

Faculty of Interdisciplinary Studies

Savitribai Phule Pune University, Pune



Curriculum for

Bachelor of Computer Applications (BCA) (Science)

(2024 Pattern)

(OL Mode)

3 Years UG Programme – NEP Compliant

(w.e.f. Academic Session July-August 2026)

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Preamble

The field of computing is rapidly expanding and changing, especially, since the last decade with continuous emergence of new disruptive technologies such as artificial intelligence, data science, cyber security, Internet of things, robotics and so on.

21st Century has witnessed rapid technological developments in every sector including the field of Computing. Moreover, it has created new job roles and massive job opportunities for budding graduates. Premium Institutes, public and private Universities, autonomous and affiliated colleges in India have always played a crucial role in producing human resources with required skill sets by capturing and monitoring these developments and offered various UG and PG programmes.

The Savitribai Phule Pune University, Pune has made its significant contribution by offering degree programmes as per the trends from time to time. In the year 1989, it started offering a degree programme Bachelor of Computer Science (BCS), now called B. Sc. (Computer Science) and was its unique offering in the state of Maharashtra. Later the University offered undergraduate and graduate programmes such as Master of Computer Management (MCM), Bachelor of Computer Applications (BCA), Master of Computer Applications (MCA), M. Sc (Computer Science), M. Sc. (Computer Applications) etc.

The Savitribai Phule Pune University, Pune has taken a leading role in design and implementation of Programmes as per the guidelines and recommendations of National Education Policy (NEP) 2020. The university decided to offer UG and PG programmes with features recommended by NEP-2020 such as inter and multi-disciplinary education, focus on skilling, on-job training/field projects, research, incorporation of Indian Knowledge System etc. for the holistic development of students.

The university has adopted the guidelines provided by the state Steering Committee and prepared the credit structure for this UG programmes.

The Ad-hoc Board of Studies in Open and Distance Learning has prepared a structure for **Bachelor of Computer Applications (BCA) (OL Mode) programme.**

The structure of the course is designed as per National Education Policy (NEP) 2020 and is in line with University guidelines.

The total credits offered for the three years with six semesters are 132 credits with 22 credits assigned for each of the six semesters.

I am thankful to Hon. Vice-Chancellor, Hon. Pro-Vice Chancellor, Hon. Dean of FoIDS, Hon. Dean of FoS&T and Chairman BoS in Computer Applications. I am thankful to all board members for their valuable inputs for their active participation in preparing the syllabus.

**Chairman,
BoS (Ad-hoc) in Open and Distance Learning,
Faculty of Interdisciplinary Studies,
Savitribai Phule Pune University**

Program Outcomes (POs)

Graduates will be able to:

1. **Scientific Knowledge:** Apply the knowledge of mathematics, science fundamentals, and specialization to the solution of complex problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and sciences.
3. **Design/development of solutions:** Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modelling to complex activities with an understanding of the limitations.
6. **The Graduate and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.
7. **Environment and sustainability:** Understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex activities with the professional community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the science and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Types of Courses in BCA (Science) Programme

Abbreviation	Type of Course
BSC	Basic Science Course
PCC	Program Core Course
PEC	Program Elective Course
OE	Open Electives Course
MN	Multidisciplinary Minor Course
AEC	Ability Enhancement Course
VEC	Value Education Course
VSEC	Vocational Skill Enhancement Course
IKS	Indian Knowledge System
CC	Co-curricular Course
EEM	Entrepreneurship, Economics and Management
OJT	On-job Training
FP	Field Project
CEP	Community Engagement Programmes
RM	Research Methodology
RP	Research Project

Rules and Regulations for BCA (Online Mode)

1) Eligibility Criteria for Admission:

12th standard / H.S.C. / Diploma / I.T.T. Certificate / 10+2 with Mathematics as one of the subjects from any recognized board.

2) Medium of Instruction / Appearance:

The medium of instruction / appearance shall be English only.

3) Attendance Criteria:

For theory courses, it shall be mandatory for the learner to watch minimum 75 % of the videos on LMS and answer the questions thereafter.

For Practical courses, minimum 80 % attendance in Virtual Lab Sessions is mandatory. The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each lab assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion. Program codes with sample output of all performed lab assignments are to be submitted as softcopy. The lab In-charge should maintain the students' programs in Virtual Lab system.

4) Scheme of Examination:

The course with 2 credits shall carry 50 marks & the course with 4 credits shall carry 100 marks. For 2 credits course, Continuous Internal Assessment (CIA) will be conducted for 15 marks & End-Semester Examination (ESE) will be conducted for 35 marks. For 4 credits course, CIA will be conducted for 30 marks & End-Semester Examination (ESE) will be conducted for 70 marks. The ESE shall be conducted in December session and June Session.

5) CIA:

5.1) CIA for theory courses can be conducted through variety of ways including

1. Handwritten Assignments 2. Seminar / Power Point Presentations 3. Oral Examination 4. Open Book Test 5. Online MCQ Test 6. Group Discussion 7. Analysis of Case Studies

5.2) CIA for practical courses shall be conducted during regular online lab sessions. Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage. Suggested parameters include-timely completion, performance,

innovation, efficient codes, code documentation, punctuality and neatness of the write-up etc.

5.3) For 'Field Work' course and 'Community Services' course, the instructor shall carry out internal evaluation of fieldwork throughout the semester based on timely completion of the work, analysis, findings and neatness of the report etc.

5.4) For 'Field Project' course, the criteria for CIA shall be:

1. Attendance and Participation
2. Daily Diary / Log Book
3. Report writing and contents
4. Presentation and Viva
5. Industry Supervisor Feedback

5.5) For Co-Curricular courses, CIA should be done by the respective course coordinator as a part of continuous assessment and be based on the regularity, performance of a student and his/her participation in various activities & power-point presentation before the class.

5.6) For OJT / Internship course, CIA shall be conducted by the mentor of the student based on the Learner's performance, regularity, participation and performance of the student at the place of OJT / Internship.

6) Mode of End-Semester Examination:

For foreign learners, the mode of ESE shall be Remote Proctored Online only. Indian learners can appear for the ESE by either of the following modes:

- i. Remote Proctored Online Examination
- ii. Exam Centre based Online Examination
- iii. Exam Centre based Offline Examination

For remote proctored online examinations, learners are solely responsible for providing a properly configured computer system with a webcam, a stable power supply, reliable internet connectivity, and a quiet, isolated environment. Any issue arising therefrom shall be treated as malpractice and will result in the immediate removal of the candidate from the examination. The timings for all the modes of examination shall be same.

At the beginning of the semester, every Indian learner has to declare the mode of ESE. The mode of ESE, once selected cannot be changed for that exam session (it can be changed for next exam session). For the Exam Centre based Examination mode, the exam centre shall be located at Pune, Ahilyanagar & Nashik only.

7) End–Semester Examination:

7.0) The time for Examination shall be same as applicable for examination of conventional mode.

7.1) The patterns of Question papers for Theory courses for End-Semester Examinations are given at the End of this curriculum.

7.2) For Practical courses, a pair of examiners shall conduct end semester examination in the form of practical examination based on journal assignments. Examiners shall ask questions about journal assignments and / or problem statement provided during practical examination to judge understanding of concepts by the students. There shall be a batch for ____ students.

7.3) For ‘Community Services’ course, the end semester examination shall be based on Group presentation and the reports of activities participated.

7.4) For Field Work course, the end semester examination shall be based on Group presentation and the reports of fieldwork submitted in the journal.

7.5) For ‘Field Project’ course, the criteria for ESE shall be:

1. Attendance and Participation
2. Daily Diary / Log Book
3. Report writing and contents
4. Presentation and Viva
5. Industry Supervisor Feedback

7.6) For OJT / Internship courses, evaluation should be done by a panel of examiners in two parts: 1) Based on the work report submitted by the student (50% marks), and 2) Remaining 50% marks should be based on his presentation and viva-voce on the work carried to be assessed by the panel of examiners.

7.7) For Co-Curricular course, Viva-Voce shall be conducted along with the Power-Point Presentation. Evaluation should be done jointly by the concerned faculty & external examiner.

7.8) The ESE for FP/CEP/OJT/CC courses shall be conducted along with the ESE for practical courses.

