extractor, Some Standard CNN architectures like AlexNet, VGGNet, GoogLeNet, ResNet and more Recent Networks	12	CO-2	K3
III	Autoencoders and Generative Adversarial Networks: Autoencoders (AEs), Undercomplete and Overcomplete AE, Convolutional AE, Regularization, Sparsely regulated AEs,Denoising and Stacked AE. Generative Adversarial Networks (GAN), Variants of GAN.	12	CO-3	K4
IV	Recurrent Neural Networks: Brief Introduction to Recurrent Neural Networks, LSTM, GRU and their applications in Machine Translation, Language Modelling and Sentiment Classification.	12	CO-4	K5

V	CNN Application to Classification and Detection problems: Object detection algorithms, RCNN, Faster R-CNN, YOLO and SSD	12	CO-5	K6

RECOMMENDED TEXTBOOK

1.   Chollet, Francois. Deep learning with Python, Manning Publications

REFERENCES:
1.   Ian Goodfellow ,Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning series), The MIT Press,
2.   Seth Weidman , Deep Learning from Scratch: Building with Python from First Principles,O'Reilly; 1st Edition
3.   Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Deep Learning, Pearson Education; First edition

WEB LINKS:

NPTEL Material / Courses

- https://nptel.ac.in/courses/106/105/106105215/
- https://nptel.ac.in/courses/106/106/106106184/
- https://nptel.ac.in/courses/106/106/106106201/
- https://www.geeksforgeeks.org/introduction-deep-learning/

Elective Paper Theory – 5			
Title of the paper with subject code	**Introduction to Web Analytics**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Skill Development**		

COURSE OBJECTIVE:

● To know the importance of quality data, get insights and techniques.

● To develop customer centric approach in dealing with data

● To apply the principles, tools and methods of web analytics.

● To apply analytics for business situations.

COURSE OUTCOME:

CO1: Understand the fundamental concepts and scope for Web Analytics.

CO2: Confidence about where web analytics fits in an organization

CO3: Identify the key performance indicators of web analytics

CO4: Explore the use of tools and techniques of web analytics

CO5: To gain exposure on websites, web data insights and conversions

UNIT NO.	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Introduction: Understanding web analytics - The foundations of Web analytics: Techniques and Technologies - Present and Future of Web analytics.	12	CO-1	K1
II	Data Collection: Importance and Options - Web server log files: Click stream data - User submitted information - Web server performance data - Page tags - First and third party tracking.	12	CO-2	K2
III	Web Analytics Strategy: Key performance indicators - Web analytics process - Heuristics evaluations - Site visits - Surveys - Measuring reach - Measuring acquisition - Measuring conversion - Measuring retention - Security and privacy implications of Web analytics.	12	CO-3	K3, K4
IV	Web Analytics tools: Content organization tools - Process measurement tools - Visitor segmentation tools - Campaign analysis tools - Commerce measurement tools - Google analytics - Omniture - Web trends - Yahoo! Web analytics.	12	CO-4	K5

	Google Analytics:: Key features and capabilities - Quantitative and qualitative data - Working of Google analytics - Privacy - Tracking visitor clicks, Outbound links and Non HTML files.			
V	Google Analytics:: Key features and capabilities - Quantitative and qualitative data - Working of Google analytics - Privacy - Tracking visitor clicks, Outbound links and Non HTML files.	12	CO-5	K6

RECOMMENDED TEXTBOOK
1. Bernard J. Jansen, "Understanding User-Web Interactions via Web analytics‖", Morgan and Claypool

REFERENCES:
1. Avinash Kaushik, "Web Analytics 2.0", John Wiley and Sons
2. Brian Clifton, "Advanced web metrics with Google analytics", John Wiley and Sons
3. Justin Cutroni, "Google Analytics", O'Reilly,
4. Jerri L. Ledford, Joe Teixeira and Mary E. Tyler, "Google Analytics", John Wiley and Sons

WEB LINKS:
1. https://analytics.google.com/analytics/web/
2. https://developers.google.com/analytics
3. https://www.wix.com/blog/2020/01/best-website-analytics-tools/

Elective Paper Theory – 6			
Title of the paper with subject code	**Social Media Analytics**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Skill Development**		

COURSE OBJECTIVE:

➢ To understand how accurately analyze voluminous complex data set in social media and other sources.

