Bharathidasan Government College for Women (Autonomous)

(Affiliated to Pondicherry University)

B.Sc. Computer Science (Honors)

B.Sc. Computer Science (Honors with Research)

REGULATIONS, CURRICULUM & SYLLABUS

(Under the National Education Policy - NEP 2020)

Effective from the Academic Year 2023 - 2024

October 2024

BHARATHIDASAN GOVERNMENT COLLEGE FOR WOMEN
(AUTONOMOUS)
(AFFILIATED TO PONDICHERRY UNIVERSITY)
PUDUCHERRY- 605 008

DEPARTMENT OF COMPUTER SCIENCE
MINUTES OF THE BOARD OF STUDIES MEETING HELD ON 28.10.2024.

The Board of Studies meeting of B.Sc. Computer Science was held on October 28, 2024, at 2:00 P.M. in the Department of Computer Science, BGCW, Puducherry. The following members attended the meeting:

Board of Studies (BOS) – B.Sc. Computer Science

Sl. No.	Name	Affiliation	BOS
1	Dr. R. Rengasamy	HOD, Department of Computer Science, Bharathidasan Govt. College for Women	Chairman
2	Dr. S.K.V. Jayakumar	Professor and Head, Department of Computer Science, Pondicherry University	University VC Nominee
3	Dr. L. Jabasheela	Professor & Head Department of Computer Science & Engineering, Panimalar Engineering College, Chennai	Subject Expert
4	Dr. D.I. George Amalarethinam,	Principal and HOD of Department of Computer Science, Jamal Mohamed College (Autonomous) Tiruchirapalli – 620 020	Subject Expert
5	Mr. Md. Zubair Ahmad	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	Members of Board
6	Mrs. A. Saipriya	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	

7	Dr. R. Sethuraman	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	Members of Board
8	Mrs. K. Sivapaquiavady	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	
9	Mr. S. Sundararajan	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	
10	Dr. S.T. Arokkiya Mary	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	
11	Ms. S. Varalakshmi	Assistant Professor, Department of Computer Science, Bharathidasan Govt. College for Women	
12	Dr.Sridevi R	Assistant Professor of Computer Science, Tagore Govt. Arts & Science College, Puducherry 605008	Meritorious Alumnus
13	Ms. Papitha V	Senior System Associate, Infosys, Mahendra City, Chennai	Representative from Industry

The curriculum of B.Sc. Computer Science under the NEP 2020 system was discussed, and the following recommendations were made:

1. The curriculum framework and course contents for all semesters of B.Sc. Computer Science (3-Year Programme) have been approved and will be effective from 2023-2024.
2. The curriculum framework and course contents for all semesters of B.Sc. Computer Science (4-Year- Honors/Honors in Research) have been approved and will be effective from 2024-2025 onwards.
3. The syllabi for multi-disciplinary and minor courses offered by the computer science department to the other major programmes have been approved.

The recommended curriculum framework, course contents and rules & regulations are attached.

Dr. R.Rengasamy,
(HOD & Chairman-BoS)

Members

Dr. S.K.V. Jayakumar

Dr. L. Jabasheela

Dr. D.T. George Amalarethinam

Dr. Sridevi R

Ms. Papitha V

Mr. Zubair Ahmad

Mrs. A. Saipriya

Dr. R. Sethuraman

Mrs. K. Sivapaquiavady

Mr. S. Sundararajan

Dr. S.T. Arokkiya Mary

Ms. S. Varalakshmi

Table of Contents

1. PREAMBLE & PROGRAMME OUTCOMES

1.1. Preamble

The Bachelor of Science (B.Sc.) in Computer Science programme is a dynamic and comprehensive academic journey designed to equip students with a strong foundation in the principles and practices of computing. Rooted in the ever-evolving field of technology, this programme is crafted to cultivate a deep understanding of computer science theories, algorithms, and applications.

The curriculum encompasses a balanced blend of foundational courses and specialized electives on experiential learning, offering opportunities for internships, industry projects, and participation in coding competitions. Students will engage in practical applications of their knowledge, honing their skills through hands-on experiences that mirror the challenges and demands of the rapidly evolving technological landscape.

Recognizing the global nature of technology, the B.Sc. in Computer Science incorporates an international perspective. Students will explore global technology trends, multicultural influences, and ethical considerations, preparing them to contribute responsibly to the global digital community.

The B.Sc. in Computer Science at Bharathidasan Government College for Women (Autonomous) (Affiliated to Pondicherry University) is a transformative educational experience that empowers students to become adept problem solvers, innovators, and leaders in the field of computer science. By fostering a passion for continuous learning and providing a solid foundation in theory and application, the programme sets the stage for a successful and fulfilling career in the dynamic world of technology.

1.2 Programme Outcomes

Upon completion of the Bachelor of Science (B.Sc.) programme in Computer Science, students will demonstrate the following outcomes at:

UG Certificate Level

- Acquire foundational knowledge in computer science.
- Demonstrate basic skills in problem-solving and programming.

UG Diploma Level

- Develop intermediate-level knowledge and skills in computer science.
- Apply problem-solving and programming concepts to practical scenarios.

UG Degree Level

- Attain advanced knowledge and skills in computer science.
- Demonstrate proficiency in problem-solving, programming, and system design.

UG Degree with Honors / Honors with Research

- Demonstrate proficiency in programming languages and software development.
- Apply principles of data structures and algorithms to solve complex problems.
- Design and implement efficient solutions for real-world computing challenges.
- Exhibit effective communication skills in conveying technical concepts orally and in writing.
- Engage in collaborative projects and demonstrate the ability to work effectively in a team.
- Apply ethical considerations in professional and societal contexts related to computer science.
- Possess a comprehensive understanding on their Specialization in Computer Science and in the chosen specialization.
- Exhibit a commitment to lifelong learning and adaptability to evolving technologies.

2. DEFINITIONS

Terms used in the NEP Regulations shall have the meaning assigned to them as given below unless the context otherwise requires:

A. Credit: A credit is the number of hours of instruction required per week for the given subject in a given semester of 16-18 weeks. One credit is equivalent to 15 hours of teaching (lecture or tutorial) or 30 hours of practice/field work/community

engagement and service per Semester.

B. Academic Year: Means the year starting on 1st day of July and ends on the 30th day of June in the succeeding year.

C. Residence time: Means the time a student spends for attending classes in the College/Institution (either Online/Offline) as a full-time student and enrolled in any Academic programme of the Institution.

D. Semester: Means 18 weeks (90 Working days) of teaching-learning sessions of which two weeks shall be set apart for examinations and evaluation.

E. Grade: Means a letter grade assigned to a student in a Course for his/her performance at academic sessions as denoted in symbols of: O(Outstanding), A+(Excellent), A (Very good), B+ (Good), B (Above average), C (average), P (Pass) F (Fail) and Ab (Absent) with a numeric value of O=10, A+=9, A=8, B+=7, B=6, C=5, P=4, F=0 and Ab=0.

F. Grade Point Average (GPA): Means an average of the Grades secured by a student in all courses in a given academic session duly weighted by the number of credits associated to each of the courses.

G. Cumulative GPA (CGPA): Means the weighted average of all courses the student has taken in a given Programme.

H. A common Course: Means the set of courses that all students who are admitted to any Programme of the University/College are required to study. These courses include, Languages (English- Modern Indian Languages), NEP specific courses- viz. Understanding India, Environmental Sciences/Education, Health and wellbeing / Yoga, Digital & Technological solutions.

I. Major Discipline: Means the core subjects mandatory for the programme, Major discipline may be a single discipline or interdisciplinary/ multidisciplinary courses. e.g. B.Sc. (Physics) or B.Sc. (Physics, Maths and Chemistry).

J. Minor Discipline: Means the courses which are specific to the specializations in Computer Science.

K. Credit Requirement: For a Degree/Diploma/Certificate Programme means the minimum number of credits that a student shall accumulate to achieve the status of being qualified to receive the said Degree, Diploma/Certificate as the case may be.

L. Exit option: Means the option exercised by the students, to leave the Programme at the end of any given Academic year.

M. Lateral entry: Means a student being admitted into an ongoing Programme of the University/College otherwise than in the 1st year of the Programme.

N. Vocational Studies / Education: This refers to set of activities for participation in an approved project or practical or lab, practices of application of scientific theories, studio activities involving students in creative artistic activities, workshop-based activities, field-based shop-floor learning, and Community engagement services, etc. (These courses are expected to enable students to incorporate the learned skills in daily life and start up entrepreneurship.)

O. Skill-based learning / project: This refers to activities designed to understand the different socio- economic contexts, first-hand understanding of the policies, regulations, organizational structures, processes and programmes that guide the development process.

P. Work-based internship: Means structured internships with Software Companies, Research and Higher Educational Institution Laboratories, Corporate offices, etc. which will further improve employability.

3. DURATION, ELIGIBILITY & AWARD OF UG DEGREE / DIPLOMA / CERTIFICATE

3.1. Duration of the Programme

The duration of the UG programme is 4 years or 8 semesters. Students who desire to undergo a Three-year UG Programme will be allowed to exit after completion of the 3rd year. If a student wants to leave after the completion of the first or second year, the

student will be given a UG Certificate or UG Diploma, respectively, provided they secure the prescribed number of credits (as given in table 1).

3.2. Eligibility

Senior Secondary School Leaving Certificate or Higher Secondary (12^{th} Grade) Certificate obtained after successful completion of Grade 12 or equivalent stage of education corresponding to Level-4 (Levels in NHEQF). **For detailed eligibility, refer the Admissions and Lateral Entry Section 5.**

3.3. Awarding of UG Certificate, UG Diploma and Degrees Nomenclature

Four years B.Sc. Degree Programme shall have options for earning a Certificate / Diploma / UG Degree / UG Degree (Honors) / UG Degree (Honors with Research) based on the exit option exercised by the candidates.

3.3.1. UG Certificate

Students who opt to exit after completion of the first year (2 Semesters) and have earned a minimum of 40 credits will be awarded a UG Certificate in Problem Solving and Programming if, in addition, they complete work based vocational courses / internship of 4 credits during the summer vacation of the first year.

3.3.2. UG Diploma

Students who opt to exit after completion of the second year (4 Semesters) and have earned a minimum of 80 credits will be awarded the UG Diploma in Computer Science if, in addition, they complete work based vocational courses / internship of 4 credits during the summer vacation of the second year.

3.3.3. Three-year UG Degree

Students who wish to discontinue after the 3-year (6 Semesters) UG programme will be awarded a UG Degree in Computer Science after successful completion of three years, earning a minimum of 120 credits and satisfying the minimum credit requirements as mentioned in Table 1.

3.3.4. Four-year UG Degree (Honors)

A four-year UG Honors degree in the Computer Science will be awarded to those who complete a four-year (8 Semesters) degree programme, earning a minimum of 160 credits and have satisfied the credit requirements as mentioned in Table 1.

3.3.5. Four-year UG Degree (Honors with Research)

Students who secure a minimum of 7.5 CGPA in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the University/College.

The research project/dissertation will be in the major discipline, Computer Science. The students who secure a minimum of 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree in Computer Science (Honors with Research).

3.3.6. Programme overview

As per the guidelines of NEP, students are mandated to complete 120 credits to complete a basic Bachelor's Degree in 3 years. With an additional 40 credits of course work one can pursue 4^{th} Year Honors or Honors with Research Degree. The UG Programme will consist of the following categories of courses and the minimum credit requirements for 3-year UG and 4-year UG(Honors) or UG (Honors with Research) programmes are given in Table 1.

Table 1: Breakup of Credits and Courses – Minimum Requirements

S.No.	Component	3 Year UG	4 Year UG (Honors/ Honors with research)
1	Major Disciplinary - Computer Science	56 Credits (15 Courses of 4 credits)	80 Credits (20 Courses of 4 credits)
2	Minor Disciplinary - Specialization Courses	24 Credits (6 Courses of 4 Credits)	32 Credits (8 Courses of 4 credits)
3	Multi-Disciplinary Courses	9 Credits (3 courses of 3 credits)	9 Credits (3 courses of 3 credits)
4	Ability Enhancement Courses	8 Credits (4 courses of 2 credits)	8 Credits (4 courses of 2 credits)
5	Skill Enhancement Course – On the chosen Specialization	9 Credits (3 courses of 3 credits)	9 Credits (3courses of 3 credits)
6	Value-added courses	8 Credits (4 courses of 2 credits)	8 Credits (4 courses of 2 credits)
7	Summer internship	4 Credits (Included in Major courses of 60 credits)	4 Credits (Included in Major courses of 80 credits)
8	Community engagement and service	2 Credits (1 Field based Course)	2 Credits (1 Field based Course)
9	Research Dissertation Project	-	12 Credits
	Total	**120**	**160**

Note: Honors students not undertaking research will do 3 courses for 12 credits in lieu of a Research Project / Dissertation.

3.3.7. Degree and Nomenclature

Candidates who complete Eight semesters and earn a minimum of 160 credits and have satisfied the credit requirements as mentioned in the table 1 will be awarded either of the following degrees.

- B.Sc. Computer Science*
- B.Sc. Computer Science (Honors) #
- B.Sc. Computer Science (Honors with Research) ##

* for candidates who wish to exit at the end of third year with 120 credits earned and satisfied the other minimum requirements given in 3.3.9.

for candidates who complete 3 theory courses (MJD 21, MJD 22, and MJD 23) instead of the research project work in the Eighth Semester

for candidates who complete a research project work in the Eighth Semester

3.3.8. Degree with Specialization

Out of the above said 160 credits (Table1) the candidates shall earn 103 credits (83 credits out of 120 credits in the case of 3-year UG) from the Hardcore courses (Major Disciplinary, Multi-disciplinary, Ability Enhancement, Value added Courses and Community Engagement and Service) and the remaining 57 credits (37 credits in the case of 3-year UG) shall be earned from the subjects they choose to study from the list of softcore courses. These 57 credits shall be earned through studying the specialization courses in Minor Disciplinary – Specialization Courses, Skill Enhancement Courses in all the semesters and the Research Project or the Courses the candidates choose to study in the Eighth Semester.

3.3.9. Exit Options and Nomenclature of Certificate, Diploma

Candidates can exercise the following exit options and obtain the said certificate or diploma or degree, if the minimum required credits are earned and other conditions are met. Students exercising the option of exit at the end of 2nd semester or 4th semester need to have completed an internship for at least 8 weeks along with the necessary credit requirements to qualify for the relevant certificate or diploma. In any case, every student, whenever exit (or complete the 4-year programme), should have completed at least one internship for a minimum period of 8 weeks.

Exit after 2nd Semester: Certificate in Problem Solving and Programming will be awarded for candidates who exit the course at the end of 2nd semester and earned a minimum of 40 credits and have completed a Summer Internship of 4 credits for a minimum period of 8 weeks, during the summer vacation post 2nd semester.

Exit after 4th Semester: Diploma in Computer Science will be awarded for candidates who exit the course at the end of 4th semester and earned a minimum of 80 credits and have completed a Summer Internship of 4 credits for a minimum period of 8 weeks, during the summer vacation post 4th semester.

Exit after 6th Semester: UG Degree in Computer Science (B.Sc. (CS)) will be awarded for candidates who exit the course at the end of 6th semester and earned a minimum of 120 credits and have completed a Summer Internship of 4 credits for a minimum period of 8 weeks, during the summer vacation post 4th semester.