8) Passing Criteria:

There shall be separate passing in CIA & ESE. To pass in a course, the student should obtain 40 % marks in both CIA & ESE. The learners who have obtained minimum 50 % credits of 1st Year shall be eligible to take admission for 2nd Year. The learners who have passed 1st Year and obtained minimum 50 % credits of 2nd Year shall be eligible to take admission for 3rd Year.

9) Result Criteria

The result will be prepared as per the following criteria.

Marks	Grade Points	Grade Letters
90 to 100	10	O (Outstanding)
75 to 89	9	A ⁺ (Excellent)
60 to 74	8	A (Very Good)
55 to 59	7	B ⁺ (Good)
50 to 54	6	B (Above Average)
45 to 49	5	C (Average)
40 to 44	4	D (Pass)
< 40	0	F (Fail)
Absent	0	Ab (Absent)

The semester end grade sheet will contain grades for the courses along with titles and SGPA. Final grade sheet and transcript shall contain CGPA.

Semester Grade Point Average (SGPA):

The performance of a student in a semester is indicated by a number called the Semester Grade Point Average (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses, seminars and projects registered by the student during the semester.

$$\text{SGPA} = \frac{\sum \text{Grade Points Earned} \times \text{Credits for each course}}{\text{Total Credits}}$$

$$\text{SGPA} = \frac{\sum_{i=1}^p C_i G_i}{\sum_{i=1}^p C_i}$$

Course Grade Point Average (CGPA):

The CGPA is the weighted average of the grade points obtained in all the courses (Theory/term work/practical/oral/presentation) of first semester to sixth semester for the students admitted in the First year and third to sixth semester for the students directly admitted at Second year. It is calculated in the same manner as the SGPA.

In case of a student passing a failed course or in case of improvement, the earlier grade would be replaced by the new grade in calculation of the SGPA and CGPA.

Based on the performance of the student in the semester examinations, the Savitribai Phule Pune University will declare the results and issue the Semester Grade sheets. The class

shall be awarded to a student on the CGPA calculated.

Table: CGPA distribution and corresponding class of the degree awarded

Sr. No.	CGPA	Class of the degree awarded
1	$\text{CGPA} \geq 9.50$	O (Outstanding)
2	$8.50 \leq \text{CGPA} < 9.50$	A⁺ (Excellent)
3	$7.50 \leq \text{CGPA} < 8.50$	A (Very Good)
4	$6.25 \leq \text{CGPA} < 7.50$	B⁺ (Good)
5	$5.25 \leq \text{CGPA} < 6.25$	B (Above Average)
6	$4.75 \leq \text{CGPA} < 5.25$	C (Average)
7	$4.00 \leq \text{CGPA} < 4.75$	D (Pass)
8	$\text{CGPA} < 4.00$	F (Fail)

The award of the class should be as per table and corresponding percentage calculation for the CGPA has been given below:

For the calculation of Percentage from CGPA following equation can be used

Percentage calculation of a corresponding CGPA:

$$\% \text{ of Marks} = \begin{cases} \text{If O grade then } 20 \times \text{CGPA} - 100 \\ \text{If A+ grade then } 10 \times \text{CGPA} - 5 \\ \text{If A grade then } 10 \times \text{CGPA} - 5 \\ \text{If B+ grade then } 12 \times \text{CGPA} - 20 \\ \text{If B grade then } 5 \times \text{CGPA} + 23.75 \\ \text{If C grade then } 10 \times \text{CGPA} - 2.50 \\ \text{If D grade then } 6.6 \times \text{CGPA} + 13.6 \end{cases}$$

The factor considered in the above equations are evaluated from the grade point and marks distribution given in Table. The examples of the calculation of percentage are given in the following Table:

Table: Some examples of CGPA to percentage calculations

Obtained CGPA	Evaluation	Percentage	Grade
10	$20 \times 10 - 100$	100	O
9.75	$20 \times 9.75 - 100$	95	O
9.5	$20 \times 9.5 - 100$	90	O
9	$12 \times 9 - 24$	84	A ⁺
8.4	$10 \times 8.4 - 5$	79	A ⁺
7.34	$12 \times 7.34 - 20$	68.08	B ⁺
5.99	$5 \times 5.99 + 23.75$	53.7	B ⁺
4.94	$10 \times 4.94 - 2.5$	46.9	C
4.34	$6.6 \times 4.34 + 13.60$	42.24	D

Obtained CGPA	Evaluation	Percentage	Grade
10	$20 \times 10 - 100$	100	O
9.75	$20 \times 9.75 - 100$	95	O
9.5	$20 \times 9.5 - 100$	90	O
9	$12 \times 9 - 24$	84	A+
8.25	$12 \times 8.25 - 24$	75	A+
8	$10 \times 8 - 7.5$	72.5	A
7	$10 \times 7 - 7.5$	62.5	A
6.75	$10 \times 6.75 - 7.5$	60	A
6.25	$5 \times 6.25 + 26.25$	57.5	B+
5.75	$5 \times 5.75 + 26.25$	55	B+
5.5	$10 \times 5.5 - 2.5$	52.5	B
5.25	$10 \times 5.25 - 2.5$	50	B
4.75	$10 \times 4.75 - 2.5$	45	C
4	$6.6 \times 4.0 + 13.6$	40	D

While declaring the result, the existing relevant ordinances are applicable. There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course.

10) Registration Validity:

The validity of the registration for 3 years BCA (Science) programme shall be 6 years. The student has to complete the entire programme (pass all the subjects of all years) within the period of maximum 6 years. If the learner fails to complete the programme within the period of 6 years, s/he has to re-register & take fresh admission to complete the programme.

11) Grade Improvement Programme:

For grade improvement, a student will have to take minimum 40 credits. These courses will be theory courses from Subject 1, BSC, MJ, MN, SEC, PCC or PEC courses only. Grade improvement programme will be implemented at the end of the academic year. A student can option for the grade improvement programme only after the declaration of the result for his/her final semester exam, i.e. at the end of the next academic year after passing the final examination and within two years of completion of the degree and only once.

Level 4.5 (FY) Semester - I

Course Type	Course Code	Course Name	Credits				No. of hours						Examination Scheme & Marks		
			TH	PR	Total	Counselling (Synchronous)	Mentoring (Asynchronous)	e-tutorial		Field Work	e-Content	Self-Study Hours	CIA	ESE	Total
								AV Content	Virtual Lab						
Subject 1	OCA–101–T	Problem Solving and Programming in C	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA–102–P	Lab Course on Problem Solving and Programming in C (OCA–101–T)	--	02	02	--	--	--	30	--	10	20	15	35	50
BSC	OCA–103–T	Computer Organization and Architecture	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA–104–P	Lab Course on Computer Organization and Architecture (OCA–103–T)	--	02	02	--	--	--	30	--	10	20	15	35	50
BSC	OCA–105–T	Discrete Mathematics and Statistics	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA–106–P	Laboratory Course Based on Discrete Mathematics and Statistics (OCA–105–T)	--	02	02	--	--	--	30	--	10	20	15	35	50
OE	OOE–108–COMT	Financial Literacy-I	02	--	02	6	12	10	--	--	10	22	15	35	50
VSEC	VSEC–101–OCA	HTML and Webpage Designing	--	02	02	--	--	--	30	--	10	20	15	35	50
IKS Generic	OIKS–101–T	History of Knowledge Production in India (Generic)	02	--	02	6	12	10	--	--	10	22	15	35	50
AEC	OAEC–101–ENG	Professional Communication Skills – I	02	--	02	6	12	10	--	--	10	22	15	35	50
VEC	OVEC–101–T	Environmental Education – I	02	--	02	6	12	10	--	--	10	22	15	35	50
Total			14	08	22	--	--	--	--	--	--	--	165	385	550

Level 4.5 (FY) Semester – II

Course Type	Course Code	Course Name	Credits				No. of hours						Examination Scheme & Marks		
			TH	PR	Total	Coun- selling (Synch- ronous)	Mentoring (Asynch- ronous)	e-tutorial		Field Work	e- Content	Self- Study Hours	CIA	ESE	Total
								AV Content	Virtual Lab						
Subject 1	OCA-151-T	Advanced C Programming	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-152-P	Lab course on CA-151-T	--	02	02	--	--	--	30	--	10	20	15	35	50
BSC	OCA-153-T	Introduction to Microcontrollers	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-154-P	Lab course on Introduction to Microcontrollers (CA-153-T)	--	02	02	--	--	--	30	--	10	20	15	35	50
BSC	OCA-155-T	Linear Algebra	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-156-P	Lab course on Linear Algebra (OCA-155-T)	--	02	02	--	--	--	30	--	10	20	15	35	50
OE	OOE-158-COMT	Financial Literacy – II	02	--	02	6	12	10	--	--	10	22	15	35	50
VSEC	VSEC-151-OCA	Software Tools for Business Communication	--	02	02	--	--	--	30	--	10	20	15	35	50
AEC	OAEC-151-ENG	Professional Communication Skills – II	02	--	02	6	12	10	--	--	10	22	15	35	50
VEC	OVEC-151-T	Environmental Education – II	02	--	02	6	12	10	--	4	10	18	15	35	50
CC	OCC-151_1	Study of Contemporary Issues & News Clippings	02	--	02	--	--	--	30	--	10	20	15	35	50
Total			14	08	22	--	--	--	--		--	--	165	385	550