➢ To understand the models and algorithms to process large data sets.

➢ To understand social behaviour and recommendation challenges and methodologies

Course Outcome:

CO1: Understand and apply key concepts in Social Media metrics.

CO2: Understand and apply concepts of Graph Models, Social communities.

CO3: Understand and apply algorithms to model data using graph and network structures

CO4: Develop social media strategy and measure social media campaign effectiveness.

CO5: Make better business decisions by leveraging social media data.

UNIT NO.	SYLLABUS	HOURS	COs	COGNITIVE LEVEL
I	Social Media Mining - Introduction - Atoms - Molecules - Interactions - Social Media mining Challenges - Graphs - Basics - Nodes - Edges - Degree of Distribution - Types - Directed - Undirected - Weighted - Graph Connectivity - Tress and Forests - Bipartite graphs - Complete Graphs - Sub graphs – Planar Graphs - Graph Representation - Graph Traversal Algorithms – Shortest path algorithms Dijkstra"s - Spanning tree algorithms – Prims - Bipartite matching – Ford-Fulkerson algorithm	12	CO-1	K1, K2
II	Network Models - Measures - Node : Eigen Centrality - Page Rank - Group Measures - Betweenness centrality - group degree centrality, centrality, and group - Closeness centrality - Node Linking Behavior - Transitivity and reciprocity - Linking Analysis - Cluster coefficient - Jaccard - Case Study : -Modeling small networks with real	12	CO-2	K3

	world model.			
III	Social media Communities - Social Communities - Member based Detection - Node degree - Node Similarity - Node reachability - Group Based detection methods - balanced - robust - modular - dense - hierarchical - Spectral Clustering: Balanced Community algorithm Community Evolution - Evaluation.	12	CO-3	K4
IV	Social Network - Information Diffusion - Types - herd behavior - information cascades diffusion of innovation - epidemics - Diffusion Models Case Study - Herd Behavior - Information Cascades Methods - Social Similarity - assortativity - Social Forces - Influence homophily - Confounding - Assortativity measures - Influence measures - Predictive Models	12	CO-4	K5
V	Recommendation Vs Search - Recommendation Challenges - Recommender algorithms – Content - Based Methods - Collaborative Filtering - Memory Based - Model Based - Social Media Recommendation - User friendship - Recommendation Evaluation - Precision - Recall – Behavioral - User Behavior - User - Community behavior - User Entity behavior - Behavioral Analytics – Methodology.	12	CO-5	K6

RECOMMENDED TEXTBOOK

1.Reza Zafarani , Mohhammad Abi Elasi, Huan Liu, "Social Media Mining: An Introduction", Cambridge press, 2014

REFERENCE BOOKS:

1.Peter Mika, "Social Networks and the Semantic Web", Springer, First Edition,

2007.

2.Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging

Technologies and Applications for Searching the Web Effectively", IGI Global

Snippet, 2008.

3. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, First Edition, 2011

Non-Major Elective : 1			
Title of the paper with subject code	**Technical Writing with LaTex**		
Category of the course	Year	Semester	Credits
Elective	I	I	2

UNIT NO.	SYLLABUS	COs	COGNITIVE LEVEL
I	Introduction: Overview – Install LaTex – Create First LaTex Document – Section level and ToC	CO-1	K1
II	Styling Pages: Paper size and Margins – Page Styles – Header and Footer – Formatting pages – footnotes – Orientation – Page breaks – Multicolumn document – Reading error messages	CO-2	K2
III	Formatting Content: Formatting Text – Colouring Text – Aligning Text – Spacing Text – Bullets and Numbering – Writing Mathematics	C0-3	K3
IV	Tables and Images: Creating Tables – Table Borders Merging Rows and Columns – Large Tables – Table Environments – Including Images – Image Properties – Image Borders – Figure and Sub-Figures	CO-4	K4, K5
V	Referencing and Indexing: Creating Title Page – Hyperlinks – Cross Referencing – Creating Indexes – Creating Bibliography.	CO-5	K6
RECOMMENDED TEXTBOOKS 1. Firuza Karmali Aibara, A Short Introduction to Latex: A Book for Beginners, Createspace Independent Publishing Platform 2. Stefan Kottwitz, LaTeX Beginner's Guide: Create high-quality, professional-looking documents and books for business and science using LaTeX, Packt Publishing.			
REFERENCE BOOKS			

1. George Gratzer, First Steps in LaTeX, Birkhäuser Publication
2. Pooja Raj Verma, Sandeep Kumar, Binay kumar sharma, LaTeX and HTML, Vardhman Publications.