Exit after	Credits and other requirements	Awards
2nd Semester	Min: 40 Credits & Internship	Certificate in Problem Solving and Programming
4th Semester	Min: 80 Credits & Internship	Diploma in Computer Science
6th Semester	Min: 120 Credits & Internship	B.Sc. Computer Science

4. STRUCTURE OF THE UNDERGRADUATE PROGRAMME

This B.Sc Honors programme is offered in the affiliated colleges shall confirm to the structure specified hereunder. As per the decided programme mandate, the students to complete 120 credits to complete a basic Bachelor's Degree in 3 years. With an additional 40 credits of course work one can pursue 4th Year Honors or Honors with Research Degree. The UG Programme will consist of the categories of courses and the minimum credit requirements for 3-year UG and 4-year UG(Honors) or UG (Honors with Research) programmes as given in Table 1 at Section 3.3.6.

4.1. Types of Courses

Hardcore Courses	Softcore Courses (Specialization specific)
Major Disciplinary - Computer Science Multi-Disciplinary Courses Ability Enhancement Courses Value Added Courses Community Engagement and Service	Minor Disciplinary Skill Enhancement Courses Summer Internship Research Dissertation Project

4.2. Description of Courses

The following are the types of courses in this programme:

4.2.1. Major Discipline: 60 Credits - 3 Year UG & 92 Credits - 4 Year UG

Major discipline here means to Computer Science. Students should secure the prescribed number of credits (not less than 50% of the total credits) through core courses in the major discipline. The major discipline would provide the opportunity

for a student to pursue in-depth study of a particular subject or discipline. A student may choose to change the major discipline within the broad discipline at the end of the second semester provided all the prerequisites of the respective degree programme are fulfilled.

4.2.2. Minor Discipline / Specialization: 24 Credits - 3 Year UG & 32 Credits - 4 Year UG

Minor discipline helps a student to gain a broader understanding beyond the major discipline.

4.2.3. Multidisciplinary courses (MD): 9 Credits

All undergraduate students are mandated to pursue 9 credits worth of courses in such Multi- disciplinary areas/Courses in the NEP defined subjects. Colleges may identify any 3 multiple disciplinary streams listed below based on availability of resources and manpower.

a) Natural Sciences
b) Physical Sciences
c) Mathematics & Statistics
d) Computer Science/Applications
e) Data Analysis
f) Social Sciences
g) Humanities
h) Commerce & Management
i) Library Science
j) Media Sciences, etc.

Students are expected to learn basic/introductory courses designed by other departments for this purpose. Colleges may list any 3 introductory courses (one each in Natural Sciences, Physical Sciences, Humanities) for uniform adoption of all UG students.

4.2.4. Ability Enhancement Courses (AEC): 8 credits

All Undergraduate (UG) students are mandated to complete at least 8 Credits worth of Courses which focus on Communication and Linguistic skills, Critical reading, and writing skills. These courses are expected to enhance the ability in articulation and presentation of their thoughts at workplace. Colleges may design these ability enhancement courses tuned to the requirements of given major discipline. For example, a course in Business Communication is more appropriate in place of literature/prose/poetry.

Ability Enhancement Course	
I. English Language a. English Language & Literature - 1 and 2 b. Functional English - 1 and 2 c. Communicative English - 1 and 2	**II. Indian Language (two courses)** a. Indian language & Literature - 1 and 2 b. Functional language - 1 and 2 c. Communicative language - 1 and 2

4.2.5. Skill Enhancement Courses (SEC): 9 credits

These courses are aimed at imparting practical skills, hands-on training, soft skills, and other skills to enhance the employability of students. Courses are designed as per the students' needs with the available resources. Students can choose these courses from the list of courses offered in the chosen specialization. Colleges may also outsource the Skill Enhancement Courses to UGC approved agencies for conducting short term Training Workshops, Skill India initiatives of GOI and approved Trades by Skill development of corporation are to be considered.

4.2.6. Value-Added Courses (VAC) Common to All UG Students: 8 credits

Under NEP, the UGC has proposed for 6 to 8 credits worth of common courses which are likely to add value to overall knowledge base of the students. These courses include:

a) Understanding India
b) Environmental Science / Education, Higher Order Thinking
c) Digital and Technological solutions
d) Health & Wellness, Yoga Education, Sports, Fitness, Universal Human Values

The course structure and coverage of topics are suggested by UGC in its draft documents, colleges / UG Boards of Studies may design the methodology for conducting these value-added courses.

4.2.7. Summer Internship: 4 Credits

All students will undergo Internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other Higher Education Institutions / Research institutions during the summer term.

Students will be provided with opportunities for internships to actively engage with the practical side of their learning. Such Summer Internship is to be conducted in between 4th Semester and 5th semester. A review report and award of grade based on Work based learning by students is to be recorded during the 5th Semester. Students who exercise the option of exit at the end of 1st year or 2nd year need to do the internships as specified in the respective section.

4.2.8. Community Engagement and Service: 2 Credits

The curricular component of 'Community Engagement and Service' seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity or part of a major or minor course. Community Engagement shall be conducted for a minimum of 2 weeks.

4.2.9. Research Project / Dissertation: 12 Credits

Students choosing a 4 Year Bachelor's degree (Honors with Research) are required to take up research projects under the guidance of a faculty member. The students are expected to complete the Research Project in the eighth semester.

4.2.10. Audit courses: 0 credits

Audit courses offered do not carry any credits. Evaluation will be based on continuous assessment. Students may be given a Pass or Fail (P/F) based on the assessment that may consist of class tests, homework assignments, and/or any other innovative assessment methodology suitable to the expected learning outcome, as determined by the faculty in charge of the course of study.

4.3. Levels of the Courses

Course codes are based on the academic rigor. The first four letters of the course code indicate the department/Centre, followed by the academic rigor level code in digits (For example, COMS 201) as given in Section 12. The coding structure follows:

4.3.1. 0-99: Pre-requisite courses

It is required to undertake an introductory course which will be a pass or fail course with no credits. It will replace the existing informal way of offering bridge courses that are conducted in some of the colleges/ universities.

4.3.2. 100-199: Foundation or introductory courses

These are courses which are intended for students to gain an understanding and basic knowledge about the subjects and help decide the subject or discipline of interest. These courses generally would focus on foundational theories, concepts, perspectives, principles, methods, and procedures of critical thinking in order to provide a broad basis for taking up more advanced courses.

4.3.3. 200-299: Intermediate-level courses including subject-specific courses

These courses are intended to meet the credit requirements for minor or major areas of learning. These courses can be part of a major and can be pre-requisite courses for advanced-level major courses.

4.3.4. 300-399: Higher-level Courses

These courses are required for majoring in a disciplinary/interdisciplinary area of study for the award of a degree.

4.3.5. 400-499: Advanced Courses

These courses which would include lecture courses with practicum, seminar-based course, term papers, research methodology, advanced laboratory experiments/software training, research projects, hands-on-training, internship / apprenticeship projects at the undergraduate level or first year post- graduate theoretical and practical courses.

4.4. Credit-hours for different types of courses

A three-credit lecture course in a semester means three one-hour lectures per week with each one- hour lecture counted as one credit. One credit for tutorial work means one hour of engagement per week. A one-credit course in practicum or lab work, community engagement and services, and fieldwork in a semester mean two-hour engagement per week. The Faculty to Student Ratio in all the practical / laboratory

classes shall be maintained at 1:25.

In a semester of 15 weeks duration, a one-credit practicum in a course is equivalent to 30 hours of engagement. A one-credit of Seminar or Internship or Studio activities or Field practice / projects / community engagement and service means two-hour engagements per week. Accordingly, in a semester of 15 weeks duration, one credit in these courses is equivalent to 30 hours of engagement.

4.4.1. Pedagogical Styles

In order to achieve the expected Learning outcomes, UGC Framework has specified different Pedagogical approaches for different courses at undergraduate level. These approaches include:

a) Lecture course
b) Tutorial course
c) Practice cum or laboratory courses
d) Seminar Course
e) Internship course
f) Studio activity-based course
g) Field practicing
h) Project work courses
i) Community engagement and service course

The details of these different types of Pedagogical methods are as follows:

Table 2: Pedagogical Approaches

COURSE TYPES	APPROACH
Lecture Courses	Regular classroom lectures by qualified / experienced Expert Teachers • These Lectures may also include classroom discussion, demonstrations, case analysis • Use of Models, Audio-Visual contents, Documentaries, PPTs may supplement.
Tutorial Courses	Problem solving Exercise classes guided discussion, supplementary readings vocational training, etc.
Practical / Lab work	Practical Lab activity with Theoretical support Mini projects, Activity based engagement, Program executions, Data processing and presentation exercise.

Seminar Course	A course requiring student to design and participate in discussions, Group Discussions, Elocution and Debate, Oral Communication Paper presentations, Poster Presentation, Role play participation, Quiz competitions, Business plan preparation/presentation, etc.
Internship course	Courses requiring students to *Learn by Doing* in the workplace external to the educational Institutions. Internships involve working in Software Companies, Research and Higher Educational Institution Laboratories, Corporate Offices, etc. All Internships should be properly guided and inducted for focused learning.
Research Project	Students need to study and analyze the recent research publications from indexed/peer reviewed journals in their area of specialization. Outcome of the study and analysis need to be presented as a thesis or research report with necessary experimental results.

4.5. Semester-wise Break: for courses of 3 year UG and 4 year UG (Hons) Degree programme Incorporating the focus of NEP in terms of different categories of courses and award of Certificates, Diplomas and Degrees during different stages of 4 years Degree programme, a template for Semester-wise course work was designed by the UGC Curriculum Framework. Salient features of it are as follows:

- All courses shall carry specified number of credits.
- Every Semester shall have a minimum of 20 credits worth of courses.
- Credits for a course shall be decided on the basis of number of Contact hours of the teaching in a classroom.
- One credit means one hour of Teaching in case of Theory subject and at least 2 hours of conducting Practical hours in case of Lab subjects.
- All Major and Minor disciplinary Courses shall have 4 credits with 6 hours of work load (including of tutorial hours)
- Language courses, ability enhancement, skill enhancement and value-added common course also will have 2 hours of hands-on training.
- Progress of Learning is measured in terms of credits earned by the students on successful completion of the course.

- Students can exercise his/her choice for exiting the course at the end of every Academic year.
- Graduate attributes listed by UGC shall be the focus of Teaching-Learning process.
- Semester I and II shall focus on introductory courses/subjects in Major/Minor disciplines and shall focus on providing knowledge in Multidisciplinary areas, skill enhancement and ability enhancement courses.
- Semester III and IV shall focus on Core disciplinary courses with a focus on building strong foundation in the given Discipline.
- Semester V and VI shall focus on providing in-depth knowledge and skills required for taking up a career in the given discipline.
- Semester VII and VIII shall focus on Advanced knowledge and shall direct the students to take up socially relevant projects/Research works newer applications of the knowledge.

5. ADMISSION ELIGIBILITY, LATERAL ENTRY

5.1 Admission Eligibility

The candidates for admission to this programme shall be required to have passed 10+2 / 10+3 system of examinations or equivalent with Mathematics / Business Mathematics / Computer Science / Computer Applications / Informatics Practices / or Equivalent as one of the subjects of study.

Students shall be admitted to this programme based on admissions criteria fixed by the University / Government of Puducherry.

5.2 Admissions by Lateral Entry

In this programme, where admission was carried out adopting approved procedures in preceding years, subject to availability, lateral entry admission shall be permitted, subject to:

Candidates seeking entry at the second, third and fourth year, should meet the necessary eligibility criteria with respect to the certificate / diploma / degree they possess, with necessary minimum credits banked in the Academic Bank of Credits (ABC). Such students who get admitted in later years, other than first year will be

guided by the following clauses:

- that the College shall notify the admission process and number of vacancies open for lateral entry.
- that the Lateral entrants shall be admitted only after such transparent screening process and such procedure that the College may prescribe from time to time. College may prescribe different methods of screening for different programmes depending on the circumstances prevailing in each case.
- Lateral entry shall be permissible only in the beginning of years 2, 3, 4 of the Under Graduate / Honors programme, provided that the students seeking lateral entry shall have obtained the minimum pass marks / grades fixed by the University/College in their previous academic years.

6. EVALUATION

All Credit courses are evaluated for 100 marks. Internal Assessment component is for 25 marks and the End Semester University exam is for 75 marks. In case of Practicals, Project work, etc., it is 50:50 marks for Internal and End-Semester Exams.

6.1. Category of Courses

There are three categories of courses as shown in 6.2. Category A, theory courses with lecture hours and tutorials are evaluated for an internal assessment component of 25 Marks and End Semester University Exam for 75 Marks.

Category A	Theory Courses with Lecture hours and hours allotted for Tutorials wherever required.
Category B	Practical Courses with only Practical hours or Laboratory hours. Laboratory Courses, Internships, Research Project Works and other courses allotted only with practical hours in the curriculum shall be under this category.
Category C	Theory & Practice combined Courses where Lecture and Practical hours allotted.

6.2. Learning Assessment

Course Types	Internal Assessment	End Semester Assessment
Category A **IA: 25 Marks** **EA: 75 Marks**	**25 Marks** **Evaluation Component** **I. Mid Semester Exam (one) – 20 marks** **II. Percentage of Attendance - 05 marks**	**75 Marks** **(Evaluation Details given in Table 3)**
Category B **IA: 50 Marks** **EA: 50 Marks**	**50 Marks** **For Practical / Internship Courses** **I. Weekly Observation Book/Report – 15 marks** **II. Practical Record/Internship Record – 15 marks** **III. Model Practical Exam - 15 marks** **IV. Percentage of Attendance - 05 marks** **For Research Project Work Course Evaluation** **I. Monthly Review (3 Reviews – 10 marks each) - 30 marks** **II. Project Report - 10 marks** **III. Project Work - 10 marks**	**50 Marks** **(Evaluation Details given in Table 3)**
Category C **IA: 25 Marks** **EA: 75 Marks**	**25 Marks** **Evaluation Component** **I. Mid Semester Exam (one) – Theory - 10 mar** **II. Observation Book, Record Book - 10 mar** **III. Percentage of Attendance - 05 mar**	**75 Marks** **(Evaluation Details given in Table 3)**

6.3. Marks for Attendance

Attendance %	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

6.4. Internal Test Scheme

Principal of the College schedules the Mid-Semester Exam for all courses during 8/9th week of start of classes. All faculty members are expected to conduct this Mid-Semester exam for 1½ hour duration and evaluate, submit the marks to Controller of Examinations. Colleges need to preserve the answer books of Mid-Semester exams until declaration of results by the University/College.

6.5. End Semester University Exam

Controller of Examinations (COE) of the Institution schedules the End-Semester exams for all three categories of courses. **For Category C courses, theory and practical exams will be conducted separately by the Controller of Examinations.**

A detailed Exam Time Table shall be circulated atleast 15 days before the start of exams mostly during 15/16th week of the Semester. Question Papers shall be set externally based on BOS approved syllabus. All students who have a minimum of 70% attendance are eligible to attend the end-semester exams. The breakup of end semester marks is as given below.

6.6. Break up of end semester marks

(All End Semester Exams shall be conducted by the Controller of Examinations, BGCW)

The question paper shall be set as per the Bloom's Taxonomy. Table3 below gives the details of evaluation methods for Category A, B and C courses. Various levels along with their description and sample questions are as follows:

Knowledge: Recall or remember previously learned

information. Example: List the basic data types in Python

Comprehension: Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating the main ideas.