Level 5.0 (SY) Semester – III

Course Type	Course Code	Course Name	Credits				No. of hours						Examination Scheme & Marks		
			TH	PR	Total	Coun- selling (Synch- ronous)	Mentoring (Asynch- ronous)	e-tutorial		Field Work	e- Content	Self- Study Hours	CIA	ESE	Total
								AV Content	Virtual Lab						
MJ	CA-201-MJ	Data Structures	04	--	04	12	24	20	--	--	20	44	30	70	100
	CA-202-MJP	Lab course on Data Structures (CA-201-MJ)	--	02	02	--	--	--	30	--	10	20	15	35	50
VSC	OCA-221-VSC	C++ Programming	--	02	02	--	--	--	5	--	10	22	15	35	50
FP	OCA-231-FP	Field Work	--	02	02	--	--	--	30	--	10	20	15	35	50
MN	OCA-241-MN	Data Communications	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-242-MNP	Lab Course on Data Communications (OCA-241-MN)	--	02	02	--	--	--	30	--	10	20	15	35	50
OE	OOE-208-COMT	Personality Development for Business Professionals	02	--	02	6	12	10	--	--	10	22	15	35	50
IKS	OCA-200-IKS	Indian Knowledge System for Computing	02	--	02	6	12	10	--	--	10	22	15	35	50
AEC	OAEC-201-ENG	Advanced Professional & Applied Communication – I	02	--	02	6	12	10	--	--	10	22	15	35	50
CC	OCC-151_2	Study & Documentation for Local History	--	02	02	--	--	--	--	5	10	45	15	35	50
Total			14	08	22	--	--	--	--	--	--	--	165	385	550

Level 5.0 (SY) Semester – IV

Course Type	Course Code	Course Name	Credits			Coun- selling (Synch- ronous)	Mentoring (Asynch- ronous)	No. of hours					Examination Scheme & Marks		
			TH	PR	Total			e-tutorial		Field Work	e- Content	Self- Study Hours	CIA	ESE	Total
								AV Content	Virtual Lab						
MJ	OCA-251-MJ	Database Management Systems	04	--	04	12	24	20	--	--	20	44	30	70	100
	OCA-252-MJP	Lab course on Database Management Systems (OCA-251-MJ)	--	02	02	--	--	--	10	--	10	22	15	35	50
VSC	OCA-271-VSC	Python Programming	--	02	02	--	--	--	30	--	10	20	15	35	50
CEP	OCA-281-CEP	Community Services	--	02	02	--	--	--	--	30	10	20	15	35	50
MN	OCA-291-MN	Communication Networks	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-292-MNP	Lab course on Communication Networks (OCA-291-MN)	--	02	02	--	--	--	30	--	10	20	15	35	50
OE	OOE-258-COMT	Principles and Functions of Management	02	--	02	6	12	10	--	--	10	22	15	35	50
SEC	SEC-251-OCA	Spreadsheet Applications	02	--	02	6	12	10	--	--	10	22	15	35	50
AEC	OAEC-251-ENG	Advanced Professional & Applied Communication – II	02	--	02	6	12	10	--	--	10	22	15	35	50
CC	OCC-151_3	Basics of Fire Safety	--	02	02	--	--	--	--	30	10	20	15	35	50
Total			14	08	22	--	--	--	--	--	--	--	165	385	550

Level 5.5 (TY) Semester – V

Course Type	Course Code	Course Name	Credits				No. of hours						Examination Scheme & Marks		
			TH	PR	Total	Counselling (Synchronous)	Mentoring (Asynchronous)	e-tutorial		Field Work	e-Content	Self-Study Hours	CIA	ESE	Total
								AV Content	Virtual Lab						
PCC	OCA-301-PCC	Software Engineering and Testing	04	--	04	12	24	20	--	--	20	44	30	70	100
	OCA-302-PCC	Fundamentals of Artificial Intelligence	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-303-PCCP	Lab course on Fundamentals of Artificial Intelligence (OCA-302-PCC)	--	02	02	--	--	--	30	--	10	20	15	35	50
	OCA-304-PCC	Fundamentals of Data Science	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-305-PCCP	Lab course on Fundamentals of Data Science (OCA-304-PCC)	--	02	02	--	--	--	30	--	10	20	15	35	50
PEC	OCA-314-PEC	Cyber Security	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-315-PECP	Lab course on Cyber Security (OCA-314-PEC)	--	02	02	--	--	--	30	--	10	20	15	35	50
VSC	OCA-321-VSEC	Core JAVA Programming	--	02	02	--	--	--	30	--	10	20	15	35	50
FP	CA-331 FP	Field Project	--	02	02	--	--	--	--	30	10	20	15	35	50
MN	OCA-311-MN	Python Programming	02	--	02	6	12	10	--	--	10	22	15	35	50
Total			12	10	22	--	--	--	--	--	--	--	165	385	550

Level 5.5 (TY) Semester – VI

Course Type	Course Code	Course Name	Credits				No. of hours						Examination		
			TH	PR	Total	Coun- selling (Synch- ronous)	Mentoring (Asynch- ronous)	e-tutorial		Field Work	e- Content	Self- Study Hours	Scheme & Marks		
								AV Content	Virtual Lab				CIA	ESE	Total
PCC	OCA-351-PCC	Software Project Management	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-352-PCC	Web Programming	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-353-PCCP	Lab course on Web Programming (OCA-352-PCC)	--	02	02	--	--	--	30	--	10	20	15	35	50
	OCA-354-PCC	Operating system Design	04	--	04	12	24	20	--	--	20	44	30	70	100
	OCA-355-PCCP	Lab course on Operating system Design (OCA-354-PCC)	--	02	02	--	--	--	30	--	10	20	15	35	50
PEC	OCA-360-PEC	Prompt & Generative AI	02	--	02	6	12	10	--	--	10	22	15	35	50
	OCA-361-PECP	Lab course on Prompt & Generative AI (OCA-360-PEC)	--	02	02	--	--	--	30	--	10	20	15	35	50
VSC	OCA-371-VSC	Advanced JAVA Programming	--	02	02	--	--	--	30	--	10	20	15	35	50
OJT	OCA-381-OJT	On-Job Training/ Internship	--	04	04	--	--	--	--	80	10	30	15	35	50
Total			10	12	22	--	--	--	--	--	--	--	165	385	550

Syllabus for Semester – I

Course Objectives:

- To provide a broad overview of problem solving techniques
- To learn C programming to solve problems

Course Outcomes:

At the end of the course, students will be able to

- Define algorithms and explain their characteristics
- Formulate algorithm and draw flow chart to solve a given problem
- Explain use of appropriate data types, control statements
- Demonstrate ability to use top-down program design

Course Contents

Unit I : Problem solving, algorithms and flowcharts

Types of Problems, Problem solving using computer, Difficulties with problem solving, Problem solving aspects.

Definition & Characteristics of algorithm, Examples of algorithms, Flow charts with examples, Top-down design

Problem solving using Arithmetic Statements, Conditional Statement & Iterative Statements such as Addition/Multiplication, check number is positive/negative, Maximum of 2 numbers & 3 numbers, sum of first n numbers, sum of given n numbers, reverse digits of a number, check whether the number is palindrome, check number is prime, factorial of number, factors of number, GCD, LCM of numbers etc.