Non-Major Elective : 2			
Title of the paper with subject code	**Web Office**		
Category of the course	Year	Semester	Credits
Elective	I	I	2

UNIT NO.	SYLLABUS	COs	COGNITIVE LEVEL
I	Google Docs: Accessing Google Doc - Sharing a Google Doc - Using the editing tools - Organizing Google Docs - Downloading and converting Google Docs.	CO-1	K1
II	Google Slides: Accessing Google Slides - Creating presentation in Google Slides - Adding and editing content - Presenting Google Slides - Sharing Google Slides	CO-2	K2
III	Google Sheets: Accessing Google Sheets - Creating a Google Sheet - Sorting and organizing data - Filtering data - Editing a Google Sheet - Creating charts and graphs - Sharing a Google Sheet	CO-3	K3, K4
IV	Google Forms - Accessing Google Forms - Creating a Google Form - Sharing a Google Form - Viewing responses as a summary - Viewing responses individually.	CO-4	K5
V	Google Drive - Google Calendar – Google Jamboard - Google Meet - Google Maps - Google Classroom - LMS - CANVAS LMS - MOODLE LMS - EDMODO.	CO-5	K6

UNIT NO.	SYLLABUS	COs	COGNITIVE LEVEL
I	Programming Language: Introduction - classification of programming languages - Machine language - assembly language - high level language - Translator: Compiler - Interpreter - C Language: Introduction - history - structure of C - tokens: identifiers - keywords - variables - constants - data types	CO-1	K1, K2
II	I/O function: Scanf() function - printf() function - gets() - puts() - getc() - putc() - getch() vs getche() - Operators	CO-2	K3
III	Conditional Statement: simple if - if else - nested if - switch - Looping: while - do while - for - nested for - Jumping statement: goto - continue - break	CO-3	K4
IV	Arrays: one dimensional array - two dimensional array	CO-4	K5

Non-Major Elective : 3			
Title of the paper with subject code	**Programming Fundamentals**		
Category of the course	Year	Semester	Credits
Elective	I	I	2

V	Function: types of function - category of function – recursion	CO-5	K6

Non-Major Elective : 4				
Title of the paper with subject code	**Technical Writing with LaTex LAB**			
Category of the course	Year	Semester		Credits
Elective	I	II		2

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Create LaTeX document using class, packages, information.	CO-1	K1
2	Create LaTex document with 5 sections and corresponding Toc		K2
3	Create LaTex document with paper size as A4 and margin at 2cm.		
4	Create LaTex document with document name in header and page number in footer.		
5	Create LaTex document with footnote.	CO-2	
6	Create LaTex document with multicolumn document.		
7	Create LaTex document with text formatting (bold, italic, underline, text colouring).		K3
8	Create LaTex document with text alignment (left, right, centre, justify).		
9	Create LaTex document with different vertical spaces (\medskip, \bigskip, \vspace{20pt}, \vfill, \pagebreak)	CO-3	
10	Create LaTex document displaying Input Devices using Bullets.		K4
11	Create LaTex document displaying Output Devices using Numbering.		
12	Create LaTex document displaying quadratic equation $x = -b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$		
13	Create LaTex document displaying time table.	CO-4	K5

14	Create LaTex document with Image.		
15	Create LaTex document with Figures and Sub-Figures.		
16	Create LaTex document with title page.		K6
17	Create LaTex document with hyperlink.	CO-5	
18	Create LaTex document with cross reference.		
19	Create LaTex document with Indexes.		
20	Create LaTex document with Bibliography		

Non-Major Elective : 5			
Title of the paper with subject code	**Web Office LAB**		
Category of the course	Year	Semester	Credits
Elective	I	II	2