Example: Explain how a stack data structure works.

Application: Apply knowledge and concepts to solve problems in new situations. Use learned information in a different context.

Example: Write a Python program to solve the deadlock problem.

Analysis: Break down information into parts and examine the relationships between the parts. Identify motives or causes.

Example: Analyze the efficiency of two sorting algorithms and compare their advantages and disadvantages.

Synthesis: Create a new whole by combining elements in novel ways. Use creativity to produce something original.

Example: Design a web application that can generate a time table of a school.

Table 3: End Semester Assessment examination details for all three categories of courses

Course Components	Marks	Duration
Category A. Theory subjects Sec A: 10 Questions X 2 Marks = 20 Marks (10 out of 12 Questions) Sec B: 5 Questions X 5 Marks = 25 Marks (5 out of 8 Questions) Sec C: 3 Questions X 10 Marks = 30 Marks (3 out of 5 Questions) **Questions from all units of Syllabus equally distributed.**	75 Marks	3 Hours
Category B. Skill Enhancement / Practical Courses Based on Practical examinations conducted by CoE, BGCW **Internship / Research Project Work** Presentation of the work / Report / Viva-voce examinations conducted by CoE, BGCW	50 Marks	3 Hours --
Category C. Theory Subjects with Practical Components **i. Theory Component** Sec A: 5 Questions X 2 Marks = 10 Marks (5 out of 7 Questions) Sec B: 4 Questions X 5 Marks = 20 Marks (4 out of 6 Questions) Sec C: 2 Questions X 10 Marks = 20 Marks (2 out of 4 Questions) **Questions from all units of Syllabus equally distributed.** **ii. Practical Component** Based on Practical examinations conducted by CoE, BGCW **The examination shall be conducted for 50 Marks and reduced to 25 Marks.** **Total Marks: 75 (Theory: 50 Marks + Practical: 25 Marks)**	50 Marks 25 Marks	3 Hours 3 Hours

7. CONSOLIDATION OF MARKS, PASSING MINIMUM AND ARREAR EXAM

Controller of Examinations of the College consolidates the Internal Assessment marks submitted by the departments and marks secured by students in end-semester examination. The total marks will be converted into letter grades as shown in Section 8.1.

7.1. Passing Minimum

As per NEP Regulations, the passing minimum is 50% marks (IA + End semester put together). However, Pondicherry University considers 40% marks as pass during first 3 years of study and students who secured less than 50 will be awarded ‘P’ (Pass

Grade).

7.2. Arrear Exam

For the first three years of study, student who failed to secure 40% marks in aggregate is declared as Failed and she is eligible to take up supplementary examination by registering to the said course in the following Semester. For the fourth year, student who failed to secure 50% marks in aggregate is declared as Failed and she is eligible to take up supplementary examination by registering to the said course in the following Semester. All other candidates who failed due to shortage of attendance, those who are seeking to improve the grade shall repeat the course.

8. LETTER GRADES AND RANGE OF MARKS

Total Marks secured by a student in each subject shall be converted into a letter grade. UGC Framework has suggested a Country wide uniform letter grades for all UG courses.

8.1. Letter Grades

The following Table shows the seven letter grades and corresponding meaning and the grade points for calculation of CGPA.

Letter Grade	Grade Point
O (outstanding)	10
A+ (Excellent)	9
A (Very good)	8
B+ (Good)	7
B (Above average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

In order to work out the above letter grades, the marks secured by a student (Total of Internal Assessment and End Semester Assessment) would be categorized for relative grading.

8.2. Range of Marks for each letter grades

The ranges of marks for each grade would be worked as follows:

Highest marks in the given subject	X
Cut of marks for grading purpose	50 Marks
Passing mark (for 3-years UG)	40 Marks
Number of grades G (Excl. P grade)	Grades: O, A+, A, B+, B, C, Hence, **G = 6**
Range of marks	K
K = (X – 50) / G	

The following table gives the range of marks and letter grades. According to K value, one of the following grading schemes will be followed.

(i) If K ≥ 5, then the grades shall be awarded as given in the following table.

Range of Marks in %	Letter Grade Points for	Grade Points for
X to (X-K) + 1	O	10
(X-K) to (X-2K) + 1	A+	9
(X-2K) to (X-3K) + 1	A	8
(X-3K) to (X-4K) + 1	B+	7
(X-4K) to (X-5K) + 1	B	6
(X-5K) to 50	C	5
40 – 49	P	4
Below 40	F	0
Absent (Lack of Attendance)	Ab	0

(ii) If K< 5, then the grades shall be awarded as given in the following table.

Range of Marks in %	Letter Grade Points for	Grade Points for
80-100	O	10
71-79	A+	9
66-70	A	8
61-65	B+	7
56-60	B	6
50-55	C	5
40-49	P	4
Below 40	F	0
Absent (lack of attendance)	Ab	0

9. CALCULATION OF SGPA & CGPA

Semester Grade Point Average (SGPA) is calculated by taking a weighted average of all grade points secured by a candidate from all subjects registered by him/her in the given Semester. The weights being the number of credits assigned to each subject.

Cumulative Grade Point Average (CGPA) shall be calculated as the weighted average of credits that course carries and the value of Grade points averaged for all subjects.

9.1. Procedure of computation of SGPA and CGPA

The following procedure shall be followed to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. SGPA (Si) = $\Sigma(Ci \times Gi) / \Sigma Ci$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

9.2. Example for Computation of SGPA where candidate has not failed in any course.

Semester	Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	B	6	4 X 6 = 24
		20			139
	SGPA				139/20=6.95

9.3. Example for Computation of SGPA where candidate has failed in one course.

Semester	Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	F	0	4 X 0 = 00
		20			115
	SGPA				115/20=5.75

9.4. Example for Computation of SGPA where candidate has failed in two courses.

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	F	0	3 X 0 = 00
I	Course 4	3	B	6	3 X 6 = 18
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	F	0	4 X 0 = 00
		20			85
	SGPA				85/20=4.25

The CGPA shall also be calculated in similar way as shown in examples (i), (ii) and (iii) of SGPA for all subjects taken by the students in all the semesters. However, if any student fails more than once in the same subject, then while calculating CGPA, the credit and grade point related to the subject in which the student fails in multiple attempts will be restricted to one time only. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

In case of audit courses offered, the students may be given (P) or (F) grade without any credits. This may be indicated in the mark sheet. Audit courses will not be considered towards the calculation of CGPA.

10. DECLARATION OF RESULTS

Controller of Examinations (COE) of the College shall declare the results of given UG programme following the CGPA secured by students by the end of 6th Semester and 8th Semester.

Pass Classes:

Range of CGPA	Result
9.0 – 10	First Class with distinction
6.0 - 8.99	First Class
5.0 - 5.99	Second Class
4.0 - 4.99	Pass Class

11. MINIMUM CREDIT REQUIREMENTS

S.No	Component	3-years UG			4-years UG (Honors / Honors With research)		
		Credits	Courses	Cr/Course	Credits	Courses	Cr/Course
1	Major Disciplinary/ Interdisciplinary Courses	56	14	4	76	19	4
2	Minor Disciplinary/ Interdisciplinary Courses	24	6	4	32	8	4
3	Multi-Disciplinary Courses	9	3	3	9	3	3
4	Ability Enhancement Courses	8	4	2	8	4	2
5	Skill Enhancement Courses	9	3	3	9	3	3
6	Value-added courses	8	4	2	8	4	2
7	Summer Internship (MJD 11)	4	1	4	4	1	4
8	Community Engagement and Service	2	1	2	2	1	2
9	Research Project/Dissertation	--	--	--	12	Project or 3 Courses##	
Total		**120**			**160**		

##Note: *Honors students not undertaking research will do 3 courses for 12credits in lieu of a research project/Dissertation.*

- *MJD: Major Disciplinary (Compulsory – Hardcore Subjects)*

- *MID: Minor Disciplinary (Specialization Specific – Softcore Subjects)*
- *MLD: Multi-Disciplinary*
- *AEC: Ability Enhancement Courses*
- *SEC: Skill Enhancement Courses*
- *VAC: Value Added Courses*

12. COURSE CODE

Course code : 7 Characters: 4 Alphabets and 3 Digits. Ex: ABCD123

Alphabets : 1st and 2nd Alphabets: Major domain
3rd and 4th Alphabets: Specialization

Digits : 1st Digit: Levels (100, 200, 300, 400…)
2nd and 3rd Digits: Serial number of the courses in the given year

Example: CSAI312: Computer Science Artificial Intelligence, Level - 300, Serial number of the course in the given year - (12)

B.Sc. COMPUTERSCIENCE
CURRICULUM

FIRST SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
1	**MJD1**		**Programming Principles and C Programming**	**4**	**4**	**1**		**25**	**75**	**100**
2	**MID1**		**Mathematical Foundations of Computer Science**	**4**	**4**	**1**		**25**	**75**	**100**
3	**MLD1**		**One course from the MLDC streams (Table -MLDC)**	**3**	**3**	1		**25**	**75**	**100**
4	**AEC1**		**Language I**	**2**	**2**	**2**		**25**	**75**	**100**
5	**SEC1**		**C Programming & Office Automation Lab**	**3**			**6**	**50**	**50**	**100**
6	**VAC1**		**Understanding India**	**2**	**2**	**1**		**25**	**75**	**100**
7	**VAC2**		**Environmental Science**	**2**	**2**	**1**		**25**	**75**	**100**
Total				**20**	**30 Hours**					**700**

SECOND SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
8	**MJD2**		**Digital Electronics & Microprocessor**	**4**	**4**	**1**		**25**	**75**	**100**
9	**MID2**		**Mathematics for Data Science (OR) Management Strategies and Concepts**	**4**	**4**	**1**		**25**	**75**	**100**
10	**MLD2**		**One course from the MLDC streams (Table -MLDC)**	**3**	**3**	**1**		**25**	**75**	**100**
11	**AEC2**		**English I**	**2**	**2**	**2**		**25**	**75**	**100**
12	**SEC2**		**Digital & Microprocessor Lab**	**3**			**6**	**50**	**50**	**100**
13	**VAC3**		**Health &Wellness/Yoga Education**	**2**	**2**		**1**	**25**	**75**	**100**
14	**VAC4**		**Digital Technologies**	**2**	**2**	**1**		**25**	**75**	**100**
Total				**20**	**30 Hours**					**700**

THIRD SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
15	**MJD3**		**Python Programming**	**4**	**4**	**1**		**25**	**75**	**100**
16	**MJD4**		**Data Structures**	**4**	**4**	**1**		**25**	**75**	**100**
17	**MID3**		**Probability and Statistics**	**4**	**4**	**1**		**25**	**75**	**100**
18	**MLD3**		**One course from the MLDC streams (Table -MLDC)**	**3**	**3**	**1**		**25**	**75**	**100**
19	**AEC3**		**Language II**	**2**	**2**	**2**		**25**	**75**	**100**
20	**SEC3**		**Data Structures & Python Lab**	**3**			**6**	**50**	**50**	**100**
Total				**20**	**29 Hours**					**600**

FOURTH SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
21	**MJD5**		**Object Oriented Programming with C++**	**4**	**4**	**1**		**25**	**75**	**100**
22	**MJD6**		**Operating Systems**	**4**	**4**			**25**	**75**	**100**
23	**MJD7**		**C++ & Operating System Lab**	**4**			8	**50**	**50**	**100**
24	**MID4**		**Design and Analysis of Algorithms**	**4**	**4**	**1**		**25**	**75**	**100**
25	**AEC4**		**English II**	**2**	**2**	**2**		**25**	**75**	**100**
26	**Project**		**Community Engagement and Service**	**2**			4	**50**	**50**	**100**
Total				**20**	**30 Hours**					**600**

FIFTH SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
27	**MJD8**		**Java Programming**	4	4			**25**	**75**	**100**
28	**MJD9**		**Database Management Systems**	4	4	**1**		**25**	**75**	**100**
29	**MJD10**		**Java & DBMS Lab**	4			8	**50**	**50**	**100**
30	**MJD11**		**Summer Internship**	4			8	**50**	**50**	**100**
31	**MID5**		**Computer Networks**	4	4	1		**25**	**75**	**100**
Total				**20**	**30 Hours**					**500**

SIXTH SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
32	MJD12		**Visual Programming**	4	4	1		**25**	**75**	**100**
33	MJD13		**Software Engineering**	4	4	1		**25**	**75**	**100**
34	MJD14		**Web Client-Side Programming**	4	4			**25**	**75**	**100**
35	MJD15		**Visual Programming & Web Client-Side Programming Lab**	4			8	**50**	**50**	**100**
36	MID6		**Mini Project**	4			8	**50**	**50**	**100**
Total				**20**	**30 Hours**					**500**

SEVENTH SEMESTER										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**	**Total Marks**
					L	**T**	**P**			
37	MJD16		**Data Mining and Warehousing**	4	4	1		**25**	**75**	**100**
38	MJD17		**Web Server-Side Programming**	4	4	1		**25**	**75**	**100**
39	MJD18		**Web Server-Side Programming & IOT Lab**	4			8	**50**	**50**	**100**
40	MID7		**Cloud Computing**	4	4	1		**25**	**75**	**100**
41	MID8		**Internet of Things**	4	4	1		**25**	**75**	**100**
Total				**20**	**28 Hours**					**500**

EIGHTH SEMESTER–B.Sc. Computer Science (Honors)										
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/ Week**			CIA	ESE	Total Marks
					L	**T**	**P**			
42	MJD19		**Introduction to Artificial Intelligence and Machine Learning (OR) Big Data**	4	4	1		**25**	**75**	**100**
43	MJD20		**Professional Ethics (OR) Research Methodology**	4	4	1		**25**	**75**	**100**
44	MJD21		**Cyber Security**	4	4	1		**25**	**75**	**100**
45	MJD22		**Data Science**	4	4	1		**25**	**75**	**100**
46	MJD23		**Data Science & Cyber Security Lab**	4			8	**50**	**50**	**100**
Total				20	28 Hours					**500**
OR										
EIGHTH SEMESTER–B.Sc. Computer Science (Honors with Research)										
42	MJD19		**Introduction to Artificial Intelligence and Machine Learning (OR) Big Data**	4	4	1		**25**	**75**	**100**
43	MJD20		**Professional Ethics (OR) Research Methodology**	4	4	1		**25**	**75**	**100**
44	MJD21		**Research Project Work**	4			8	**50**	**50**	**100**
45	MJD22		**Project Report**	4			5	**50**	**50**	**100**
46	MJD23		**Project Viva-voce**	4			5	**50**	**50**	**100**
Total				20	28 Hours					**500**

Table: MID – MINOR PAPERS for OTHER MAJORS												
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**		**Total Marks**
					L	**T**	**P**		**T**	**P**	
1			**Foundations of Information Technology**	4	4			**25**	**75**	**-**	**100**
2	MID		**Internet and E-Commerce**	4	4		2	**25**	**50**	**25**	**100**
3	MID		**Computer Applications in Corporate Offices**	4	4		2	**25**	**50**	**25**	**100**
4	MID		**Programming in C**	4	4		2	**25**	**50**	**25**	**100**
5	MID		**Introduction to Python Programming**	4	4		2	**25**	**50**	**25**	**100**
6	MID		**Basics of Cyber Security**	4	4			**25**	**75**	**-**	**100**