Unit II : C Fundamentals

Introduction to C, Features of C, Structure of C Program, C Character Set, Identifiers and Keywords, Variables and constants

Data types- Basic data types, Enumerated types, Type casting, Declarations, Expressions, Operators and Expressions Unary and Binary arithmetic operators, Increment Decrement operators, Relational and logical operators, Bit wise operators, Assignment operators, Comma operator, size of operator, Ternary conditional operator, Precedence and associativity

Input Output Statements: printf, scanf functions, getchar, putchar, getch functions, gets, puts functions, Escape sequence characters, Format specifiers

Unit III : Control & Iterative Structures

If, If- Else Statements, Nested If Statements, Conditional Branching – switch statement, Loop (while, do...while, for), break, continue, goto statements

Unit IV : Functions

Introduction to Functions, Function Arguments, Library & User defined functions, Methods for parameter passing, Recursion, Storage Classes – Auto, Static, Global and Register

Unit V : Arrays

Introduction, Array Declarations, Bounds Checking, Single dimension Arrays, Two dimension Arrays, Arrays & Function

Course Type: Subject 1

Course Code: OCA–102–P

Course Title: Lab Course on Problem Solving and Programming in C (OCA–101–T)

Course Objectives:

- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C

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

- Formulate an algorithm and draw flowchart for the given problem
- Implement the given algorithm in C
- Write programs using appropriate data types and control structures in C

Sr. No.	Lab Assignment List (Minimum 14)
1	Assignment on use of data types, simple operators (expressions)
2	Assignment on decision making statements (if and if-else, nested structures)
3	Assignment on decision making statements (switch case)
4	Assignment on use of while loops
5	Assignment on use of for loops
6	Assignment on nested loops
7	Assignment on exit, goto, continue, break
8	Assignment on menu driven programs.
9	Assignment on writing C programs in modular way (use of user defined functions)
10	Assignment on call by value
11	Assignment on call by reference
12	Assignment on recursive functions
13	Assignment on use of arrays (1-D array) and functions
14	Assignment on use of multidimensional array (2-D arrays) and functions
15	Assignment on Standard Library Function

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

Course Outcomes: On completion of the course, student will be able to–

- Design of combinational circuits
- Design of sequential circuits
- Describe block diagram of CPU, Memory and types of I/O transfers

Course Contents

Unit I	Data representation and Computer Arithmetic
Review of Decimal, Binary, Octal, Hexadecimal Number systems and their inter-conversion, BCD code, Gray code, Excess-3 code, ASCII , EBCDIC, Unicode, Signed and Unsigned numbers, 1's and 2's complements, Binary arithmetic.	
Unit II	Boolean Algebra & Logic Gates
Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Introduction to Logic (AND, OR, NOT), Classification of Logic gates, Universal Logic gates, Implementation of other gates using universal gates. Basic concepts of Karnaugh map, minterm and maxterm.	
Unit III	Combinational Circuits
Definition of combinational circuits, Detail study of Half adder, Full adder, Half subtractor, Full subtractor, Multiplexer(4:1) & Demultiplexer(1:4), Encoder (8-line-to-3-line) and Decoder (3-line-to-8-line), Parity generator and checker, Block diagram of ALU.	
Unit IV	Sequential circuits
Definition of sequential circuits, Detail study of Flip Flops and truth tables: S-R FF, J-K FF, T and D type FFs, Flip flop as memory device. Counters: Asynchronous-Mod16, Mod-10, Mod-8, up down counter, Synchronous-Ring counter, Event counter. Shift Registers and their types, serial to parallel and parallel to serial converters using shift registers.	
Unit V	CPU, Memory and I/O Organization
Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory. Basics of I/O organisation: types of I/O data transfers.	

Course Type: BSC

Course Code: OCA-104-P

Course Title: Lab Course on Computer Organization and Architecture (OCA-103-T)

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

Course Outcomes: On completion of the course, student will be able to–

- Design of combinational circuits
- Design of sequential circuits
- Describe block diagram of CPU, Memory and types of I/O transfers

List of Lab Assignments (Minimum 12)
1. To Study and verify the Truth Tables of Logic Gates. 2. To Study De-morgan's theorems. 3. Code Converters using K-Map. 4. Half Adder and Full Adder. 5. Decimal to BCD Encoder 6. Multiplexer (2:1) and De-multiplexers (1:2) 7. Flip-flops (SR, D and JK-FF) 8. 4-bit binary asynchronous counter using IC 7493. 9. Shift Registers. 10. Study of 4-bit ALU (IC 74181) 11. Study of 3-bit Synchronous Up-Down counter. 12. Parity generator and checker

Course Objectives:

- Learn basic terminology formal logic, proofs, sets, relations, functions and perform the operations associated with same
- Use formal logic proof and logical reasoning to solve problems
- To understand significance of statistical measures
- To study Correlation and Probability

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

- Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems
- Use function or relation models to interpret associated relationships
- Apply basic counting techniques and use principles of probability
- Given a data, compute various statistical measures of central tendency
- Use appropriate Sampling techniques

Course Contents

Unit I	Set Theory and Logic
Sets – Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, Types of Sets – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, power set, Propositional Logic - logic, Propositional Equivalences, Application of Propositional Logic-Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.	
Unit II	Relations and Functions
Relations: Properties, n-ary Relations and Applications, Representing Relations , Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall’s Algorithm Functions - Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions.	
Unit III	Counting and Probability
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, The Pigeonhole Principle. Probability: Basic Concepts, Definition, Addition and Multiplication Theorems, Conditional probability and Bayes’ Theorem	

Unit IV	Data Presentation and Aggregation
Data Types: attribute, variable, discrete and continuous variable, Data presentation: frequency distribution, histogram, ogive, box-plot, bar plots Measures of Central Tendency: Arithmetic Mean (AM), Weighted Arithmetic Mean, Arithmetic Mean Computed from Grouped Data, Concept of Median, Mode, Geometric Mean (GM), Harmonic Mean (HM), Quartiles, Deciles, and Percentiles Measures of Dispersion: Standard Deviation, Root Mean Square, Variance, Absolute and Relative Dispersion	
Unit V	Correlation Theory and Sampling
Correlation: Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes, Coefficient of correlation Regression: Concept, Linear Regression, Prediction Elementary Sampling Theory : Sampling Theory, Random Samples, Sampling With and Without Replacement, Stratified Sampling	

Course Type: BSC

Course Code: OCA-106-P

Course Title: Laboratory Course Based on Discrete Mathematics and Statistics (OCA-105-T)

Course Objectives:

- To learn to apply theoretical concepts of discrete mathematics and statistics to solve problems.
- To provide hands-on experience on R software.

Course Outcomes: On completion of the course, student will be able to

- Demonstrate understanding of fundamental mathematical concepts.
- Apply mathematical and statistical concepts to solve problems.
- Use R software to perform statistical operations and data visualization.

Suggested List of Laboratory Assignments (Minimum 12)	
Applied Mathematics: Lab Assignments based on the following topics	
1. Set Theory	
2. Logic	
3. Relations	
4. Functions	
5. Counting	
Statistics (To be performed using R software)	
1. Download and Install R, understand IDE	
2. Using R execute the basic commands, array, list and frames.	
3. Using R Execute the statistical functions: mean, median, mode, quartiles, range.	
4. Using R import the data from Excel / .CSV file and calculate the standard deviation.	
5. Import the data from Excel / .CSV and perform the Statistical distribution: Normal Distribution.	

Course Objectives:

- To understand the importance, principles and concept of Financial Literacy.
- To familiarize students with different aspects of financial literacy such as savings, investment rules.
- To help students understand the relevance and process of financial planning, digital payments and its types.
- To promote understanding of financial well-being and role of modern digital payment system.

Course Outcomes: After completion of the course, students will be able:

To understand the importance, types, principles and concept of financial literacy.

To develop proficiency for personal and family financial planning.

To understand the importance and types of financial planning, digital payments and its types

To understand the financial well-being and role of modern digital payment system

Unit 1: Introduction to Financial Literacy:

1.1 Meaning, Concept, Advantages of Financial Literacy

1.2 Objectives, Scope and Functions of Financial Literacy

1.3 Types of Financial Literacy

1.4 Principles and Pillars of Financial Literacy

1.5 Understanding Basic Rules of Financial Literacy: The 50-30-20 Rule

Unit 2: Financial Planning and Digital Payments:

2.1 Introduction to Saving, Investments and Expenditure

2.2 Time Value of Money

2.3 Management of Spending and Financial Discipline

2.4 Modern Digital Payment Trends: Credit / Debit Cards, QR Code Scanners, Mobile Point of Sale, NEFT and RTGS. Contactless Payments – Samsung Pay / Apple Pay and use of NFC Technology

2.5 Role of Modern Digital Payment Systems and Challenges faced in Indian Retail Sector

Course Type: VSEC

Course Code: VSEC-101-OCA

Course Title: HTML and Webpage Designing

Course Objectives:

- To understand web based application development process.
- To study basics of HTML elements and tag.
- To know usage of CSS in HTML.
- To design and create simple websites.
- To apply JavaScript to websites.