S. NO.	LIST OF EXERCISES	COs	COGNITIVE LEVEL
1	Create a Google Doc about your Institution and share with your friends	CO-1	K1
2	Create a Google Doc and allow edit access to your friends		
3	Perform editing in the available Google Doc and download it.	CO-2	K2
4	Create a Google Slides about your Institution and share with your friends	CO-3	K3
5	Create a Google Slides about yourself and present the Slides.		
6	Create a Google Sheets to add some data and share with your friends		K4
7	Create a Google Sheet and perform sorting the data.		
8	Create a Google Sheet and display the data using Charts and Graphs	CO-4	
9	Create a Google Form to collect the contact information from your friends		K5
10	Conduct a Quiz by creating Google Forms among your Friends.	CO-5	
11	Create a folder in your Google Drive and add upload files of different file format.		K6
12	Share your Google Drive Folder contents to your friends by sharing the link.		

Non-Major Elective : 6			
Title of the paper with subject code	**Programming Fundamentals**		
Category of the course	Year	Semester	Credits
Elective	I	II	2

S. NO.	LIST OF EXERCISES	COs	COGNIYIVE LEVEL
1	Write a C program to print "Hello World"	CO-1	K1
2	Write a C program to read an integer value and print the value		
3	Write a C program for calculate area of Circle	CO-2	K2
4	Write a C program to perform addition, subtraction, multiplication and division using arithmetic operator		
5	Write a program to find a given number is odd or even	CO-3	K3
6	Write a program to print a given a number is positive or negative		
7	Write a program to print a. 1 2 3 4 5 6 7 8 9 10 b. 10 9 8 7 6 5 4 3 2 1 c. 1 3 5 7 9 d. 9 7 5 3 1 e. 2 4 6 8 10		K4
8	Write a program to calculate sum of n numbers	CO-4	K5
9	Write a program to generate fibonacci series	CO-5	K6
10	Write a program to calculate factorial value using function		

PROGRAM OUTCOMES (PO)

1. Enriching the knowledge in theoretical and practical aspects at the undergraduate level.

2. Developing curiosity in the subject and encouraging them to pursue higher studies.

3. Enabling the students to come out successfully in competitive examinations.

4. Developing students' skills, based on current trends by offering Job oriented, Entrepreneurial, certificate courses and Value-added courses.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO1: Identify and define the concepts of computer Programming.

PSO2: Illustrate the constructs of computer Programming

PSO3: Comprehending the technical skill

PSO4: Illustrate the technical skills

PSO5: Develop practical skills to provide solution to society, industry and business

	PSO1	PSO2	PSO3	PSO4	PSO5
PO1	✓				
PO2		✓			
PO3			✓	✓	
PO4					✓

Core Paper Theory - 1			
Title of the paper with subject code	**Web Programming**		
Category of the course	Year	Semester	Credits
Core	I	I	4
Course Type	**Employability**		

Course Outcome:

CO1: To work with basic tags of HTML

CO2: To Illustrate the application of List and Tables

CO3: To Explain various basic elements of JavaScript

CO4: To Understand various Event Handling Procedures

CO5: To Demonstrate form handling

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓
CO2	✓	✓			✓
CO3	✓				
CO4	✓	✓			
CO5	✓	✓			✓

Core Practical - 1			
Title of the paper with subject code	**Web Programming Lab**		
Category of the course	Year	Semester	Credits
Core	I	I	3
Course Type	**Employability**		

CO1: Understand, analyze and apply the role of languages like HTML, CSS and Javascript in web applications

CO2: Analyze a web project and identify its elements and attributes in comparison to traditional projects.

CO3: Understand, analyze and create web pages using HTML and Cascading Styles sheets.

CO4: Understand, analyze and build dynamic web pages using JavaScript (client side programming).

CO5: Understand, analyze and build interactive web applications.

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✔	✔			
CO2		✔			✔
CO3		✔			✔
CO4	✔	✔			✔
CO5	✔	✔			✔

Core Paper Theory - 2			
Title of the paper with subject code	**Python Programming**		
Category of the course	Year	Semester	Credits
Core	I	II	4
Course Type	**Employability**		

Course Outcome:

CO1: To Understand the principles of Python and acquire skills in programming in python

CO2: To develop the emerging applications of relevant field using Python

CO3: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.