Table: MID – MINOR PAPERS for COMPUTER SCIENCE												
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**		**Total Marks**
					L	**T**	**P**		**T**	**P**	
1	MID1		**Mathematical Foundations of Computer Science**	4	4	1		**25**	**75**	**-**	**100**
2	MID2		**Mathematics for Data Science OR Management Strategies and Concepts**	4	4	1		**25**	**75**	**-**	**100**
3	MID3		**Probability and Statistics**	4	4	1		**25**	**75**	**-**	**100**
4	MID4		**Design and Analysis of Algorithms**	4	4	1		**25**	**75**	**-**	**100**
5	MID5		**Computer Networks**	4	4	1		**25**	**75**	**-**	**100**
6	MID6		**Mini Project**	4			8	**50**		**50**	**100**
7	MID7		**Cloud Computing**	4	4	1		**25**	**75**	**-**	**100**
8	MID8		**Internet of Things**	4	4	1		**25**	**75**	**-**	**100**

Table MLDC– Multidisciplinary Papers (For Non-Computer Science Students)												
Sl. No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**			CIA	**ESE**		**Total Marks**
					L	**T**	**P**		**T**	**P**	
1	MLDC		Introduction to Computers	3	3	1		**25**	**75**		**100**

Table MLDC– Multidisciplinary Papers								
S.No	**Component**	**Course Code**	**Title of the Course**	**Credits**	**Hours/ Week**			
					L	**T**	**P**	
1	**MLDC**		Mathematics & Logical Essentials	3	3	1		Semester I
2	**MLDC**		Everyday Physics	3	3	1		
3	**MLDC**		Chemicals in life	3	3	1		
4	**MLDC**		Biodiversity & Conservation	3	3	1		
5	**MLDC**		Applied Zoology	3	3	1		
6	**MLDC**		Fundamentals of Food Preservation	3	3	1		
7	**MLDC**		Banking Skills	3	3	1		
8	**MLDC**		Consumer education	3	3	1		
9	**MLDC**		Gandhiyan Thoughts	3	3	1		
10	**MLDC**		Economics for Competitive Examination	3	3	1		
11	**MLDC**		**பேச்சுக்கலை**	3	3	1		
12	**MLDC**		Basic Communication Skills	3	3	1		
13	**MLDC**		French Essentials	3	3	1		
14	**MLDC**		Hindi for Communication	3	3	1		
15	**MLDC**		Accounting Skills	3	3	1		Semester II
16	**MLDC**		Gender sensitization	3	3	1		
17	**MLDC**		Essential English	3	3	1		
18	**MLDC**		Interactive French	3	3	1		
19	**MLDC**		Management skills	3	3	1		Semester III
20	**MLDC**		Human Rights	3	3	1		
21	**MLDC**		Spoken English for Corporate Jobs	3	3	1		

SEMESTER I

Year	I	Course Code:	Credits	4
Sem.	I	Course Title: Programming Principles and C Programming	Hours	60
			Category	A

Course Prerequisites, If any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To Analyze problems and develop Algorithms. • To learn the C programming language that is attractive, considerable worldwide and portable • To study and understand the arrays, structures, pointers and file basics in C.

Unit No.	Course Content	Hours
Unit I	Introduction to Algorithm: Definition –uses and need of Algorithm- Characteristics of an Algorithm- Types of Algorithm – Complexity analysis of Algorithm –Software development life cycle.	12
Unit II	C language fundamentals: structure of C program- character set- Identifiers and keywords- Constants- Data types- Declarations. Preprocessor command: #include, define. Operators types: arithmetic, Unary, Logical, bitwise, assignments and conditional operator.	12
Unit III	Control statements: if-else, nested if, For, While and do-while loop statements, nested loop, switch, break, continue. Arrays: Defining and processing- Multi dimensional arrays (Matrix). Strings and strings operations. Input-Output: getchar(), putchar(), scanf(), printf(), gets, puts, functions	12
Unit IV	Functions: Defining and accessing- Passing arguments- Function prototypes- library functions. Storage classes: Automatic, external and static variables.	12
Unit V	Structure: Defining and declaring – array of structure-structure within structure-pointers to structure - union. Pointers: definition- advantages- array of pointers- Pointers and arrays- malloc (). Simple file operations: create, open and close a file-operations on file.	12

Recommended Learning Resources

Print Resources	1. Introduction to Algorithm by Thomas H Cormen, Charles E Leuersn. 2. Introduction to "C" by E. Balaguruswamy. 3. The C Programming Language By Brian W.Kernighan and Dennis M.Ritchie Publishers: Prentice-Hall

Year	I	Course Code:	Credits	3
Sem.	I	Course Title: C Programming & Office Automation lab	Hours	90
			Category	B

Course Prerequisites, if any: NIL

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Ability to work with MS offices suite Application, • Hands on working experience in MS-Word, MS- Excel and MS-PowerPoint. • Ability to write c program using ID array and Matrices. • Ability to write program in array of structure in C.

Unit No.	Course Content	Hours
Unit I	• Create Bio data using MS word. • Create Time table using MS word. • Create Advertisement using MS word. • Create mail merge using MS word.	20
Unit II	• Create student mark sheet using MS Excel. • Create pay bill using MS Excel. • Create Electricity bill using MS Excel. • Create slides to implement Tourism places in Puducherry using MS Power point.	20
Unit III	• Write simple c program to check for prime number. • Write simple c program to check for Armstrong number • Write C program to find maximum and minimum in array of numbers • Write C program to implement Linear and Binary search. • Write C program to implement Bubble sort.	20
Unit IV	• Write C program for Matrix manipulation to implement Matrix addition, multiplication and Transpose. • Write C program for string manipulation • Write C program to implement functions. • Write C program to create student mark list using structures.	20
Unit V	**Case Study1**: Create an Artistic presentation about Incredible India using Power Point features **Case Study 2: Write** C program to create electricity bill using structure.	10

Recommended Learning Resources

Print Resources	1. Sanjay Sexena, "MS- Office 2000 for Everyone", 2002, Vikas Publishing House pvt ltd., Chennai. 2. C programming by Balagurusamy. Edition 4

SEMESTER II

Year	I	Course Code:	Credits	4
Sem.	II	Course Title: Digital Electronics and Microprocessor	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes

- To study and understand the functioning of digital elements full adders, decoder
- To study and understand the functioning of digital elements Registers and counters.
- To study the basics to design a simple computer.
- To study and understand the functioning of Microprocessor 8085

Unit No.	Course Content	Hours
Unit I	Digital System: Binary, Octal and Hexadecimal Numbers -Number Base conversions, Complements, Binary Codes. Boolean Algebra: Boolean Function -Canonical and standard forms- Digital logic gates. Map Method: Three variable, Four Variable Simplification -Don't care conditions	12
Unit II	Combinational Logic: Design of Full adder, Binary Adder, Decoder and Multiplexer. Sequential logic: Flip-Flops types-flip flop Excitation table-Design of Registers, Shift register, Synchronous Counter.	12
Unit III	Register transfer logic: Bus and memory transfer. Design of Arithmetic micro operations, Logic micro operations and Shift micro operations.	12
Unit IV	Computer Organization and Design: Computer instruction format-Instruction Cycle-Memory-Reference Instructions. General Register organization - Stack Organization-Addressing modes.	12
Unit V	Architecture of 8085 Microprocessor – Demultiplexing address and data bus – Generating control signals. Instruction types: Data transfer, arithmetic, logical and branch instructions - 16-bit arithmetic instructions.	12

Recommended Learning Resources

Print Resources

1. M.Morris Mano," Digital Logic and computer Design", PHI, New Delhi 2002.
2. M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Prentice Hall.
3. 3Microprocessor Architecture, Programming and Applications by Ramesh S.Gaonkar, Wiley Eastern Limited.
4. Introduction to Microprocessor by A.P.Mathur, Tata McGraw Hill Publishing

Year	I	Course Code:	Credits	4
Sem.	II	Course Title: Management Strategies and Concepts	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Understand the fundamentals of Management Theories • Learn the management & communication Process Concepts • Analyse the performance of decentralized and centralized organizational structures • Analyse the different leadership styles and their effects on team performance and organizational culture • Evaluate the effectiveness of the strategies in enhancing productivity and efficiency

Unit No.	Course Content	Hours
Unit I	**Management Theories** Science Theory and Practice – Management and Society – Social Responsibility and Ethics – The nature and purpose of planning – objectives – Strategies Policies and planning premises	12
Unit II	**Decision Making** Process of decision making – organizing – Nature and purpose of organizing – Basics of departmentalization – Line/Staff Authority and Decentralization – Effective Organizing and organizational structure & culture	12
Unit III	**Human Resource Management & Selection** Staffing – Manpower planning – Recruitment & Selection – Performance appraisal and career strategy – Organizational development	12
Unit IV	**Managing the Human factor** Motivation – Leadership – Communication	12
Unit V	**The System & Process of Controlling** Control techniques and Information Technology – Productivity and Operations Management – Overall and Preventive Control – Towards a Unified – Global management theory	12

Recommended Learning Resources

Print Resources	1. Herald Knootz and Heinz Weihrich, “Essentials of Management”, Eleventh Edition, McGraw-Hill Publishing Company, 2020. 2. Fred R. David and Forest R. David, "Strategic Management: Concepts and Cases", Prentice Hall India Learning Private Limited, Sixteenth Edition, 2020.

Year	I	Course Code:	Credits	3
Sem.	II	Course Title: Digital & Microprocessor lab	Hours	90
			Category	B

Course Prerequisites, if any: NIL

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Ability to work in Digital Kit to implement circuits • Ability to work in 8085 Kit to run the assembly language programs. • Apply indexing, looping, counting in assembly language program.

Unit No.	Course Content	Hours
Unit I	• Study of logic Gates. • Implement De-Morgan Laws. • Supplication of Boolean function using three variable K- map.	20
Unit II	• Supplication of Boolean function using four variable K- map using Don't care condition. • Combination circuit- half Adder. • Combination circuit- Full Adder.	20
Unit III	• Write 8085 assembly programs • Addition of two 8-bit number with and without carry. • Multiplication of two 8-bit number. • Find largest of N numbers of 8-bit number	20
Unit IV	• Counting positive, negative and zeros in given set of numbers • Applying Linear search. • Applying Bubble Sort.	20
Unit V	Case Study1: Design Even Parity Generator and checker. Case Study 2: Block operations (Copy, Move & Exchange) in 8085 assembly programs.	10

Recommended Learning Resources

Print Resources	1.M.Morris Mano, "Digital Logic and computer Design" ,PHI, New Delhi 2002. 2. Microprocessor Architecture, Programming and Applications by Ramesh S.Gaonkar, Wiley Eastern Limited.

SEMESTER III

Year	II	Course Code:	Credits	4
Sem.	III	Course Title: Python Programming	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes

- Understand the basics of writing Python code
- Implement programs using lists, tuples and dictionaries
- Understand the use of control structures
- Ability to write programs using packages
- Understand the file manipulation.

Unit No.	Course Content	Hours
Unit I	Introduction, Data types Introduction to Python– Advantages of using Python – Executing Python Programs – Python's Core data types – Numeric Types – String Fundamentals.	12
Unit II	Lists, Tuples, Dictionaries Lists, Tuples, Dictionaries Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension.	12
Unit III	Control Flow, Functions, Modules Python Statements: Assignments – Expressions – If condition – While and For Loops. Functions: Definition, Calls – Scopes – Arguments – Recursive Functions– Functional Programming tools. Classes and Object-Oriented programming with Python. Modules and Packages: Purpose, using packages– Exception Handling with Python.	12
Unit IV	Packages Packages: NumPy, Pandas, Scikit learn - Machine learning with Python – Cleaning up, Wrangling, Analysis, Visualization - Matplotlib package – Plotting Graphs.	12
Unit V	File Handling Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions	12

Recommended Learning Resources

Print Resources	1. Mark Lutz, "Learning Python", Fifth Edition, O'Reilly, 2013. 2. Daniel Liang, "Introduction to programming using Python", Pearson, First edition, 2021. 3. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012. 4. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", A press, First Edition, 2009. 5. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", A press, Second Edition, 2005

Year	II	Course Code:	Credits	4
Sem.	III	Course Title: Data Structures	Hours	60
			Category	A

Course Prerequisites, if any:

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	● Learn basic terminologies of linear and nonlinear data structures and algorithms ● Understand the concept of polynomial addition and sparse matrices using arrays ● Apply linked lists to solve problems related to stacks, queues, and sparse matrices ● Understand the operations and traversals of binary trees ● Apply graph algorithms to solve problems like topological sorting and finding minimum cost spanning trees

Unit No.	Course Content	Hours
Unit I	Introduction - How to create programs? - How to analyze program? – Arrays – ordered list – sparse matrices–Representation of Arrays	12
Unit II	Stacks & Queues -A mazing problems – evaluation of expressions – multiple stacks and queues- linked lists – singly linked lists – linked stacks and queues	12
Unit III	Polynomial additions-More on linked lists - doubly linked lists and dynamic storage management – Garbage collection and compaction	12
Unit IV	Trees –Basic Terminology – binary trees– binary trees representations - binary tree traversal – binary tree representation of trees – application of trees.	12
Unit V	Graph -Terminology and Representation - Traversals, Connected components – Shortest paths –Topological Sort and Critical paths.	12

Recommended Learning Resources

Print Resources	1. Fundamental of Computer Data structure by Ellis Horowitz and Sartaj Sahni, GalgotiaPublications Pvt.Ltd. 2. Data Structures by Seymour Lipschutz, McGraw Hill Edition.

Year	I	Course Code:	Credits	3
Sem.	I	Course Title: Data Structures & Python Lab	Hours	90
			Category	B

Course Prerequisites, if any:Nil

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• To get a knowledge about the python programming • Ability to write programs using packages in python • To apply appropriate data structures in coding

Unit No.	**Course Content**	**Hours**
Unit I	Python Lab: String operations - List operations and methods - List cloning and Comprehension - Tuple and Dictionary Operations.	18
Unit II	Python Lab: Sorting - Linear Search and Binary Search - Generate Student marks statement - Matrix operations using NumPy – Data frame operations using Pandas - File operations	20
Unit III	Data structure lab: sparse matrix transpose-stack in array- queue in array-circular queue	17
Unit IV	Data structure lab: Linked lists, stack and queue-Doubly linked list- Tree traversals	17
Unit V	Case studies in Python: Implement the Machine learning algorithm on Student dataset - Visualize the data using Matplotlib Case studies in Data structure: Polynomial addition using array and linked list-maze problem-Evaluate expressions	18

Recommended Learning Resources

Print Resources	1. Daniel Liang, “Introduction to programming using Python”, Pearson, First edition, 2021. 2. Wes Mc Kinney, “Python for Data Analysis”, O’Reilly Media, 2012. 3. Fundamental of Computer Data structure by Ellis Horowitz and Sartaj Sahni, Galgotia Publications Pvt.Ltd.