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

- Enlist various HTML elements and tags
- Use HTML elements and tags
- Apply CSS and Java script features.
- Design a website using HTML, CSS and JavaScript.

List of Lab Assignments (Minimum 14)
Assignment 01: Using basic HTML elements (headings, paragraphs, line break, colour, fonts, links, Images, etc)
Assignment 02: Creating Lists using HTML Tags
Assignment 03: Creating Tables using HTML Tags
Assignment 04: Creating Frames in HTML
Assignment 05: Creating Forms using HTML
Assignment 06: Designing of HTML screens using CSS
Assignment 07: Using Functions in JavaScript
Assignment 08: Carryout Validation using JavaScript
Assignment 09: Using Event Handling.
Assignment 10: Designing website using basic elements of HTML, CSS and JavaScript.
Assignment 11: Designing website using HTML, CSS and advanced JavaScript elements and event handling

Course Objectives:

- To understand the nature of knowledge.
- To understand the evolution of the scientific approach in the Indian subcontinent.
- To study contributions made by different people to the various branches of knowledge before modernity evolved in India.

Course Outcomes:

1. The concept of the ancient intellectual knowledge tradition will be understood.
2. Developments in science from ancient times will be introduced.

Developments in humanities from ancient times will be understood.

Unit 1. Introduction to Indian Knowledge System

- a. Definition, Scope and importance of knowledge
- b. nature of Indian Knowledge System
- c. Evolution of scientific approach

Unit 2. Development of Sciences

- a. Astronomy- Aryabhatta, Varahamihira, Sawai Jaisingh
- b. Medicine- Ayurveda and Yunani
- c. Metallurgy- Copper, Iron, Bronze & alloys

Unit 3. Development of Humanities

- a. Language - Prakrit, Sanskrit, Farsee
- b. Philosophy- Vedic, Lokayat, Buddhist, Jaina
- c. Education system in ancient India – Takshashila, Nalanda, Valabhi University
- d. Architecture

Prescribed Text: *Professional Communication Skills*
(Board of Editors) Orient BlackSwan, 2024

Course outcomes:

- Read and understand texts in English
- Enrich and use vocabulary effectively
- Understand and Develop Communicative Competence
- Use body language in different situations
- Acquaint with digital platforms and technology
- Write letter, notice, agenda, minutes and blog

Basic Language Skills:

A) Grammar

1. Sentence Structures/Patterns
2. Subject - Verb agreement
3. Tenses

B) Vocabulary :

1. Synonyms and Antonyms
2. Homonyms
3. One-word substitutes
4. Idioms
5. Suffixes and prefixes
6. Collocations.

C) Speaking for Different Purpose:

a) Meeting and Greeting People

1. Introducing your Self
2. Introducing People to One another
3. Apologies and Responses
4. Agreeing and Disagreeing
5. General Speaking Strategies

b) Group Discussion, Interview and Interviewing Skills

1. Initiating a Group Discussion
2. Continuing a Group Discussion
3. Concluding Group Discussion
4. Preparing for an Interview
5. Facing an Interview
6. Interviewing Techniques

c) Presentation Skills

1. Kinds of Presentation
2. Structuring Content
3. Visual Aids
4. The Language of Presentations
5. Making a Presentation

Course outcomes:

After the completion of this course, student will be able to

- Describe how human activities impact the environment.
- Explain principles of sustainable development and resource management.
- Analyze local, regional, and global environmental issues and their effects.
- Evaluate different strategies for conserving biodiversity and ecosystems.
- Apply relevant environmental policies and ethical considerations to real-world scenarios.
- Design and implement action plans for community-based environmental projects.

Chapter 1: Humans and the Environment

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change.

The emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Chapter 2: Natural Resources and Sustainable Development

Overview of natural resources: Definition of resource; Classification of natural resources biotic and abiotic, renewable and non-renewable.

Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges.

Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water.

Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Nonconventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment.

Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Chapter 3: Environmental Issues: Local, Regional and Global

Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena.

Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact.

Global change: Ozone layer depletion; Climate change.

Chapter 4: Conservation of Biodiversity and Ecosystems

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change.

Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.

Syllabus for

Semester – II

Course Code: OCA-151-T

Course Objectives:

- Course Outcomes:** On completion of the course, student will be able to–

- Write programs using pointers and structures
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Unit I	Preprocessor
Concept, Format of preprocessor directives, File inclusion directives (#include), Macro substitution directives (#define), nested macros, parameterized macros, Macros versus functions, #error / #pragma directives, Conditional compilation (#if/#ifdef/#else/#elif/#endif), Predefined macros (_DATE_ / _TIME_ / _FILE_ / _LINE_ / _STDC_)	
Unit II	Pointers
Concept – reference & dereference, Declaration, definition, initialization & use, Types of pointers, Pointer Arithmetic, Multiple indirection, parameter passing – call by value and call by reference Arrays & Pointers - Pointer to array, Array of pointers, Functions & pointers - Passing pointer to function, Returning pointer from function, Function pointer, Pointers &const Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers	
Unit III	Strings
Concept, Declaration, definition, initialization, format specifiers, String literals/ constants & variables – reading & writing from & to console, Importance of terminating NULL character, Strings & pointers Array of strings & array of character pointers, User defined functions, predefined functions in string.h - strlen , strcpy , strcat , strcmp , strcmpi , strrev , strlwr ,strupr , strset , strchr , strchr , strstr , strncpy , strncat , strncmp , strncmpi , strnset , strtok, Command line arguments – argc and argv	
Unit IV	Structures
Concept, Declaration, definition, initialization, accessing structure members (. operator), Array of structures, Pointers to structures, Declaring pointer to structure Accessing structure members via pointer to structure, Structures & functions, Passing each member of structure as a separate argument, Passing structure by value / address Nested structures, typedef & structures, Concept of Union	
Unit V	File Handling
Concept of streams, need, Types of files, Operations on text & binary files, Random access file, library functions for file handling – fopen, fclose, fgetc, fseek, fgets, fputc etc	

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

Course Outcomes: On completion of the course, student will be able to–

- Write programs using pointers and structures
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Sr. No.	Lab Assignments (Minimum 12)
1	To demonstrate use of preprocessor directives
2	To demonstrate use of pointers
3	To demonstrate advanced use of pointers
4	To demonstrate concept of strings, array of strings
5	To demonstrate string operations using pointers
6	To demonstrate command line arguments
7	To demonstrate structures (using array and functions)
8	To demonstrate nested structures
9	To demonstrate use of bitwise operators.
10	To demonstrate file handling

Course Objectives:

- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051 microcontroller.
- To learn to design simple applications using 8051 microcontroller.

Course Outcomes: On completion of the course, student will be able to–

- Write programs using instruction set of 8051 microcontroller.
- Interface I/O peripherals to 8051 microcontroller.
- Design simple microcontroller-based applications.

Course Contents

Unit I	Introduction
Introduction of microcontroller and microprocessor, difference between microcontroller and microprocessor, classification of microcontrollers, Applications of microcontrollers.	
Unit II	8051 microcontroller
Features of 8051 microcontrollers, block diagram & Architecture of 8051, Internal Memory organization, SFRS, PSW register, pin functions of 8051, Structure of I/O ports and its Operation, External Memory Interface.	
Unit III	8051: Programmer's Model
Introduction to Assembly programming, Compilers. Assemblers, Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples. Introduction to 8051 programming in C.	
Unit IV	Timers and Counters
Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.	
Unit V	Interrupts and Interfacing
Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP). Basics of Interfacing: ADC, DAC, LCD, stepper motor.	

Course Type: BSC

Course Code: OCA-154-P

Course Title: Lab course on Introduction to Microcontrollers (CA-153-T)

Course Objectives:

- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051 microcontroller.
- To learn to design simple applications using 8051 microcontroller.

Course Outcomes: On completion of the course, student will be able to–

- Write programs using instruction set of 8051 microcontroller.
- Interface I/O peripherals to 8051 microcontroller.
- Design simple microcontroller-based applications.