CO4: Demonstrate the concepts of List and Tuples

CO5: Illustrate Dictionaries

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓				
CO2	✓	✓			✓
CO3	✓	✓			✓
CO4	✓	✓			✓
CO5	✓	✓			✓

Core Practical - 2			
Title of the paper with subject code	**Python Programming Lab**		
Category of the course	Year	Semester	Credits
Core	I	II	3
Course Type	**Employability**		

Course Outcome:

CO1: Understand the numeric or real life application problems and solve them.

CO2: Apply a solution clearly and accurately in a program using Python.

CO3: Apply the best features available in Python to solve the situational problems.

CO4: Illustrate list and tuple

CO5: Demonstrate the concept of application of Dictionaries

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓				✓
CO2		✓			✓
CO3		✓			✓
CO4		✓			✓
CO5		✓			✓

Third Semester

Core Paper Theory - 3			
Title of the paper with subject code	**Java Programming**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Employability**		

ourse Outcome:

CO1: Understand the concept of Object Oriented Programming

CO2: To Work with control Structures

CO3: Creating classes and implementing inheritance

CO4: Describe and construct Package, Interface

CO5: To Work with Exception

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✔				
CO2	✔	✔			✔
CO3	✔	✔			✔
CO4	✔	✔			✔
CO5	✔	✔			✔

Core Paper Theory - 4			
Title of the paper with subject code	**Operating System**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Skill Development**		

Course Outcome:

CO1: Understand the basic functionality of the operating system

CO2: Summarize Memory Management

CO3: Describe Scheduling

CO4: Illustrate Device Management

CO5: Understand File System

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✔		
CO2			✔	✔	
CO3			✔	✔	
CO4			✔	✔	
CO5			✔		

Core Paper Theory - 5			
Title of the paper with subject code	**Data Structures**		
Category of the course	Year	Semester	Credits
Core	II	III	4
Course Type	**Skill Development**		

Course Outcome:

CO1: Use linked list in various applications

CO2: Illustrate stack and queue data structures

CO3: Work with different types of tree

CO4: Write applications using Graph

CO5: Compare and Contrast various sorting and searching Algorithm

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✔	✔			✔
CO2	✔	✔			✔
CO3	✔	✔			
CO4	✔	✔			
CO5	✔	✔			✔

Core Practical - 3			
Title of the paper with subject code	**Java Programming Lab**		
Category of the course	Year	Semester	Credits
Core	II	III	2
Course Type	**Employability**		

Course Outcome:

CO1: To work with simple problems

CO2: To implement Class, object and use methods

CO3: Suggest appropriate linear and non-linear data structure operations for solving a given problem.

CO4: Analyze various sorting methods.

CO5: Illustrate Tree and Graph

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓
CO2		✓			✓
CO3		✓		✓	✓
CO4		✓			
CO5		✓			✓

Core Paper Theory - 6			
Title of the paper with subject code	**Data Communication and Networking**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Employability**		

Course Outcome:

CO1: Describe the layers in OSI Model and TCP/IP protocol

CO2: Understand various guided media

CO3: Summarize Data link control

CO4: Appraise the Addressing in IPV4 & IPV6

CO5: Articulate TCP and UDP

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓		
CO3			✓		
CO4			✓	✓	
CO5			✓	✓	

Core Paper Theory - 7			
Title of the paper with subject code	**Relational Database Management System**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Employability**		

Course Outcome:

CO1: Understand the purpose and need for Database Management System

CO2: Demonstrate the applicability of Codd's Rules

CO3: Illustrate the need and necessity of Normalization concepts

CO4: Effective use of DDL, DML & TCL commands

CO5: Able to implement features like Database connectivity with programming languages

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓		
CO2	✓		✓		
CO3	✓		✓		
CO4	✓	✓			✓
CO5	✓	✓			✓

Core Paper Theory - 8			
Title of the paper with subject code	**Software Engineering**		
Category of the course	Year	Semester	Credits
Core	II	IV	4
Course Type	**Entrepreneurship**		

Course Outcome:

CO1: Understand various software development models

CO2: To write the specification for software development

CO3: Work with various design principles

CO4: Understand Object Oriented design principles

CO5: Describe various testing techniques

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓	✓	
CO3			✓	✓	
CO4			✓		
CO5			✓		

Core Practical - 4			
Title of the paper with subject code	**RDBMS LAB**		
Category of the course	Year	Semester	Credits
Core	III	IV	2
Course Type	**Employability**		

Course Outcome:

CO1: Implement the DDL , DML Commands and Constraints

CO2: Create, Update and query on the database

CO3: Work Interaction between front end and back end

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓			✓
CO2		✓			✓
CO3		✓			✓

Core Paper Theory - 9			
Title of the paper with subject code	**PHP Programming**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OUTCOMES:

CO1: To understand the major elements of the PHP & MySQL

CO2: Analyze the basic structure of a PHP web application

CO3: Learn different ways of connecting to MySQL through PHP

CO4: Understand the File Structure Concepts in PHP

CO5: Understand the implementation of OOP Concepts in PHP

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓
CO2		✓			✓
CO3		✓		✓	✓
CO4		✓			
CO5		✓			✓

Core Paper Theory – 10			
Title of the paper with subject code	**R Programming**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OUTCOMES:

CO1: Understand basic concepts such as data type and index and to use them

CO2: Understand the R data structures – vector and Data Frame.

CO3: Conceptualize and create loops to solve different types of problems.

CO4: Construct tables and figures for descriptive statistics

CO5: Apply R graphical packages for visual representation of data.

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓			✓
CO2		✓			✓
CO3		✓		✓	✓
CO4		✓			

CO5		✓			✓

Core Paper Theory – 11			
Title of the paper with subject code	**Data Mining**		
Category of the course	Year	Semester	Credits
Core	III	V	4
Course Type	**Employability**		

COURSE OUTCOMES:

CO1: To have knowledge in Data mining concepts.

CO2: To apply Data mining concepts in different fields

CO3: Ability to apply acquired knowledge for understanding data and select suitable methods for Data Analysis.

CO4: Ability to identify appropriate Data Mining Algorithm to solve different applications.

CO5: Ability to conceptualize basic applications, concepts and techniques of Data Mining

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓		
CO3			✓	✓	

CO4			✓	✓	✓
CO5			✓	✓	✓

Core Practical Paper – 5			
Title of the paper with subject code	**PHP Programming Lab**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OUTCOMES:

CO1:To Write PHP scripts to handle HTML forms.

CO2: To Create PHP programs that use various PHP library functions.

CO3: To Analyze and solve various database tasks using the PHP language

CO4:To Analyze and solve common Web application tasks by writing PHP programs

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓			
CO2		✓	✓		
CO3		✓	✓		
CO4		✓	✓		

Core Practical Paper – 6			
Title of the paper with subject code	**R Programming Lab**		
Category of the course	Year	Semester	Credits
Core	III	V	2
Course Type	**Employability**		

COURSE OUTCOMES:

CO1: Import external data into R for data processing and statistical analysis

CO2: To learn the R data structures – vector and Data Frame.

CO3: To compute basic summary statistics

CO4:To display data visualizations using R Graphical Package

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓				
CO2	✓	✓			✓
CO3	✓	✓			✓
CO4	✓	✓			✓

Elective Paper Theory – 1			
Title of the paper with subject code	**Introduction to Cloud Computing**		
Category of the course	Year	Semester	Credits
Elective	III	V	4
Course Type	**Employability**		

COURSE OUTCOMES:

CO1: To explain and apply levels of services of Cloud

CO2: To describe the security aspects in the cloud.

CO3: Understand cloud storage

CO4: Compare various cloud tools and technologies

CO5: Use various Cloud services

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓		
CO3			✓		
CO4			✓		
CO5			✓	✓	

Elective Paper Theory – I			
Title of the paper with subject code	**Introduction to Blockchain Technology**		
Category of the course	Year	Semester	Credits
Elective	III	V	5
Course Type	**Employability**		

Course Outcome:

CO1: State the basic concepts of block chain

CO2: Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger Fabric

CO3: Implement SDK composer tool and explain the Digital identity for government

CO4: Study the avenues for of Blockchain Applications in various domains.