SEMESTER IV

Year	II	Course Code:	Credits	4
Sem.	IV	Course Title: Object Oriented Programming with C++	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To inculcate knowledge on Object-oriented programming concepts. • To gain Knowledge on programming with C++. • To write programs using OOP concepts like Abstraction, Encapsulation, Inheritance and Polymorphism

Unit No.	**Course Content**	**Hours**
Unit I	Introduction to C++ - key concepts of Object-Oriented Programming – Object Oriented Languages – I/O -Declarations. Control Structures: - Decision Making Statements- Loops -functions- inline functions –Function Overloading.	12
Unit II	Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions–Constructor and destructor.	12
Unit III	Operator Overloading: Overloading unary, binary operators – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multipath inheritance–Virtual base Classes– Abstract Classes.	12
Unit IV	Pointers – Declaration – Pointer to Class, Object – this pointer – Pointers to derived classes and Base classes –new and delete operators –dynamic object–Binding, Polymorphism and Virtual Functions.	12
Unit V	Files handling – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation - Exception Handling - String – Declaring and Initializing string objects– String Attributes.	12

Recommended Learning Resources

Print Resources	1. E.Balagurusamy, "Object-Oriented Programming with C++", TMH2013, 7th Edition. 2. Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", PearsonEducation2003.

Year	II	Course Code:	Credits	4
Sem.	IV	Course Title: Operating Systems	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Analyze the structure of OS and basic architectural components involved in OS design. • Analyze the various device and resource management techniques for timesharing • Analyze and design of the applications to run in parallel • Understanding Mutual Exclusion, Deadlock detection. • Understanding Device and Information Management.

Unit No.	**Course Content**	**Hours**
Unit I	Operating System-Introduction-Basic concept and Terminology-An OS Resource Manager-OS process view point-OS hierarchical and extended machine view-Introduction to multiprogramming-Multitasking.	12
Unit II	Memory Management: Single contiguous memory allocation-Partitioned Allocation – Re-locatable partitioned memory management-Paged memory management-Demand paged memory management-Segmented memory management.	12
Unit III	Job and Processor scheduling: Process control block-scheduling policies-scheduling algorithms: In non-multiprogramming environment-In multiprogramming environment.	12
Unit IV	Process Synchronization: Race Condition-Hardware solution to mutual exclusion problem: semaphores. Deadlock: Conditions-prevention-avoidance- Banker's algorithm-starvation.	12
Unit V	Device Management: I/O device-device management functions- device access types-Disk scheduling. File management: Functions – file organization- file allocation methods.	12

Recommended Learning Resources

Print Resources	1. Operating System by Stuart E.Madnick and John Donovan Pub: Tata McGraw-Hill 2. Fundamentals of Operating System By Prof. R. Sriddhar Dynaram Publication-Bangalore Company.

Year	II	Course Code:	Credits	4
Sem.	IV	Course Title: Design and Analysis of Algorithm	Hours	60
			Category	A

Course Prerequisites, if any: Data Structure.

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To learn about the different algorithm techniques. • To analyze the performance of algorithms. • To demonstrate a familiarity with major algorithms and data structures. • To identify efficient algorithms in common engineering design situations.

Unit No.	Course Content	Hours
Unit I	Introduction – What is an Algorithm? – Writing Structured Programs – Complexity of Algorithms - Analyzing Algorithms	10
Unit II	Divide and conquer: The general method – Binary search – Finding the maximum and minimum – Merge sort – Quick sort – Selection – Strassens ‘s matrix multiplication.	13
Unit III	The Greedy method: The general method – Optimal storage on tapes – Knapsack problem – Job sequencing with deadlines – Optimal merge patterns – Minimum spanning trees.	13
Unit IV	Backtracking: The general method – The n queen’s problems – Sum of subsets – Graph coloring – Hamiltonian cycles – Knapsack problem.	13
Unit V	Branch and Bound: The general method - 0/1 Knapsack problem – Travelling Salesman problem.	11

Recommended Learning Resources

Print Resources	1. Fundamental of Computer Algorithms by Ellis Horowitz and Sartaj Sahni, Galgotia Publications Pvt.Ltd. 2. Design and Analysis of Algorithms by Aho A.V. & Hopcraft .J.E.Addison Wessley.

Year	II	Course Code:	Credits	4
Sem.	IV	Course Title: C++ & Operating System Lab	Hours	120
			Category	B

Course Prerequisites, if any: NIL

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Implement and Demonstrate the various object-oriented programming concepts using C++ • Analyze memory management schemes and process scheduling algorithms. • Evaluate process Synchronization Techniques • Analyse deadlock handling techniques.

Unit No.	**Course Content**	**Hours**
Unit I	➢ Implement and demonstrate • Class and Objects • Passing Objects to Functions • Friend Functions. • Constructor and Destructor • Unary Operator and binary operator Overloading	25
Unit II	➢ Implement and Demonstrate the following inheritance • Single Inheritance • Multi-level and Multiple Inheritance • Hierarchical and Hybrid Inheritance ➢ Implement and demonstrate Virtual Functions. ➢ Implement and demonstrate File Operations	25
Unit III	• Memory Allocation (Monoprogramming). • Memory Allocation (Multiprogramming). • Job Scheduling (Monoprogramming). • Job Scheduling (Multiprogramming).	25
Unit IV	• Process Scheduling (Round Robin). • Process Synchronization. • Implementing Bankers Algorithm. • General file Management.	25
Unit V	Case Study 1: Implementing employee information system using inheritance C++ Case Study 2 : Implementation of Bankers' Algorithm	20

Recommended Learning Resources

Print Resources	1. Operating System by Stuart E.Madnick and John Donovan Pub:Tata McGraw-Hill 2.Fundamentals of Operating System By Prof.R. SriddharDynaram Publication-Bangalore Company 3. E.Balagurusamy, "Object-Oriented Programming with C++", TMH2013, 7thEdition

SEMESTER V

Year	III	Course Code:	Credits	4
Sem.	V	Course Title: Java Programming	Hours	60
			Category	A

Course Prerequisites, if any : NIL	
Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Knowledge of the structure and model of the Java programming language. • Understand the basic principles of creating Java applications with GUI. • Demonstrate use of string and String Buffers, Develop multithreaded programs in Java.

Unit No.	Course Content	Hours
Unit I	Introduction: Command Line Arguments, Data Types, Constants, Variables, Scope of Variables, Symbolic Constants, Type Casting, Java Program Structure, Operators, Expressions, Statements, Decision Statements, Control statement, JDK, JRE, and JVM	12
Unit II	Class and Objects, Constructors, Methods Overloading, Static Members, Nesting of Methods. Inheritance: Extending a Class, interface, super, Overriding, final Variables and Methods, Finalize Methods, Abstract Methods and Classes, Visibility Control., Arrays, Wrapper Classes.	12
Unit III	Packages: Introduction, Java API Packages, using system Packages, Naming Conventions, Creating Packages, accessing a Packages, adding a Class to a Package, Hiding Classes. Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, and Synchronization.	12
Unit IV	Managing Errors and Exceptions: Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, using finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. Functions: String handling and its functions, Math Functions. I/O Streams: File – Streams – Advantages - The stream classes – Byte streams–Character streams.	12
Unit V	Applets: Introduction – Applet Life cycle – Creating an Applet, Executing an Applet –Applet tags in HTML – Parameter tag – Aligning the display - Graphics Class: Drawing and filling lines– Rectangles – Polygon – Circles – Arcs – Line Graphs – Drawing Bar charts. AWT Components and Even Handlers: Abstract window tool kit – Event Handlers –Event Listeners – AWT Controls and Event Handling: Labels – Text Component – Action Event – Buttons – Check Boxes – Item Event – Choice– Scrollbars – Layout Managers- Input Events –Menus.	12

Recommended Learning Resources

Print Resources	1. E. Balagurusamy, Programming with Java, A Primer Second Edition, Tata McGraw Hill, New Delhi. 2. P.Naughton and H. Schildt, JAVA: The Complete Reference, TMH, New Delhi 2005. 3. D.Jana, Java and Object Oriented Programming Paradigm, PHI, New Delhi, 2005

Year	III	Course Code:	Credits	4
Sem.	V	Course Title: Database Management Systems	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To understand the basic principles and architecture of DBMS • Ability to Design and Develop Database • To understand the basics of SQL • Ability to work with the Various DBMS Software • Ability to connect to a database and create small projects.

Unit No.	Course Content	Hours
Unit I	Introduction – Basic Terminology – Database Definition – Objective of Database- File systems versus Database systems – Entities and Attributes – Schemas and Sub-schemas – DBMS Architecture.	12
Unit II	Data Models –Data Modeling using Entity–Relationship Model – Enhanced E-R Modeling. Relational data Model – Data Independence- - Normalization – Different Normal Forms	12
Unit III	SQL – SQL Statements – Data Definition Languages – CREATE, ALTER, DROP, RENAME, TRUNCATE, Data Manipulation Language: INSERT, UPDATE, DELETE. Data Control Language – GRANT, REVOKE, - Joins – Types of joins – Creating and manipulating views. - Transactional Control: COMMIT, ROLLBACK, SAVEPOINT. Constraints	12
Unit IV	Indexing and Hashing: Single level and Multi-level Indexes – B+ tree Index Files – Static Hashing – Dynamic Hashing-Comparison of Ordered Indexing and Hashing	12
Unit V	Concurrency Control – Time Stamp ordering – Validation Techniques – Recovery System –Log Based Recovery – Shadow Paging – Buffer Management	12

Recommended Learning Resources

Print Resources	1.AbrahamSilverschatz, Henry F.Korth and S.Sudarshan “Database System Concepts”, Fourth Edition, McGraw Hill, 2002. 2. James Martin “Computer Data-Base Organization” Second Edition, PHI.

Year	III	Course Code:	Credits	4
Sem.	V	Course Title: Computer Networks	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To help the student to get knowledge about the Networking aspects of computer. • Ability to design the new protocols for modern networks. • To get familiarized with next generation networks

Unit No.	Course Content	Hours
Unit I	Introduction – Uses of computer Networks – Network hardware – Network software – Reference Model- The OSI Reference model, TCP/IP Reference Model, and A Comparison of the OSI and TCP Reference models – Example Networks – Novell networks. The ARPANET and the Internet	12
Unit II	The physical layer – Guided Transmission media – Wireless transmission – Communication satellites- The public switched telephone network-Mobile telephone system. Data link layer – Design issues – Error Detection and Correction – Elementary data link protocols – Example data link protocols – Sliding window protocols.	12
Unit III	The medium access sub layer – The channel allocation problem – Multiple access protocols – Aloha. Carrier sense multiple access protocols, Collision protocols – ETHERNET-Wireless LAN's-802.1 –Broadband wireless-802.16, and Data Link layer switching-Repeaters, Hubs, Bridges, Switches, Routers and Gateways.	12
Unit IV	The Network layer – Network layer design issues – Routing algorithms – Shortest path routing, Flooding, Flow based routing, Hierarchical routing, Broadcasting routing – Congestion control algorithms – General principle of Congestion algorithms, Congestion prevention policies, Internetworking – The Network layer in the internet-IP protocol, IP addressing, Internet multicasting-Mobile IP.	12
Unit V	The Transport layer- Transport service – Elements of transport protocols – Internet transport protocol-UDP, Remote procedure call, TCP, TCP connection management, Wireless TCP and UDP. The Application layer – Domain name system-Electronic mail-WWW-Network Security – Cryptography - Introduction, Substitution Ciphers-Transposition ciphers-fundamental cryptographic principals-e-mail security- PGP – PEM – S/MIME.	12

Recommended Learning Resources

Print Resources	1. Computer Networks – Andrew S. Tanenbaum, PHI. Fourth edition 2. Introduction to Data Communication and Networking – Behrouz and Forouzan – Second Edition – TMH 2001.

Year	III	Course Code:	Credits	4
Sem.	V	Course Title: Java & DBMS Lab	Hours	120
			Category	B

Course Prerequisites, if any : NIL

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• To generate ability to Create simple packages in Java. • Demonstrate the behavior of Multiple Inheritance, Multithreading, Exception handling and GUI techniques (Applet and AWT). in Java. • Ability to create and develop Database and to write and execute SQL Query using any DBMS software

Unit No.	Course Content	Hours
Unit I	• Finding area and Perimeter of a circle. Use buffered reader class • Substring removal from a string. Use StringBuffer class • Determining the order of numbers generated randomly using random class • Implementation of Point class for image manipulation *and* calendar class. • String manipulation using char array • Database creation for storing telephone numbers and manipulation • Usage of vector classes • Implementing thread-based applications and exception handling • Implementing Packages	25
Unit II	• Working with frames and various controls, Dialogues and Menus • Panel and Layout, Graphics, Color and Font	25
Unit III	• Design database using ER-Diagram • Implement a Database and Data Table in Database using SQL • Write SQL query to select record from a table using various clause • Write SQL query to use various inbuilt function.	25
Unit IV	• Write SQL query to perform various types of join over multiple tables. • To study and execute various DML commands in RDBMS. • To study and execute various DDL commands in RDBMS. • To study and execute various DCL commands in RDBMS.	25
Unit V	**Case Study 1**: Banking System in Java: Study how a Java application can handle banking operations, such as deposits, withdrawals, account management, and transaction history, implementing exception handling and file I/O**.** ***Case Study 2 :*** Design and implement Employee Payroll Database System in RDBMS	20

Recommended Learning Resources

Print Resources	1. The Complete Reference, H. Schild, Tata McGraw-Hill publication, Fifth Edition, Jul2017. 2. JAVA: How to program, Paul J. Deitel, Harvey Deitel, Prentice Hall publication, tenth edition,2014.

SEMESTER VI

Year	III	Course Code:	Credits	4
Sem.	VI	Course Title: Visual Programming	Hours	60
			Category	A

Course Prerequisites, if any: Nil

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To understand the basic principles and architecture of .NET Framework. • Ability to create Console and Windows Application using C#. • Ability to work with the File and Directory and to handle exception • Ability to connect to a database and create small projects.

Unit No.	Course Content	Hours
Unit I	Introduction to .Net Framework: - Architecture -Framework Components - The Common Language Runtime (CLR) - .NET Base Class Library - Common Language Specification (CLS) - Common Type System (CTS) - Metadata and Assemblies - MSIL - JIT Compilers.	12
Unit II	Introduction to C# - Program structure, variables, Data Type, Operators, Procedures, Flow Control and Iteration, Arrays, String manipulation, Boxing and Unboxing, Namespace.	12
Unit III	Object Oriented Programming in C#: Class, Objects, Encapsulation, Constructors, Inheritance, Operator & Method overloading, Polymorphism, Interface, Properties, Collections- Console class in C#.	12
Unit IV	Errors and exception handling, Garbage Collection- Visual Studio IDE, Windows Forms and various controls, menu creation, SDI and MDI applications, Common Dialog Boxes- Events and event handling. File IO (Directories, Files, and Streams)	12
Unit V	Introduction to ADO.NET - ADO.NET Architecture - NET Framework Data Providers - Connection Object - Command Object - Dataset and Data Reader Object - Data Adapter Object –Connecting to a database.	12

Recommended Learning Resources

Print Resources	1. Herbert Schildt, The Complete Reference: C# 4.0, Tata McGraw Hill, 2012. 2. Christian Nagel et al. Professional C# 2012 with .NET 4.5, Wiley India, 2012.

Year	III	Course Code:	Credits	4
Sem.	VI	Course Title: Software Engineering	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To provide the students with an overall view over Software Engineering • To understand various processes of software development • To Study about Software Metrics and the various methods of Cost Estimation. • To Study about Software Quality Management.