List of Lab Assignments (Minimum 12)
1. Study of 8051 microcontroller chip, keil μ vision-5.
2. Study of proteus simulator for 8051 simulation.
3. Program to find Largest/smallest from a series.
4. Program to perform Addition / subtraction / multiplication/division of 8/16 bit data.
5. Program to perform Arithmetic, logical & code conversion problems
6. Program to perform data transfer/exchange between specified memories locations.
7. Interfacing of LED/LEDs to 8051 microcontroller.
8. Interfacing of switch & LED to 8051 microcontroller.
9. Waveform generation using DAC Interface to 8051 Microcontroller.
10. Traffic light controller using 8051 microcontroller.
11. Interfacing LCD to 8051 Microcontroller.
12. Interfacing with IR sensor to 8051 microcontroller and LCD.
13. ADC interfacing to 8051 Microcontroller.
14. Stepper motor interfacing to 8051 microcontroller.
15. DC motor interfacing to 8051 microcontroller.

Course Title: Linear Algebra**Course Objectives:**

- To offer the learner the relevant Linear Algebra concepts through Computer Science applications.
- To interpret existence and analyse the solution set of a system of linear equations.
- To formulate, solve, apply, and interpret properties of linear systems.
- To learn about the concept of linear independence of vectors and the dimension of a vector space.
- To interpret basic concepts of linear transformations, dimension, matrix representation of a linear transformation.

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

- Appreciate the relevance and applications of Linear Algebra in the field of Computer Science.
- Instill a computational thinking while learning linear algebra.
- Express clear understanding of the concept of a solution to a system of equations.
- Find eigenvalues and corresponding eigenvectors for a square matrix.
- Represent linear transformations using matrices.

Course Contents

Unit I	Systems of Linear Equations and Matrices
1.1 Row echelon form of a matrix, reduced row echelon form of a matrix. 1.2 Definition of rank of a matrix using row echelon or row reduced echelon form. 1.3 System of linear equations- Introduction, matrix form of linear system, definition of row equivalent matrices. 1.4 Consistency of homogeneous and non-homogeneous system of linear equations using rank, condition for consistency 1.5 Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.	
Unit II	Vector Spaces – I
2.1 Definition and examples 2.2 Subspaces 2.3 Linear Dependence and Independence (Statement and examples only) 2.4 Basis of vector space	
Unit III	Vector Spaces – II
3.1 Dimension of a vector space 3.2 Row Space, Column Space, and Null Space of a matrix 3.3 Definition: Rank and Nullity	
Unit IV	Eigen values and Eigen vectors
4.1 Eigen values 4.2 Eigen vectors 4.3 Diagonalization	
Unit V	Linear Transformations
5.1 Definition and Examples, Properties, Equality 5.2 Kernel and range of a linear Transformation 5.3 Rank-Nullity theorem (Statement only) 5.4 Matrix representation of Linear Transformation	

Course Type: BSC

Course Code: OCA-156-P

Course Title: Lab course on Linear Algebra (OCA-155-T)

Course Objectives:

- To learn to apply theoretical concepts of discrete mathematics and statistics to solve problems.
- To provide hands-on experience on R software.

Course Outcomes: On completion of the course, student will be able to

- Demonstrate understanding of fundamental mathematical concepts.
- Apply mathematical and statistical concepts to solve problems.
- Use R software to perform statistical operations and data visualization.

Suggested List of Laboratory Assignments (Minimum 12)	
Assignments based on the following topics	
1. Practical 1: Problems on Unit 1 based on Systems of Linear Equations-I (Written).	
2. Practical 2: Problems on Unit 1 based on Systems of Linear Equations-II (Written).	
3. Practical 3: Problems on Unit 2 (Written).	
4. Practical 4: Problems on Unit 3 (Written).	
5. Practical 5: Problems on Unit 4 (Written).	
6. Practical 6: Problems on Unit 5 (Written).	
Assignments To be performed using Scilab Software	
7. Practical 7: Introduction to Scilab software.	
8. Practical 8: Problems on Unit 1 using Scilab software	
9. Practical 9: Problems on Unit 2 using Scilab software..	
10. Practical 10: Problems on Unit 3 using Scilab software.	
11. Practical 11: Problems on Unit 4 using Scilab software.	
12. Practical 12: Problems on Unit 5 using Scilab software	

Course Type: OE

Course Code: OOE-158-COMT

Course Title: Financial Literacy – II

Course Objectives:

- To understand the importance, principles and concept of personal finance.
- To Familiarize students with different aspects of financial terms like fund and portfolio management.
- To help students understand the relevance and process of financial planning and its need.
- To Promote understanding of financial budgeting and understand insurance concepts.
- To better understand of the various concepts/principles related to investment analysis and portfolio management.

Course Outcomes: After completion of the course, students will be able to:

- Understand the importance, types, principles and concept of personal finance.
- Develop proficiency for personal financial planning.
- Understand the importance and types of financial planning, budgeting and insurance.
- Understand the process of financial management.

Unit 1: Personal Finance:

1.1 Concept of Personal Finance, need to study and analyze personal finance. Factors impacting personal finance.

1.2 Financial Planning: Meaning, Household financial health checkup, Investor's Age and Assets Allocation.

1.3 Budgeting, Setting Financial Goals, Medical and other Emergencies, Retirement planning.

1.4 Insurance Policies, Life and non-life Insurance, Term Life Insurance, Endowment Policies, Pension Policies.

Unit 2: Investment Planning and Portfolio Management:

2.1 Concept of Investment, Types of Investments, Investment Planning.

2.2 Concept of Portfolio Management, Portfolio Management – Investment Policy and Strategy.

2.3 Investment opportunity and financial products.

2.4 Portfolio Theory (Markowitz, Sharpe Index model)

Course Type: VSEC

Course Code: VSEC-151-OCA

Course Title: Software Tools for Business Communication

Course Objectives:

- To study word processing, spreadsheets and presentation tools
- To learn G-suite
- To be familiar with tools for Electronic communications

Course Outcomes: At the end of the course, students will be able to

- Perform various word processing tasks
- Prepare spreadsheets and presentations
- Collect feedbacks and make surveys
- Communicate and collaborate through electronic communications

Topics for Lab Assignments		
Unit No	Topics	Number of Assignments
Unit I	Word processing and Google DOCs	04 Nos
Create, Save, Open and Edit Documents, Text Alignments, Enhancements, and Effects Basic Document Formatting and Editing, Additional Document Formatting and Editing Work with Multiple-Page Documents and Multiple Documents, Work with Columns and Tables Work with Objects, Lines, and Text Boxes, Drawing Tools, Add Special Effects Create and manipulate Google DOC using various features		
Unit II	Spreadsheets and Google Sheets	04 Nos
Create, Save, and Print a Worksheet, Use Formulas; Copy a Formula; Format and Enhance Use Functions, Additional Formatting, and Editing, Create and Edit Charts, Integrate Worksheets with Other Applications Create and manipulate Google Sheets using various features		
Unit III	Presentations and Google Slides	02 Nos
Create, Save, and Print a Presentation, Enhance Slides; Work with Text and Objects, Work with Slide Shows; Integrate Presentations with Other Applications Create and manipulate Google Slides using various features		
Unit IV	Google Forms, Drives and Calendar	03 Nos
Create, Save, Open and Edit Google form using essential features Google Drive: Create folders and subfolders, upload documents, share drive files and folders, Google Calendar: essential features		
Unit V	Emails, Groups and Generative AI Tools	04 Nos
Create and send, receive emails, email folders and fields, attach documents, address book, email signatures and other essential settings, Email etiquettes Create, join email groups, send and receive emails on groups Using Generative AI tools such as ChatGPT		

Course Type: AEC

Course Code: OAEC-151-ENG

Course Title: Professional Communication Skills – II

Prescribed Text: *Professional Communication Skills*
(Board of Editors) Orient BlackSwan, 2024

Course outcomes:

- Read and understand texts in English
- Enrich and use vocabulary effectively
- Understand and Develop Communicative Competence
- Use body language in different situations
- Acquaint with digital platforms and technology
- Write letter, notice, agenda, minutes and blog

Unit No.	Topic
1.	Forms of Writing: i. Letter Writing ii. Writing Resume iii. Report Writing iv. Notice/ Agenda and Minutes v. Email vi. Blog Writing
2.	Soft Skills a) Introduction to Soft Skills i. Definitions and Nature ii. Soft Skill vs Hard Skill iii. Importance of Soft Skill iv. Types of Soft Skill b) Soft Skills in Career Prospects i. Role of Soft Skills in Professional Success ii. Time and Stress Management iii. Decision Making and Moral values iv. Leadership Skills and Team Building v. Negotiation Skills and Etiquettes
3.	Business Communication: i. Nature and Importance of Business Communication ii. Process of Communication iii. Types of Communication iv. Channels of Communication v. Digital Communication

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

- Identify various types of environmental pollution and their impacts on health.
- Explain the basic concepts of climate change, including its causes and effects.
- Analyze different strategies for adapting to and mitigating the effects of climate change.
- Evaluate various environmental management practices and their effectiveness.
- Apply the principles of key environmental treaties and legislation to case studies.
- Create action plans that address specific environmental issues based on current policies and management practices.