CO5: Understand the Privacy issues prevailing in Blockchain Applications.

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓	✓	
CO3			✓		

CO4				✓
CO5			✓	

Core Paper Theory – 12			
Title of the paper with subject code	**Software Project Management**		
Category of the course	Year	Semester	Credits
Elective	III	VI	4
Course Type	**Entrepreneurship**		

COURSE OUTCOME:

CO1:Understand software project management issues and learn project planning.

CO2:Identify the critical path and critical activities using activity-on-arrow networks to estimate the cost of the project.

CO3:Analyze risks associated with the given project using PERT technique

CO4:Understand the techniques for resources allocation and cost monitoring

CO5:Describe the techniques of software configuration management and quality assurance policies for a project.

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓		

			✓	✓	
CO3			✓	✓	
CO4			✓		
CO5			✓	✓	

Core Paper Theory – 13			
Title of the paper with subject code	**Advanced Python Programming**		
Category of the course	Year	Semester	Credits
Core	III	VI	4
Course Type	**Employability**		

COURSE OUTCOME:

CO1: To perform numeric computing with numpy elements

CO2: Understand Panda Data structure

CO3: Interact with various types of data and file formats

CO4: Analyze Data through Data Preparation and Manipulation.

CO5: To visualize the data using various Graphical Modules

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓				
CO2	✓				

CO3	✓	✓			✓
CO4	✓	✓			✓
CO5	✓	✓			✓

Core Paper Theory – 14				
Title of the paper with subject code	**Introduction to Data Science**			
Category of the course	Year	Semester	Credits	
Core	III	VI	4	
Course Type	**Skill Development**			

COURSE OUTCOME:

CO1: Evaluate the data analysis techniques for applications handling large data and

CO2: Demonstrate the concept of Data Science process.

CO3: Understand the application of Machine Learning in the Data Science process.

CO4: Visualize and present the inference using various tools.

CO5: Learn to assess the ethics surrounding privacy, Data sharing.

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓
CO2	✓	✓			

				✓		
CO3			✓		
CO4	✓	✓			✓
CO5			✓		

Core Practical Paper – 7				
Title of the paper with subject code	**Advanced Python Programming Lab**			
Category of the course	Year	Semester	Credits	
Core	III	V	2	
Course Type	**Employability**			

COURSE OUTCOME:

CO1: To work with numpy elements

CO2: To store and work with matrix using numpy

CO3: To process the data from the file

CO4: To analyse the data

CO5: To visualize the data

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓			✓
CO2		✓			✓
CO3		✓			✓
CO4		✓			✓
CO5		✓			✓

Core Practical Paper – 8			
Title of the paper with subject code	**Mini Project & Viva Voce**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Entrepreneurship**		

COURSE OUTCOME:

CO1: To practice acquired knowledge within the chosen area of technology for project development.

CO2: Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

CO3: Reproduce, improve and refine technical aspects for software projects.

CO4: Work as an individual or in a team in development of technical projects.

CO5: Communicate and report effectively project related activities and findings

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1				✓	
CO2				✓	✓
CO3				✓	✓
CO4				✓	✓
CO5				✓	

Elective III :			
Title of the paper with subject code	**Introduction to Deep Learning**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Skill Development**		

COURSE OUTCOME:

CO1: Understand Neural Networks and to traverse the layers of data abstraction.

CO2: Learn topics such as CNN, RNN, training deep networks and high-level interfaces

CO3: Build Deep Learning Models and interpret the results

CO4: Understand the fundamental concepts of Artificial Neural Networks

CO5: Differentiate between Machine Learning, Deep learning and Artificial Intelligence

	CO1	CO2	CO3	CO4	CO5
Unit I	✔				
Unit II		✔			
Unit III			✔		
Unit IV				✔	
Unit V					✔

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2		✓			
CO3		✓	✓	✓	✓
CO4			✓		
CO5					

Elective III :			
Title of the paper with subject code	**Introduction to Web Analytics**		
Category of the course	Year	Semester	Credits
Elective	III	VI	5
Course Type	**Skill Development**		

COURSE OUTCOME:

CO1: Understand the fundamental concepts and scope for Web Analytics.