Unit No.	Course Content	Hours
Unit I	The nature of Software – software engineering – software process - software myths - process models - a generic process model - process assessment and improvement - prescriptive process model - component-based development – product and process-agile process	12
Unit II	Requirements engineering – identifying stakeholders –recognizing multiple viewpoints –working toward collaborations – collaborative requirements gathering – building the requirements model – negotiating and validating requirements	12
Unit III	Requirement analysis – scenario-based modelling – data modelling concepts – class-based modelling. Design process – design concepts - abstraction – Architecture- patterns – modularity – information hiding – functional independence - Refinement - Aspects -Refactoring - Object-Oriented Design Concepts - Design Classes	12
Unit IV	Design model - data design elements – Architectural Design Elements - interface design elements – Deployment-Level Design Elements - Component-Level Design Elements- Webapp Design - WebApp Design Quality-Design Goals-A Design Pyramid for WebApps -WebApp Interface Design- Aesthetic Design -Content Design - Architecture Design - Navigation Design	12
Unit V	Software quality - Achieving software quality –software reliability - a strategic approach to software testing – test strategies for conventional software – system testing –black box testing – white box testing - art of debugging – basic principles of project scheduling – software reengineering and reverse engineering - capability maturity model Integration (CMMI).	12

Recommended Learning Resources

Print Resources	1. Roger Pressman, "Software Engineering A Practitioner's Approach", McGraw Hill (India), 10th reprint, 2015. 2. Jan Sommerville, "Software Engineering", 8th Edition, Pearson Education, 2008. 3. Richard Fairley, "Software Engineering Concepts", McGraw Hill, 2004. 4. Stephan Schach, "Software Engineering", Tata McGraw Hill, 2007.

Year	III	Course Code:	Credits	4
Sem.	VI	Course Title: **W**eb Client-Side Programming	Hours	60
			Category	A

Course Prerequisites, if any : Nil	
Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To design and develop web applications. • Acquire client-side scripting knowledge and their applicability. • Create scripts using JavaScript in a web page. • Design forms and check for data accuracy. • Get introduced with Bootstrap and React JS concepts

Unit No.	Course Content	Hours
Unit I	Introduction to Internet-History-internet services and Accessibility-Uses of Internet- Web Concepts: The Client-Server Model in Web Architecture - Retrieving Data from Web - How Web Works – Protocols: TCP/IP, HTTP, FTP -Web Terms& definitions--Domain Naming System-URL-Internet service providers	12
Unit II	HTML: Introduction to HTML –Basic in HTML – Lists: Ordered – unordered lists – description list-Div-Body attributes- heading-paragraph-formatting-style elements-Hyperlinks-: Hypertext-Hypermedia-Images and graphics formats – Image Map- tables – frames- iframe – forms – background graphics-color-sound- URL: Absolute –Relative. CSS: Introduction-Types: External-internal-inline-Syntax-selector-colors.	12
Unit III	JavaScript- Introduction-Internal and external script- Variables-let-const-operators- Datatypes- Functions – Events – String Methods-Arrays-Conditional Statement- Loops.	12
Unit IV	Java Script HTML DOM: Introduction- Document- Elements-HTML-Forms. JavaScript Objects: Window – Document – forms- textbox, button- checkbox – radio button-dates -Data validation	12
Unit V	Introduction to Bootstrap: Tables-Images-Button-Forms. Introduction to React JS: Introduction –Fundamentals- Components- Props &States– Events –Lists-Forms.	12

Recommended Learning Resources

Print Resources	1.HTML 5.0 Complete reference source book 2. Jon Duckett “Beginning Web Programming” WROX. 3.Web Technology:N.P. Gopalan and J. Akilandeswari 4. Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India Private Limited, 2011.

Year	III	Course Code:	Credits	4
Sem.	VI	**Course Title:** Visual Programming & Web Client-Side Programming Lab	Hours	120
			Category	B

Course Prerequisites, if any :	
Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Ability to create Console and Windows Application using C#. • Ability to work with the File and Directory and to handle exception and to connect to a database and create small projects using C#. • Ability to design a webpage

Unit No.	**Course Content**	**Hours**
Unit I	• Design and Implement a simple calculator • Create a Windows Form Application using various controls • Design and Implement a Quiz program using Multidimensional Array. • Create a Console Application for Multiplication Table • Create Console application for string manipulation	24
Unit II	• Implement Classes and Objects, Inheritance & Polymorphism • Create a Windows Application to demonstrate MDI application. • Create a Windows Application to demonstrate Exception handling in .NET • Create a windows Application to handle Directory and Files • Create a Windows Application to connect with Database.	24
Unit III	• Design a Simple web Page with Basic tags- Design a web page using List (Tutorial content) • Design a Web page using Images and hypertext/Hypermedia in HTML and CSS Concept (Incredible India) • Design a timetable / Program Schedule using Table tags • Design a webpage with India map using Html Tag- Image Map and iframe (Understanding Indian History)	24
Unit IV	• Design a webpage about full Stack development using Frames • Design a student registration form using HTML tags. • Write a JavaScript to access JavaScript Objects values and display in webpage/document-Design an webform with full validation.	24
Unit V	**Case Study1**: Design and implement Student Information System using C# and ADO.NET. **Case Study 2**: Design an interactive Webpage for Automated Payment System/ E-commerce System/Mass Media communication.	24

Recommended Learning Resources	
Print Resources	1. Herbert Schildt, The Complete Reference: C# 4.0, Tata McGraw Hill, 2012. 2. Christian Nagel et al. Professional C# 2012 with .NET 4.5, Wiley India, 2012.

SEMESTER VII

Year	IV	Course Code:	Credits	4
Sem.	VII	Course Title: Data Mining & Warehousing	Hours	60
			Category	A

Course Prerequisites, if any : Nil

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Gain a comprehensive understanding of data mining concepts • To understand the various Data preprocessing Methods. • To be familiar with the Data warehouse concepts • Gain knowledge in pattern mining • Attain knowledge and skills in classification • Understand various clustering algorithms

Unit No.	Course Content	Hours
Unit I	Overview and History – Data Mining – Types of data – Kinds of Patterns – Technologies Used – Applications – Major Issues in Data Mining – Data Objects and Attribute Types – Basic Statistical Descriptions of Data - Data Preprocessing Overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation	12
Unit II	Data Preprocessing Overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation – Data Warehouse: Basic Concepts – Data Cube and OLAP – Data Generalization by Attribute-Oriented Induction	12
Unit III	Pattern Mining Concepts – Market Basket Analysis – Frequent Itemset – Closed Itemset and Association Rules – Frequent Itemset Mining Methods – Pattern Evaluation Methods	12
Unit IV	Fundamentals – Decision Tree Induction – Bayes Classification – Rule Based Classification – Model Evaluation and selection – Techniques to Improve Classification Accuracy	12
Unit V	Cluster Analysis – Partitioning methods – Hierarchical methods – Agglomerative, Divisive hierarchical clustering – DBSCAN – Evaluation	12

Recommended Learning Resources

Print Resources	1. Jiawei Han, Micheline Kamber and Jian Pei “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2011. 2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson India Education Services Pvt. Ltd, 2016.

Year	IV	Course Code:	Credits	4
Sem.	VII	**Course Title**: **W**eb Server-Side Programming	Hours	60
			Category	A

Course Prerequisites, if any : Nil

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To understand the features like functions, forms in PHP. • To understand Cookies, Sessions in web page. • To learn how to take a static website and turn it into a dynamic website run from a database using PHP and MySQL. • Learn different ways of connecting to MySQL through PHP, and how to create tables, enter data, select data, change data, and delete data.

Unit No.	Course Content	Hours
Unit I	Introduction- Client-Server Architecture – Web Application Architecture-Server-Side Scripting- languages- example- Servers and Types. Introduction to PHP – Evolution-Embedding PHP in HTML - Basic Syntax - defining variables and constants - data types-operator.	12
Unit II	Decision & Loop: If-else-elseif-switch-loops-Functions: What is a function-define-call by value-call by reference-recursive function-String: create-search- replace- formatting. Indexed Array-sorting array-array functions.	12
Unit III	Handling HTML Form with PHP: form handling-validation-required-URL. Session and Cookie: Introduction to session control-session functionality-what is cookie - setting cookies with PHP.	12
Unit IV	Basics of Web Database-Types- Three tiers of Web Database architecture – Modern Web Database Architectures- how it Works-features. Relational Database Concepts: Working with MySQL database -Introduction to DDL Commands: create – alter-drop-truncate-view a table. Integrity Constraints: Domain-Entity-Referential. Security and locking - Codd's rule.	12
Unit V	Introduction to DML Commands: Insert-Select- Update-Delete-Operators: Arithmetic-Comparison-Logical. Introduction to TCL: Commit-Rollback-Savepoint. Accessing MySQL Database from the web with PHP - Checking and Filtering Input Data- Setting Up a connection & querying the Database.	12

Recommended Learning Resources

Print Resources	1."The Complete Reference PHP Covers PHP 5.2", Steven Holzner, Tata McGraw-Hill Edition 2008. 2. PHP6 and MySql6 Bible – Steve Svehring 3. PHP Programming Solutions – Vickram Viswan 4. Expert PHP and MySQL-MarcRochkind- Apress

Year	IV	Course Code:	Credits	4
Sem.	VII	Course Title: Cloud Computing	Hours	60
			Category	A

Course Prerequisites, if any : NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To understand the basic principles, paradigm and services of Cloud Computing. • Get an idea about the Cloud Computing architecture implementation and migration. • To understand the Virtualization Techniques • To understand the security concerns in cloud computing

Unit No.	Course Content	Hours
Unit I	Introduction to cloud computing- History, Roots of Cloud Computing, Layers and Types of Cloud, Infrastructure as a Service (IaaS), Software as a Service (SaaS), Platform as a Service (PaaS), Desired Features of a Cloud, Advantages and Disadvantages of Cloud Computing.	12
Unit II	Cloud Infrastructure Management, Cloud Computing Architecture-Cloud delivery models, Challenges in the cloud, Migrating into a cloud, The seven-step model of migration into a cloud, Migration risks and Mitigation.	12
Unit III	Cloud Deployment Models – Introduction - Private Cloud - Public Cloud-Community Cloud - Hybrid Cloud- Cloud Service Providers-AWS-Azure-GCP.	10
Unit IV	Introduction to Virtualization, Benefits of Virtualization, Types of Virtualization, Hypervisors, Virtualization and cloud computing -cloud Storage system, Service and Resource Management in cloud-SLA.	14
Unit V	Cloud Security - Infrastructure Security - Network level security, Host level security, Application level security - Data security and Storage - Data privacy and security Issues.	12

Recommended Learning Resources

Print Resources	1. RajkumarBuyya, James Broberg, AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", First Edition, Wiley, 2013. 2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", First Edition, Wiley, 2010.

Year	IV	Course Code:	Credits	4
Sem.	VII	Course Title: Internet of Things	Hours	60
			Category	A

Course Prerequisites, if any : Nil

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Understand IoT fundamentals, including design, protocols, and technologies • Explore domain-specific applications such as home automation and industry • Learn about M2M applications and system management • Develop IoT systems using platforms like Raspberry Pi • Manage IoT server and cloud infrastructure, focusing on security

Unit No.	Course Content	Hours
Unit I	Introduction: Definition, Characteristics of IoT, Physical Design of IoT, Protocols, Logical Design of IoT, IoT Enabled Technologies, IoT Levels and Templates	12
Unit II	Domain Specific IoT Applications: Home Automation, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle	12
Unit III	M2M and IoT System Management: M2M Applications, Software Defined Networks, Network Function Virtualization. Need for IoT System Management, Simple Network Management Protocol, IoT System Management with NETCOZF-YANG	10
Unit IV	Developing IoT Systems: IoT Platforms Design Methodology, Steps for IoT Design, Case Study on IoT System for Weather Monitoring, Introduction to Raspberry PI, Interfaces (serial, SPI, I2C), Programming Raspberry Pi, IoT Devices	14
Unit V	IoT Server and Cloud Management: Introduction to Cloud Storage Models and Communication APIs, Webserver – Web Server for IoT, Cloud for IoT, Security Management in an IoT System	12

Recommended Learning Resources

Print Resources	1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", First Edition, Orient Blackswan Private Limited, 2015. 2. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, "Internet of Things (IoT) Enabled Automation in Agriculture", Second Edition,CRC Press, 2022.

Year	IV	Course Code:	Credits	4
Sem.	VII	Course Title: Web Server-Side Programming & IOT Lab	Hours	120
			Category	B

Course Prerequisites, if any : Nil

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Able to design a form with input element and passing variable using URL. • Create a database in MYSQL and to manipulate data into it. • Able to store information about client's session using Cookies. • Understand IoT fundamentals, including design, protocols, and technologies • Explore domain-specific applications such as home automation and industry

Unit No.	Course Content	Hours
Unit I	Write a PHP program to get name of the user from a form and show greeting text, to check a number is palindrome or not and to use string function to handle strings. - Create a PHP page for login page without sql connection. - Write a PHP program that demonstrates form input element., passing variable using URL., use of session:1 & Cookies and to design interactive webpage	24
Unit II	Write a PHP program to create and drop a database using MySQL. - Write a PHP program to manipulate (select/insert/delete/update) table in MySQL. - Create a student Registration in PHP and Save and Display the student Record. - Write a program to read customer information from customer table and display all this information in table format on output screen. - Write PHP code to upload image. Write a program that keeps track of how many times a visitor has loaded the page.	24
Unit III	Identify and list different types of IoT devices and their functionalities Sketch a physical design for a home automation system using IoT devices - Compare and contrast different IoT protocols such as MQTT, CoAP, and HTTP. - Set up a basic communication protocol between two IoT devices using MQTT. - Discuss the role of cloud computing in enabling IoT solutions	24
Unit IV	Implement a simulation of the home automation system using IoT platforms like Arduino or Raspberry Pi - Investigate and compare M2M applications in industries such as healthcare and logistics - Program a Raspberry Pi to collect weather data from sensors and display it on a web server- Explore different cloud storage models (e.g., public, private, hybrid) and their suitability for IoT applications	24
Unit V	Case Study 1: Create a PHP page with Simple Quiz Program Website and declare correct answers and results. Case study 2: Implement security measures such as encryption and authentication in an IoT system using cloud-based services	24

Recommended Learning Resources

Print Resources	1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", First Edition, Orient Blackswan Private Limited, 2015. 2. PHP AND MYSQL Web development, 5th edn by Luke Welling and Laura Thomson

SEMESTER VIII

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Cyber Security	Hours	60
			Category	A

Course Prerequisites, if any : NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto. • Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds and importance of personal data, its privacy and security. • Analyse and evaluate the security aspects of social media platforms and ethical

Unit No.	Course Content	Hours
Unit I	Introduction to Cyber security: Defining Cyberspace Definition and scope of cyber security-Cyber security threats and vulnerabilities - Basic security concepts (CIA triad, confidentiality, integrity, availability)-Issues and challenges of cybersecurity-Awareness and Complaint Mechanism.	12
Unit II	Security Risk Management- Risk management process (identify, assess, mitigate, monitor)- Threat modeling and vulnerability assessment- Security controls and countermeasures	12
Unit III	Security Architectures- Network security architectures (firewalls, VPNs, IDS/IPS)- Cryptography (encryption, decryption, hashing) - Access control and authentication (users, roles, permissions)	12
Unit IV	Network Security- Network protocols and devices (TCP/IP, routers, switches)- Network vulnerabilities and attacks (sniffing, spoofing, phishing) - Network security tools (Wireshark, Nmap)	12
Unit V	Cryptography and Encryption-Encryption algorithms (AES, RSA)- Hashing and digital signatures- Public Key Infrastructure (PKI) Cloud and Endpoint Security- Cloud security (AWS, Azure, Google Cloud)- Endpoint security (laptops, desktops, mobile devices)- Endpoint detection and response (EDR)	12