Chapter 1: Environmental Pollution and Health

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution.

Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and Sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards.

Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life.

Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health.

Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.

Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

Chapter 2: Climate Change: Impacts, Adaptation and Mitigation

Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5°C and 2.0°C limits to global warming; Climate change projections for the Indian sub-continent.

Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change.

Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity

and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Chapter 3: Environmental Management

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001 Life cycle analysis; Cost-benefit analysis Environmental audit and impact assessment; Environmental risk assessment, Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme

Chapter 4: Environmental Treaties and Legislation

An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non-binding measures; Conference of the Parties (COP)

Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions

Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements

Major International organizations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN), World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Note: Case Studies and Field Work is compulsory

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.
2. Field visits to identify local/regional environmental issues make observations including data collection and prepare a brief report.
3. Documentation of local biodiversity.
4. Environmental management activities such as solid waste disposal, water management, and sewage treatment of Learner's residential area / workplace.

(**Note:** CDOE shall assign a faculty to coordinate and facilitate this course. Any faculty should work as a guide and mentor for the activity for all Co-Curricular courses. The faculty should help students in selecting topics of their interest and guide them in studying the subject as and when needed.)

Course Objectives:

- To develop awareness about contemporary local, national, global issues among students
- To enhance students' abilities to critically analyze contemporary issues and media content
- To encourage regional and contextual understanding about the contemporary world
- To promote responsible and active citizenship among the students
- To cultivate an attitude of continuous learning with the help of locally available media

Course Outcomes:

At the end of the course, students will be able to:

- Identify contemporary issues at local, regional, national and global level
- Study any contemporary issues on their own and develop certain insights into them
- Compare media narratives and identify any bias or misinformation
- Present own thoughts and opinions through oral presentations and written reflections

CC Activities:

1. Understand the importance of contemporary issues and their role in personal and social life
2. List the information sources available at home, workplace and neighborhood (Newspapers, radio, news and information channels, digital news portals, websites, etc.)
3. Map the significant contemporary issues at local, regional, national and global level (Students may take the help of friends and family members)
4. Shortlist the contemporary issues which would be significant during the present semester and select the topic as per the interest and orientation of the student (The topic could be from diverse fields like social, political, economic, sports, science and technology, national security, international relations, etc.)
5. Register the topic with faculty in-charge and coordinator of Co-Curricular Courses assigned by the CDOE
6. Read daily newspapers and magazines; mark and document relevant news stories, editorials, analytical articles about the selected topic and keep them neatly in a file
7. Students should also follow news portals and websites providing information and analysis about the topic, they should download or copy-paste relevant material with the links (Get the guidance from teachers about how to make documentation and note down research references in APA style)
8. Read relevant books on the topic for background knowledge and to get more insights
9. Try to find any subject experts related to the topic area and if possible, interview them (Record any such interviews and attach the notes/transcript in the file)
10. After collecting sizable reading material, write an article about the topic in 2000 or more

words. It should include significance of the chosen topic, its background, contemporary happenings, various perspectives and most importantly your own understanding about it. Get the article checked by a teacher/ CC Coordinator.

11. Study and compare the media coverage on the topic by different newspapers, media organizations and write your observations about any shortcomings, biases in it.
12. Prepare an elaborate PowerPoint Presentation about the topic and make presentations before your class. Answer any queries based on this presentation.
13. Submit the file of news clippings with relevant material and written note, PPT to the Course Coordinator.

Syllabus for Semester – III

Course Title: Data Structures**Course Objectives:**

- To study various data structures
- To learn analysis of algorithms
- To understand real-world applications of data structures.

Course Outcomes: After successful completion of this course, the learners will be able to

- Define various data structures and notations for algorithm analysis
- Design algorithms using suitable data structure(s)
- Compare various representations of a stack, queue, tree and graph CO4: List real world applications of stacks, queues, trees and graphs CO5: Apply appropriate data structure(s) to solve a given problem
- Evaluate the time and space complexity of the given algorithm/program

Course Contents

Unit I	Introduction to Data Structure
1.1	Introduction, Basic concepts, Data types and data objects.
1.2	Abstract Data Types (ADT)
1.3	Types of Data Structures: Linear and non -linear
1.4	Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation: Big O, Omega (Ω) (With examples)
Unit II	Arrays
2.1	Introduction
2.2	Matrix representation using arrays: Row and column major, operations on matrices, Sparse Matrix
2.3	Sorting techniques with time complexity: Bubble sort, Insertion sort, Merge sort, Quick sort
2.4	Searching techniques with time Complexity: Linear search and Binary search
Unit III	Linked Lists
3.1	Introduction
3.2	Representation
3.3	Types of linked lists: Singly, Doubly, Circular (Singly, Doubly)
3.4	Operations on link list: Create, Display, Insert, Delete, Reverse, Search, Sort, Concatenation, Merge
3.5	Real world applications of Link list : Polynomial Representation, Addition of two polynomials

Unit IV	Stacks and Queues
4.1	Introduction
4.2	Representation of Stack: Using arrays and Linked Lists
4.3	Operations on stack: push, pop
4.4	Applications of Stack: Recursion, Expressions: Infix to postfix, postfix to infix
4.5	Representation of Queues: Static (Array) and Dynamic (Linked List)
4.6	Operations on queue: insert, delete
4.7	Types of queues: Circular queue and Priority queue
4.8	Real world Applications of queue (Implementation not expected)
Unit V	Trees
5.1	Introduction and terminologies
5.2	Types of Binary Trees -Rooted Binary Tree, Full Binary Tree, Complete Binary Tree and Skewed Binary Tree, Expression Tree
5.3	Representation of Trees using arrays and linked lists, traversals (In-order, pre-order, post-order) and operations (Create, Insert, delete, modify, counting nodes etc.)
5.4	Applications of Binary trees – Expression conversions and evaluation
5.5	Binary Search Tree (BST):
	5.5.1 Introduction and Definition, operations on BST (Create, insert node, delete node, search node) and applications
	5.5.2 AVL Tree: Concept, Rotation (LL, LR, RL, RR) with Examples
	5.5.3 Heap Sort Technique with Examples (Implementation not expected)
Unit VI	Graphs
6.1	Introduction and Graph terminologies
6.2	Representation of a Graph -
	6.2.1 Adjacency matrix
	6.2.2 Adjacency list
	6.2.3 Adjacency multi-list
6.3	Graph Traversals -
	6.3.1 DFS (Depth First Search)
	6.3.2 BFS (Breadth First Search)
6.4	Applications of graphs -
	6.4.1 Topological sort
6.5	Minimal Spanning Trees -
	6.5.1 Prim's Algorithm
	6.5.2 Kruskal's Algorithm

Course Type: MJ

Course Code: CA-202-MJP

Course Title: Lab course on Data Structures (CA-201-MJ)

Course Objectives:

- To understand algorithms and analysis of algorithms
- To learn static and dynamic data structures.

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

- Apply appropriate data structures to solve the given problem
- Design an efficient algorithm for the given problem and implement
- Determine the time and space complexity of a given algorithm

Sr. No.	List of Assignments
1	Non-Recursive Sorting Techniques • Bubble Sort • Insertion Sort
2	Recursive Sorting Techniques • Quick Sort • Merge Sort
3	Searching Techniques • Linear search • Binary search
4	Linked List • Implementation of Linked List, Singly Circular Linked List, Doubly Linked List, Doubly Circular Linked List, operations
5	Stacks and Queues • Static Stack Implementation and operations • Dynamic Stack Implementation • Applications of Stack -Expression Conversions • Static Queue Implementation and operations • Dynamic Queue Implementation
6	Binary Trees and Binary Search Tree (Dynamic) • Operations on Binary trees – Traversing, level wise printing of nodes, counting total nodes, compute depth, Insert, Delete and search node • BST-create, traverse, count total nodes, Insert, Delete and search node
7	Graphs • Adjacency Matrix Representation • Adjacency List Representation • In-degree and Out-degree calculation • BFS, DFS Implementation

Course Type: VSC

Course Code: OCA-221-VSC

Course Title: C++ Programming

Course Objectives:

- To understand Object Oriented Programming concepts using the C++.
- To study principles of data abstraction, inheritance and polymorphism.
- To learn Virtual functions and polymorphism.
- To know Formatted I/O and unformatted I/O.