CO2: Confidence about where web analytics fits in an organization

CO3: Identify the key performance indicators of web analytics

CO4: Explore the use of tools and techniques of web analytics

CO5: To gain exposure on websites, web data insights and conversions.

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓			

CO2		✓			
CO3	✓			✓	
CO4	✓	✓	✓	✓	
CO5		✓	✓		

Elective III				
Title of the paper with subject code	**Social Media Analytics**			
Category of the course	Year	Semester	Credits	
Elective	III	VI	5	
Course Type	**Skill Development**			

Course Outcome:

CO1: Understand and apply key concepts in Social Media metrics.

CO2: Understand and apply concepts of Graph Models, Social communities.

CO3: Understand and apply algorithms to model data using graph and network structures

CO4: Develop social media strategy and measure social media campaign effectiveness.

CO5: Make better business decisions by leveraging social media data.

	CO1	CO2	CO3	CO4	CO5
Unit I	✓				
Unit II		✓			
Unit III			✓		
Unit IV				✓	
Unit V					✓

PSO – CO MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓		
CO2			✓		
CO3		✓			✓
CO4		✓	✓	✓	✓
CO5			✓	✓	

9. Teaching – Learning Process:

Teaching and Learning are two important fields which are required for effective teaching and it helps the student in better understanding. For BCA Programme the teaching and learning process is designed towards attaining the Program Specific Output(PSO) and Graduate Apptitude(GA). NPTEL and other MOOC courses are recommended for the students to enhance the knowledge. Online medium such as Google classroom are used to share the resources with the students. To meet the objectives of the course and enable students achieve the expected outcomes the course the following teaching processes are utilized:

Class Room Teaching:

The class room teaching helps the students imbibe the theoretical knowledge of the course. To demonstrate the programs and complex concepts projectors are used to illustrate the concepts.

Laboratory Teaching:

BCA programme give more emphasis for Open Source packages/programming languages. Laboratory are furnished with state-of-the-art technologies and software to help students to solve the problems practically.

Fourms:

Student forum in the name of Stepping Stones is organized every week where alumini and industrial experts are invited to provide Guest Lecture. Students discuss the latest technologies and present seminar.

MOOCS:

In BCA programme, NPTEL courses are recommended for the course to enhance their knowledge of the student. It gives student the ability to know the latest development in that subject.

Project:

Students are suggested to do project based assignments in Practical Papers. Students are given variety of real world problems to demonstrate their skills. It enriches the ability of the students to solve the futuristic problems.

Final year students in their final semester are mandated to complete a real-time mini-project for the successful completion of the degree

Assignments:

Student are given assignement regularly by which they can learn to collect data relevent to the assignment and also they can enhance the knowledge

10. Assessement Methods:

The Assesment plays the pivotal role in evaluating the progress of the student. Assessment also devises to test the cognitive levels of the students. Assessment methods are devised to assess and evaluate the understanding the foundation concept and also to illustrate the skills. The assessment methods try to validate and enhance the well-rounded skillsets of the students. Assessment Methods validates the students programming writing ability .It can help the student to develop the employable skill and entreprenueral skills.

10.1 Continuous Assessment:

The Continuous assessment occurs on a regular and continuous basis, it is an ongoing formative and summative process, involving the monitoring of students. This assessment is inherently integrated with teaching and involves of series of process like systematic collection of marks or grades that gradually flow into the final score. The assessment marks or grades collected through various stages of the semester eventually contribute to the final grade of the students.

The continuous Assessment process tests the students on various grounds and aspects such as:

- Continuous Internal Assessment – I
- Continuous Internal Assessment – I
- Continuous Internal Assessment – I
- Attendance
- Class Participation or seminars
- Assignments

The student is subjected to three internal assessment written exams in a semester. The student's regular class attendance proves to be an important factor in the evaluation of the student's credentials. The assessment also takes cognizance of the student's active participation in the class room discussions in the form of seminars and group discussions. The prompt submission of home assignments is monitored for assessing the student's final evaluation credentials.

11. Keywords:

Learning Outcome, Qualification Descriptor, Graduate Apptitute, Skill Enhancement, Program Specific Outcome, Course Outcome, Core Compulsory Courses, Discipline Specific Elective, Continuous Assessment, PSO – CO Matrix