Recommended Learning Resources

Print Resources	1.Cyber Crime Impact in the New Millennium,by R.CMishra, AutherPress. 2010 2.Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. 2011 3.Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 2001)

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Professional Ethics	Hours	60
			Category	A

Course Prerequisites, if any : Nil	
Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• Ability to know Computer Crime and Intellectual Property Rights • Able to Regulate Internet Content, Technology and Safety • Understand Computer Technologies Accessibility Issues

Unit No.	Course Content	Hours
Unit I	Introduction – Computer ethics: an overview – Identifying an ethical issue – Ethics and law – Ethical theories - Professional Code of conduct – An ethical dilemma – A framework for ethical decision making - Computer hacking– definition of hacking – Destructive programs –hacker ethics - Professional constraints – BCS code of conduct –Ethical positions on hacking.	12
Unit II	Aspects Of Computer Crime And Intellectual Property Rights : Introduction - What is computer crime – computer security measures – Professional duties and obligations - Intellectual Property Rights – The nature of Intellectual property –Patents, Trademarks, Trade Secrets, Software Issues, Copyright - The extent and nature of software piracy – Ethical and professional issues – free software and open-source code.	12
Unit III	Regulating Internet Content, Technology And Safety: Introduction – In defence of freedom of expression – censorship – laws upholding free speech – Free speech and the Internet - Ethical and professional issues - Internet technologies and privacy – Safety and risk – assessment of safety and risk – risk-benefit analysis – reducing risk.	12
Unit IV	Computer Technologies Accessibility Issues : Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace– computers and employment – computers and the quality of work – computerized monitoring in the workplace – telecommuting – social, legal and professional issues - Use of Software, Computers and Internet-based Tools - Liability for Software errors - Documentation Authentication and Control – Software engineering code of ethics and	12
Unit V	Software Development – Strategies for engineering quality standards – Quality management Standards –Social Networking ethical issues – Cyber bullying – cyber stalking – Online virtual world – Crime in virtual world - digital rights management - Online defamation – Piracy – Fraud.	12

Recommended Learning Resources

Print Resources	1. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical, legal and professional issues in computing", Middlesex University Press, 2008. 2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2011. 3. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2011.

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Big Data	Hours	60
			Category	A

Course Prerequisites, if any : NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes

- Introduce Big Data and its characteristics and Applications.
- Students will be able to understand big data Software
- Students will know the difference between conventional SQL query language and NoSQL basic concepts
- Students will earn tips and tricks for Big Data use cases and solutions.

Unit No.	Course Content	Hours
Unit I	Introduction to Big Data-Characteristics of Big Data -Types of Big Data-Applications of BIG DATA- Big Data Architecture-Challenges in BIG DATA	12
Unit II	Big Data Life Cycle-Cluster-File System-Distributed File System-OLTP-OLAP-ETL-Data Warehousing- Data Marts- Data Lake.	12
Unit III	Big Data Storage- RDBMS vs. NOSQL -NoSQL Introduction- Types of No SQL Data Bases-Data Model- Distributed Data Model.	12
Unit IV	Big Data Processing- Parallel Data Processing-Distributed Data Processing-Process Workload- Batch and Transactional Processing-Introduction to Map-Reduce processing and HDFS- Big Data Analytics and Machine Learning.	12
Unit V	The Hadoop Ecosystem Supplementary Components- NOSQL Databases-Mongo DB-Others Big Data Software- Introduction-Spark-Flink-Kafka-Cassandra.	12

Recommended Learning Resources

Print Resources

1. Thomas Eri et al “Big Data Fundamentals- Concepts, Drivers and Technnics”-The Prentice Hall Edition-2015.
2. Chris Eaton, Dirkderoosetal., “Understanding Bigdata”, McGrawHill, 2012.
3. BIG Data and Analytics, SimaAcharya, Subhashini Chhellappan, Willey
4. MongoDBinAction, KyleBanker, PiterBakkum, ShaunVerch, Dreamtech Press
5. TomWhite,“HADOOP:The definitive Guide”,OReilly 2012.

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Research Methodology	Hours	60
			Category	A

Course Prerequisites, if any: NIL

Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes	• To familiarize the students to the principles of scientific methodology • To develop analytical skills of research

Unit No.	Course Content	Hours
Unit I	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process -Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance	12
Unit II	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.	12
Unit III	Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non-Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size	12
Unit IV	Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	12
Unit V	Use of Research Guides, Handbook etc., Academic Databases for Computer Science Discipline. (Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	12

Recommended Learning Resources

Print Resources	1. Business Research Methods –Donald Cooper & Pamela Schindler,TMGH, 12th edn 2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press, 5th edition. 3. Research Methodology – C.R.Kothari

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Data Science	Hours	60
			Category	A

Course Prerequisites, if any : NIL	
Internal Assessment Marks: 25 End Semester Marks : 75	Duration of ESA (Theory): 03 hrs.
Course Outcomes:	• Build practical data skills • Data collection, Analysis, Visualization, and Preparation.

Unit No.	Course Content	Hours
Unit I	Introduction to Data Science-Overview of Data Science and its applications. Data Science process and lifecycle: Collect, Clean, Analyze, Visualize, and Interpret. Difference between Data Science, Data Analytics, and Machine Learning. Roles and responsibilities in Data Science (Data Scientist, Data Analyst, Data Engineer).	12
Unit II	Data Science Tools and Programming-Introduction to Python or R for Data Science: Basics of programming: Variables, Loops, Functions, Lists, Tuples. Introduction to Jupyter Notebooks. Essential libraries: NumPy, Pandas, Matplotlib, Seaborn (Python) or dplyr, ggplot2 (R).	12
Unit III	Data Collection and Preprocessing-Data Types and Sources (structured, unstructured, semi-structured). Data acquisition: Importing data from CSV, JSON, databases, web scraping. Data cleaning techniques: Handling missing values, duplicates, outliers. Data transformation (normalization, standardization).	12
Unit IV	Exploratory Data Analysis (EDA)-Descriptive statistics: Mean, Median, Mode, Variance, Standard deviation. Data visualization techniques: Bar charts, Line charts, Histograms, Box plots, Heatmaps, Scatter plots. Identifying patterns and insights from data.	12
Unit V	Data science and Machine Learning, Data Science and Big Data-Basic data manipulation using Pandas or dplyr. Simple data visualization exercises. - Data cleaning and preprocessing using Pandas or R. **Case study**: Preprocessing a real-world dataset (e.g., Titanic dataset). Perform EDA on a dataset (e.g., customer data). Visualizing correlations and relationships using Seaborn or ggplot2.	12

Recommended Learning Resources

Print Resources	1.Nina Zumel, John Mount, "Practical Data Science with R" MANNING 2.EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Introduction to Artificial Intelligence and Machine Learning	Hours	60
			Category	A

Course Prerequisites, if any : NIL

Internal Assessment Marks: 25 End Semester Marks : 75	Duration of ESA (Theory): 03 hrs.

Course Outcomes:

Ability to create representations of the domain of interest.
Ability to acquire knowledge on Artificial Intelligence techniques.
Ability to learn different search process in AI.
Understand the different models of Machine learning.
Able to implement different classification algorithms used in machine learning.

Unit No.	Course Content	Hours
Unit I	Introduction- Intelligence- Artificial Intelligence-Applications – History of AI– Types of AI- Knowledge - Characteristics of AI Problem – Problem Representation in AI-State Space representation.	12
Unit II	Search Process : Brute force search-Depth First Search-Breadth First Search-Heuristics Search: Hill Climbing -Constraint Satisfaction: Best First Search-A*-AO* Algorithm.	12
Unit III	Predicate logic: role of logic-tautologies-rules of inference-resolution. Min-Max Search-Alpha-Beta cutoff procedure-semantic network-frames-Scripts.	12
Unit IV	Machine Learning: Introduction - How it works-Fundamentals-Supervised Learning Algorithm: Linear regression- logistics regression-decision trees. Unsupervised Learning algorithm: k-means clustering-principal component analysis.	12
Unit V	Reinforcement Learning: Key concepts - Types-elements. Neural network: Introduction – perception - multilayer perception.	12

Recommended Learning Resources

Print Resources	1. Artificial Intelligence - By Elaine Rich, Kevin Knight. Shivashakar B Nair (Publisher: McGraw –Hill edition) 2.Foundations of Artificial intelligence and expert systems By V.S.janakiraman, K.Sarukesi, Gopalkrishnan.P(Publishers: Macmillan 3.Ethem Alpaydin, ”Introduction to Machine Learning”, MIT Press, Prentice Hall of India

Year	IV	Course Code:	Credits	4
Sem.	VIII	Course Title: Data Science & Cyber Security Lab	Hours	120
			Category	B

Course Prerequisites, if any : NIL

Internal Assessment Marks: 50 End Semester Marks: 50	Duration of ESA (Practical): 03 hrs.

Course Outcomes	• Build practical data skills, covering data collection, analysis, visualization, and preparation • Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto.

Unit No.	Course Content	Hours
Unit I	• Calculate Mean, Median, Mode, Variance, Standard Deviation, Range & comment about the values / draw inferences, for the given dataset • Calculate Skewness, Kurtosis & draw inferences on the following data • Calculate probability from the given dataset for the below cases • Check whether the data follows normal distribution	28
Unit II	• Build a simple linear regression model by performing EDA and do necessary transformations and select the best model using R or Python. • Perform Clustering (Hierarchical, Kmeans & DBSCAN) for the crime data and identify the number of clusters formed and draw inferences.	28
Unit III	• Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User). • Setting and configuring two factor authentications in the Mobile phone. • Security patches management and updates in Computer and Mobiles. • Managing Application permissions in Mobile phone in computer and mobile.	20
Unit IV	• Installation and configuration of computer Anti-virus. • Installation and configuration of Computer Host Firewall. • Wi-Fi security management	20
Unit V	Case study 1: A F&B manager wants to determine whether there is any significant difference in the diameter of the cutlet between two units. A randomly selected sample of cutlets was collected from both units and measured? Analyze the data and draw inferences at 5% significance level. Please state the assumptions and tests that you carried out to check validity of the assumptions. Case study2: List out security controls for mobile phone and implement technical security controls in the personal mobile phone.	24

Recommended Learning Resources

Print Resources	1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011) 2.Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.

MINOR PAPERS

Course Code: **Course Title: Foundations of Information Technology**		**Credits**	**4**
		Hours	**60**
		Category	**A**
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.		
Course Outcomes	• Familiarize the fundamentals of Information Technology. • Understand the management of hardware and software • Describe the basics of networking • Discuss about data management and security aspects of data • Ability to troubleshoot computer systems		
Unit No.	**Course Content**		**Hours**
Theory Components			
Unit I	**Introduction** Overview of IT – Computer Basics – Software fundamentals – Networks & Internet – IT ethics and policies		12
Unit II	**Hardware and Software Management** Computer Assembly and maintenance - Operating Systems – Software installation and maintenance – Virtualization, Cloud Computing		12
Unit III	**Networking Essentials** Network Fundamentals – Hardware – Protocols and services – Wireless Networking – Security		12
Unit IV	**Data Management and Security** Data and fundamentals of Database – Data Backup and recovery – Cyber Security – Encryption and Cryptography		12
Unit V	**IT Support and Troubleshooting** IT support – Troubleshooting methodologies – Diagnostic tools and utilities – Future trends in IT		12
Recommended Learning Resources			
Print Resources	1. Floyd Fuller, Brian Larson, Computers: Understanding Technology, EMC Paradigm, Fourth Edition, 2011. 2. Mike Meyers, CompTIA A+ Certification All-in-One Exam Guide, McGraw-Hill Education, Eleventh Edition, 2023. 3. Jeffrey S. Beasley, Piyasat Nilkaew, Networking Essentials, Prentice Hall Certification, Third Edition, 2012. 4. Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short , Cybersecurity Essentials, Sybex Publisher, First Edition, 2018.		

Course Code:		**Credits**	4
Course Title: Computer Applications in Corporate Offices		**Hours**	75
		Category	C
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75 (Theory 50 +Practical 25)		Duration of ESA (Theory): 03 hrs. Duration of ESA(Practical): 03 hrs.	
Course Outcomes	• Understand the basics of computers • Applications of MS Office packages • Basics of Tally Packages		
Unit No.	**Course Content**		**Hours**
Theory Component			
Unit I	Introduction to Computer: Components - Architecture –Software Concepts: Types of software – Operating System: Functions –Windows OS: Folder, File operation.		9
Unit II	Application of MS office – Application of MS Word-Business correspondence-letters- tables- mail merge.		9
Unit III	Application of MS Excel: Formula-Data Filters- Charts –Basic, Statistical& Financial Functions.		9
Unit IV	Application of MS Power Point : Introduction – Navigation– Creation of Slides-animations - Designing Presentations – Slide Show Controls		9
Unit V	Application of Accounting Software Tally (Prime): Features of Tally – Creation of Company – Creation of Ledgers - Vouchers – P&L a/c – Balance Sheet – Inventory Handling – Creation of Stock Items – Invoice generation.		9
Practical Component			
1. Text editing and formatting 2. Operations on table 3. Mail merge 4. Implementation of basic Excel formula 5. Data – conditional formatting and validation, filter, sorting 6. Implementation of graphs 7. Financial functions in Excel 8. What if analysis 9. Presentation with slide navigation, animation and slide show control 10. Company creation and balance sheet using Tally			30
Recommended Learning Resources			
Print Resources	1. Rajagopalan , S.P., Computer Application in Business, Vikas Publishing House, New Delhi 2. Deepak Bharihoke., Fundamentals of IT, Excel Books, New Delhi. 3. Dhiraj Sharma., Foundation of IT, Excel Books, New Delhi. 4. Bhatnagar ,S.C. & Ramani , K.V., Computers and Information Management, Prentice Hall of India , New Delhi. 5. Mastering Tally Prime, by AK Nadhani. BPB Publication, New Delhi		

Course Code: **Course Title: Internet and Ecommerce**		**Credits**	4
		Hours	75
		Category	C
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75 (Theory 50 +Practical 25)		Duration of ESA (Theory): 03 hrs. Duration of ESA(Practical): 03 hrs.	
Course Outcomes	• To acquire the basic knowledge on Internet • To enable the students on gaining the knowledge on HTML • To gain knowledge on working with webpage • Understanding the principles of e-commerce		
Unit No.	**Course Content**		**Hours**
Theory Component			
Unit I	Internet: Uses-application-advantages-History of www-web-difference between Internet and web- ISP- Internet services-Internet addressing- Internet protocol-DNA- web browser- URL- DNS-Download-Upload-online-offline-Type of Internet Connection-Modem- E-mail function –advantages-disadvantages-Search Engine.		9
Unit II	HTML: Introduction-HTML TAGS- Structure – Basic commands-list-table-Linking document –adding Graphics to HTML- Image Map-Frames.		9
Unit III	Introduction: What is E-commerce-Evolution-Nature- Scope –Issues in Implementation- Impact, challengers & limitations of E-commerce- Market forces influencing I-way-components of I-way –Classification of E-Commerce - difference-application-benefits-advantages and disadvantages-E-Commerce Technologies-Framework.		9
Unit IV	Electronic payment System (EPS)-EFT-online banking- EDI: Introduction-components-EDI legal, security and privacy issues – EDI & E-commerce-(VAN) value added networks: Application-limitations- Advantages-Future - Role of national payment corporation of India NPCI		9
Unit V	Online Shopping: Introduction – Process – advantages – disadvantages – E-payment: Benefits – components of electronic System – EFT – Credit card system on Internet – Components of online credit processing – popular E-payment methods- Role of the Information Technology Act 2000 and online payments		9
Practical Component			
	1. Basic HTML tags 2.Table creation 3. Hyper link 4.Image in web page 5. Animation of text and image 6.Frames 7. Web page using html		30
Recommended Learning Resources			
Print Resources	1. Alexis Leon & Mathews Leon, “Internet for Everyone”, Leon Tech World, Chennai 2. Eric Kramer, “HTML”. 3. Kamalesh N. Agarwala, Amit Lal & Deeksha Agarwala, “Business of the Net”. 4. John Zabour, Jeff Foust & David Kerven, “HTML 4 HOW- TO”. 5. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.		

Course Code: **Course Title: Programming in C**		**Credits**	4
		Hours	**75**
		Category	**C**
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75 (Theory 50 +Practical 25)	Duration of ESA (Theory): 03 hrs. Duration of ESA(Practical): 03 hrs.		
Course Outcomes	• To learn the C programming language that is attractive, considerable worldwide and portable • To study and understand the arrays, structures in C.		
Unit No.	**Course Content**		**Hours**
Theory Component			
Unit I	C language fundamentals: structure of C program- character set- Identifiers and keywords- Constants- Data types- Declarations. Preprocessor command: #include, #define. Operator types: arithmetic, Unary, Logical, bitwise, assignments and conditional operator.		9
Unit II	Control statements: if-else, nested if, For, While and do-while loop statements, nested loop, switch, break, continue.		10
Unit III	Arrays: Defining and processing (search and sort) - Multi dimensional arrays (Matrix). Strings and strings operations.		8
Unit IV	Input-Output: getchar, putchar, scanf, printf, gets, puts, functions: Functions: Defining and accessing- Passing arguments- Function prototypes- library functions		9
Unit V	Storage classes: Automatic, external and static variables Structure: Defining and processing- passing structure to function- union.		9
Practical Component			
• Write simple c program to check for prime number. • Write simple c program to check for Armstrong number • Write C program to find maximum and minimum in array of numbers • Write C program to implement Linear and Binary search. • Write C program to implement Bubble sort. • Write C program for Matrix manipulation to implement Matrix addition, multiplication and Transpose. • Write C program for string manipulation			30
Print Resources	1. Introduction to "C" by E. Balaguruswamy. 2. The C Programming Language By Brian W.Kernighan and Dennis M.Ritchie Publishers: Prentice-Hall		

Course Code: **Course Title: Introduction to Python Programming**		**Credits**	4
		Hours	**75**
		Category	**C**
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75 (Theory 50 +Practical 25)	Duration of ESA (Theory): 03 hrs. Duration of ESA(Practical): 03 hrs.		
Course Outcomes	• Understand the basics of writing Python code • Implement programs using lists, tuples and dictionaries • Understand the use of control structures		
Unit No.	**Course Content**		**Hours**
Theory Component			
Unit I	Introduction to Python– Advantages of using Python – Executing Python Programs – Python's Core data types – Numeric Types – String Fundamentals.		9
Unit II	list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value;		9
Unit III	Dictionaries: operations and methods; advanced list processing – list comprehension. Set and operations		9
Unit IV	Python Statements: Assignments – Expressions – If condition – While and For Loops. Functions: Definition, Calls – Scopes – Arguments – Recursive Functions– Functional Programming tools		9
Unit V	Classes and Object-Oriented programming with Python. Modules and Packages: Purpose, using packages– Exception Handling with Python.		9
Practical Component			
String operations - List operations and methods - List cloning and Comprehension - Tuple and Dictionary Operations. Sorting - Linear Search and Binary Search- Generate Student marks statement - Matrix operations using NumPy			30
Print Resources	1. Mark Lutz, "Learning Python", Fifth Edition, O'Reilly, 2013. 2. Daniel Liang, "Introduction to programming using Python", Pearson, First edition, 2021.		

Course Code:		**Credits**	4
		Hours	**60**
Course Title: Basics of Cyber Security		**Category**	**A**
Course Prerequisites, if any : Nil			
Internal Assessment Marks: 25 End Semester Marks: 75	Duration of ESA (Theory): 03 hrs.		
Course Outcomes	• Understand the cyber security threat • Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto. • Analyze and evaluate existing legal framework and laws on cyber security.		
Unit No.	**Course Content**		**Hours**
Theory Component			
Unit I	Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.		12
Unit II	Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransom ware attacks, zeroday and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.		12
Unit III	Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hash tag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.		12
Unit IV	E-Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007,		12
Unit V	Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host fire wall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.		12
Recommended Learning Resources			
Print Resources	1. Cyber Crime Impact in the New Millennium, by R.C Mishra, Auther Press.Edition 2010. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)		

Multi-Disciplinary Course

Multi-Disciplinary Course offered by Department of Computer Science

<table>
<tr><td colspan="3">Course Code:
Course Title: Introduction to Computers</td><td>Credits</td><td>3</td></tr>
<tr><td colspan="3"></td><td>Hours</td><td>45</td></tr>
<tr><td colspan="3"></td><td>Category</td><td>A</td></tr>
<tr><td colspan="5">Course Prerequisites, If any: NIL</td></tr>
<tr><td colspan="2">Internal Assessment Marks: 25
End Semester Marks: 75</td><td colspan="3">Duration of ESA (Theory): 03 hrs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">• Understand the History and Evolution of computers
• Identify Computer Components
• Working knowledge with Windows Operating Systems</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Content</td><td>Hours</td></tr>
<tr><td>Unit I</td><td colspan="3">Introduction to Computers: Characteristics- Generations of Computers - History of Computers-Advantages and disadvantages of computers.</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="3">Classification of Computers- based on working principle and based on size and capacity - Application of computers in different areas-Computer Software-types of software.</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="3">Computer Hardware -difference between hardware and software- Block diagram of a computer- Central processing Unit- Memory- types of memory - Input/output devices- Mouse, Keyboard, Joystick, Scanner, Touch screen, OMR, Monitor, Printer, Plotter.</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="3">Operating System: Introduction – Functions -types of Operating Systems Data Organization: Data, Field, Record, File, Database, Sequential Access, Random Access - Number System</td><td>9</td></tr>
<tr><td>Unit V</td><td colspan="3">Working with WINDOWS: Desktop Icons. My Computer, Recycle Bin, Internet Explorer, My Documents. How to create a Folder, Copying and deleting files, Renaming, Programs, Search, Run, Shut down.</td><td>9</td></tr>
<tr><td colspan="5">Recommended Learning Resources</td></tr>
<tr><td>Print Resources</td><td colspan="4">1. Introduction to Information Technology by Dr.P. Rizwan Ahmed, Margham Publications.
2. Rajaraman V-Fundamentals of computers, Prentice Hall of India Pvt ltd, New Delhi
3. Peter Norton, “Introduction to Computers”, TMH,2004</td></tr>
</table>

Community Engagement and Service

Course: **B.Sc Computer Science** Semester No: I**V** Paper No:

Title of the Paper: Winter Project

Project work(Internal) - 50 Marks **Total Credit -2 credits**
Project Viva - 50 Marks **Total: 100 Marks**

INTRODUCTION:

The students will have to undergo Community Engagement and Service (2 Weeks) after the completion of the Third Semester and submit a "Project Report" by end of training.

Course Objective:

- The purpose of the Winter project -Community engagement is to provide each student an awareness about social area of concern of their surroundings.
- To help and develop social communication skills necessary for social engagement with respect to various issues.
- To develop analytical and understanding skill of working in and for the society and social issues and their impact on society and individuals in day-to-day life.

Course Outcome

- The student with an opportunity to gain knowledge and skills to learn and understand social and behavioral issues.
- The students have connected with the specific problems of the society or community and practical learning experiences to solve the issues.
- Students will be equipped with in depth knowledge and experience of social and economic issues and solving methods.

General Guidelines:

- The student has to undertake project individually or collectively (not more than 3 students)
- The Internship Coordinator and Faculty Internship Advisor will assist students in making the job a valuable and productive experience.
- With permission of the Faculty in charge, a student may choose a topic nearby their residence for their winter project
- Attendance Policy: Students are required to report to work on time and according to the requirements of the student's individualized work schedule.
- Individual work schedules are established by agreement of the student, and Faculty Internship Advisor.
- After completion of this project, student has to submit, Hand written or / typed 30-40 pages detailed report to the department with the faculty in charge.

Evaluation of course:

- The total marks for the Community engagement project will be 100 and it carries 2 credits.
- The marks will be awarded in proportion of 50:50.

- The 50 marks for project and 50 marks for conducting viva (Minimum passing marks 20), Total Passing minimum is 40 Out of 100, Viva will be Conducted by department with the help of HOD and faculty in charge.

Illustrative Areas for Community Engagement:

- Making Awareness on Cyber Space and Internet
- Making awareness on Cyber Security
- Educate Internet Usage
- Educate Mobile usages
- Educate to use internet for daily minimum needs
- Awareness Government Schemes available on to web
- Educate accessing E-Governance
- Any other awareness or educational activity related to computer, internet, web and digital services to common man to reduce digital divide

Title of the Paper: Summer Internship (MJD-XI)

Course: **B.Sc Computer Science** Semester No: **V** Paper No:

Project work (Internal) -50 Marks **Total credit -4 credit**

Project- Viva - 50 Marks **Total: 100 Marks**

INTRODUCTION: The students will have to undergo Summer Training for 8 weeks after the completion of the fourth Semester and submit a "Summer Internship Project Report" by the end of training.

Course Objective:

- The purpose of the Internship Program is to provide each student practical experience in a standard work environment of company / organizations.
- To help and develop skills necessary for a lasting and rewarding career in the future.
- To develop workplace competencies required for future career.

Course outcome

- Student gets an opportunity to gain knowledge and skills in their field of interest from a planned work experience.
- The students have practical learning experiences which is not available in the classroom Environment.
- Students will be equipped with entry-level, career-related exposure and workplace competencies that employers' value when hiring new employees.
- Internships may also be used as an opportunity to explore career fields.

General Guidelines:

- The student has to undertake project individually, Joint Projects are not allowed in any case.
- The Internship Coordinator and Faculty Internship Advisor will assist students in making the job a valuable and productive experience.
- The student will work closely with the Program Manager, Faculty Internship Advisor, and Career Services to seek out appropriate experiences and develop job seeking skills as part of the internship education experience.
- Students must be able to prove the additional/enhanced knowledge gained during the internship experience.
- Attendance Policy: Students are required to report to work on time and according to the requirements of the student's individualized work schedule.
- Students receive college credit for an internship based on the total number of hours worked as agreed upon before the work experience begins. Individual work schedules are established by agreement of the student, Worksite Supervisor, and Faculty Internship Advisor.

Evaluation of course:

- The total marks for the summer internship project will be 100 and it carries 4 credits.
- The marks will be awarded in proportion of 50:50.
- The 50 marks for project and 50 marks for conducting viva (Minimum passing marks 20), Total Passing minimum is 40 Out of 100, Viva will be Conducted by department with the help of HOD/External Examiner and faculty in charge.

PARAMETERS FOR EVALUATION:

- Periodical Reporting
- Product Demonstration (in case she developed a software Product)
- Project Documentation
- Presentation and Viva voce

Title of the Paper: Mini Project (MID-VI)

Course: **B.Sc Computer Scienece** Semester No: **VI** Paper No:

Project work (Internal) -50 Marks **Total credit -4 credit**

Project- Viva - 50 Marks **Total: 100 Marks**

INTRODUCTION: The students will do the project work in the sixth semester, in this work students will develop a software in a systematic way in order to solve the real-life problems

Course Objective:

The objective of the project is to motivate them to work in emerging/latest technologies, help the students to develop ability, to apply theoretical and practical tools/techniques to solve real life problems related to industry, academic institutions and research laboratories.

Course outcome

- The students have practical learning experiences which is not available in the classroom Environment.
- Students will be equipped career-related exposure and workplace competencies.
- Students developed a software product in a systematic way

General Guidelines:

- The student has to undertake project individually or as a group (Maximum of 3 Members).
- The Project guide will assist students in making the project work a valuable and productive experience.
- Students must be able to prove the additional/enhanced knowledge gained during the project experience.
- A student is expected to do planning, analyzing, designing, coding, and implementing the project. The initiation of project should be with the project proposal. The project proposal approval will be given by the project guides.
- The students shall demo their product in front of external examiner during viva-voce examinations.
- Attendance Policy: Students are required to report periodically to their project guide.

Evaluation of course:

- The total marks for the project will be 100 and it carries 4 credits.
- The marks will be awarded in proportion of 50:50.
- The 50 marks for project and 50 marks for conducting viva (Minimum passing marks 20), Total Passing minimum is 40 Out of 100, Viva will be Conducted by department with the help of External Examiner and faculty in charge.

PARAMETERS FOR EVALUATION:

- Periodical Reporting
- Product Demonstration
- Project Documentation
- Presentation and Viva voce

Research Project (MJD XXI to XIII)

Course: **B.Sc Computer Science** Semester No: **VIII** Paper No:

Title of the Paper:

Paper Code:

Project Work = 100 Marks **Total credit =12 credits**
Project Report = 100 Marks **Total: 300 Marks**
Viva Voce =100 Marks

INTRODUCTION:

All the Eighth semester students who have scored marks above 75% (7.5 CGPA) and opted B.Sc Computer Science Hons with research degree, have to undergo compulsory project work which consists of 300 marks with 12 credits equal to 3 main papers. The objectives behind this practical component are to provide you an opportunity to investigate a problem by the application of various operational and practical concepts in a scientific manner.

Objectives of Research Project:

- To provide an opportunity for the students to develop knowledge and skill in the area of research.
- To develop ability to conduct research, analyze, and draw conclusions.
- A well-executed project will impress potential employers and help the students to stand out from the competition.
- To Familiarize with Research process and method and give an insight of the problem and probable solution in any workplace.

Course Outcome

After completion of Research Project students:

- Students gains ability to research and present information coherently and concisely.
- A project allows students to display analytical and problem-solving skills.
- A well-executed project demonstrates student's proficiency in using various software applications and tools.
- A successful project showcases student team-working skills and ability to collaborate with others.
- A good project highlights student's creativity and resourcefulness.
- Working on a project allows students to gain valuable industry experience and knowledge.

General Guidelines:

- **The student has to undertake project individually. Joint Projects are not allowed in any case.**
- The Research Project Coordinator and Faculty Advisor will assist students in making the job a valuable and productive experience.

- Students must be able to prove that additional, enhanced duties and/or knowledge will be gained during the project experience.
- Student has to write a research paper/ working paper as per area of project work as part of internal evaluation.

Evaluation of course:

- The total marks for the Research project will be 300 and it carries 12 credits.

- The 100 marks for research project Work (Minimum passing marks 50), 100 marks for project Report (Minimum passing marks 50) and 100 marks for external viva conduct (Minimum passing marks 50) by department with the help of external expert, however the student have to secure all together 150 marks for passing the research project.