Course Outcomes: After successful completion of this course, the learners will be able to

- Compare the procedural and object-oriented paradigms
- Use Classes, Objects, constructors, destructors etc.
- Illustrate the concept of function overloading, operator overloading, inheritance, virtual functions and polymorphism.
- Apply exception handling
- Demonstrate use of various OOPs concepts with the help of programs

List of Lab Assignments

The instructor shall cover necessary theoretical concepts in object-oriented programming such as objects, classes, data abstraction, encapsulation, data members, methods, access specifiers, inheritance, polymorphism, operator and function overloading, abstract classes, virtual function, file and exception handling etc.

Topic Name	Object Oriented Programming and functions in C++	
Assignment No 1: Creation of classes, objects, methods, access specifiers, input-output Assignment No 2: Scope resolution operator, static members, call by reference Assignment No 3: Inline function, friend class and function.		
Topic Name	Inheritance and Polymorphism	
Assignment No 4: Constructor and destructor Assignment No 5: Single inheritance and multiple inheritance Assignment No 6: Multilevel inheritance and Hierarchical Inheritance, Hybrid inheritance Assignment No 7: Polymorphism (Function overloading) Assignment No 8: Polymorphism (Operator overloading)		
Topic Name	File Handling and Exception Handling	
Assignment No. 9: Operations on files (Read, Write, Open, Close), Random Access file functions Assignment No 10: Exception handling Assignment No.11: Hash tables and Dictionaries		

Course Title: Field Work**Course Objectives:**

- To provide exposure to the students and sensitize them to field issues/problems
- To understand methodology used to perform field work

Course Outcomes: After successful completion of this course, the learners will be able to

- Apply methodology to perform field work
- Identify and define real-world issues or problems
- Analyze the data collected and propose solution to solve real-world problem

Guidelines for the faculty

A faculty shall be assigned as a guide for each upto 4 students.

The guide assigned for each group shall assist the assigned student group(s) for identifying topic/area (topic list is provided below for reference) for the field work, objectives and outcomes, preparation of questionnaire, resources/tools needed and guide the students for possible solutions and report preparation

The guide assigned for each group shall monitor, track and assess the progress of work carried out by students throughout the semester

Guidelines for Students

The student shall work in a group of 3 or 4 students. Each group shall select topic/area for the fieldwork to be undertaken by them in consultation with their assigned guide.

The group shall discuss and decide objectives, outcomes, overall plan for fieldwork, methodology to be adopted, such as preparation of a questionnaire for conduction of survey or methods for data gathering, tools to be used for analysis etc. and get the plan approved from their guide.

The students shall maintain a diary giving details of tasks performed by them, observations/study notes etc.

The suggested timelines for the field work are

- Formation of group – 1 week
- Selection of topic for field study – 2 Week
- Discussions and finalization of objectives, outcomes and methodology to be used – 3 Weeks
- Field work and visits, SWOT/SWOC analysis, group discussions and meeting with guide – Conduction of survey / gathering data etc. – 4 Weeks
- Preparation of report and presentation – 2 weeks

Each group shall submit a report at the end of the semester consisting of Title, Abstract, Rational of the study, problem definition, objectives, outcomes, methodology used, details of field work performed (Field Visits, Interviews, discussions etc.), analysis, SWOT/SWOC, findings, details of proposed solution (Paper design/prototype/mobile App etc.) and conclusions. Students should also submit geo-tagged photographs, audio-video clips etc.

List of suggested topics/areas for Field work (but not limited to)

1. Healthcare (Civil and private hospitals) – HIMS, Telemedicine etc.
2. Schools, colleges, Universities - e-Learning Platforms, MOOCs, ERP, IT Infrastructure and Security systems etc.
3. Agriculture - Use of IoT Devices, drones in Agriculture, Management of Water Distribution, etc.
4. Old age homes and organizations working of differently abled people - Assistive Technologies for Differently Abled Personnel, Support for Senior Citizens etc.
5. Organizations/NGOs working on food habits, nutrition, adulterations
6. Urban Region - Smart Cities, Traffic Management, Renewable energy and Solar Systems, Waste collection and disposal, studying water quality and water supply system of the city etc.
7. Rural Region - Smart Villages, Agriculture Product Distribution Systems etc.
8. Government offices and offices of Local Administration Bodies (Corporation / Municipal Corporation / Grampanchayat – ERP, IT Infrastructure and Security etc.
9. Pollution control boards – study / develop a system to monitor City environmental parameters - Air/Sound/Water pollutions
10. Department of disaster Management – Study / develop response system for allocating resources during natural disasters.
11. Governance - e-Governance Portals, Online Payment Systems etc.
12. Industries (IT/Manufacturing/Telecomm) involved in development of solutions to solve social issues

Course Objectives:

- To understand the fundamental concepts of data communication.
- To understand the error detection and signals, transmission impairments and performance.
- To understand different digital modulation and multiplexing.
- To study basics of computer network.

Course Outcomes: After successful completion of this course, learner will be able to-

- Define basic concepts in data communication.
- Understand signal transmission and error detection and correction.
- Understand digital modulation scheme and multiplexing technique.
- Understand the basic concept of computer network.

Unit I: Introduction to Data Communications

Introduction of data communication: Components of Data communications (message, sender, receiver, transmission medium),

Transmission Media: Guided (twisted pair, coaxial, fiber optic) and unguided media.

Characteristics of Data Communication: Delivery, Accuracy, Timeline, Jitter,

Data Representation: Text, Numbers, Images, Audio, Video

Types of data flow: Simplex, Half duplex, Full duplex,

Types of communication: Baseband and Broadband communication, parallel communication, and Serial communication: asynchronous and synchronous.

Unit II Signal, Transmission and Error Detection

Signal type: Analog and Digital data, Analog and Digital signals,

Digital Signals: Bit rate, Bit length, baud rate,

Transmission Impairments: Attenuation, Distortion, Noise channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem

Line Coding: Characteristics, Line Coding Schemes–Unipolar -NRZ, Polar-NRZ-I, NRZ-L, RZ (Concept level)

Error Detection and Correction: Introduction of ARQ(Automatic repeat request), FEC (Concept and type), Hamming code.

Unit III Modulation, Multiplexing and MAC

Digital modulation techniques: ASK, FSK, PSK (concept block diagram waveform)

Multiplexing technique: FDM and TDM (concept block diagram waveform)

Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure,

Media access control:

Random Access Protocols: ALOHA (concept), CSMA, CSMA/CD, CSMA/CA;

Controlled Access Protocol: Reservation, Polling and Token Passing;

Channelization Protocol: (Definitions) – FDMA, TDMA and CDMA.

Unit IV Computer Networks

Network Topologies - Bus, Star, Ring, Mesh

Network Types- LAN, MAN, WAN, Wireless Networks,

Ethernet: Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet.

Course Type: MN

Course Code: OCA-242-MNP

Course Title: Lab Course on Data Communications (OCA-241-MN)

Course Objectives:

- To familiar with different network devices and cables.
- To understand different digital modulation and multiplexing.
- To understand error detection and correction scheme.
- To understand different modulation scheme.

Course Outcomes: After successful completion of this course, learner will be able to-

- Understand the roll of different network devices and crimping of RJ45.
- Understand modulation and multiplexing scheme.
- Understand error detection and correction scheme.
- Understand the modulation scheme.

Course Contents (Any 13)

1. To Study the different network cables, connectors, and demonstration of crimping of RJ-45 Connector for practical use.
2. Set up a simple computer network in CISCO Packet Tracer.
3. Study of network devices – Repeater, HUB, Switch, Bridge, Router, Gateway, NIC, Modem etc.
4. To study line coding concept. (Using Circuit board / Simulation software)
5. To study hamming code generation.
6. To study hamming code error detection and correction.
7. To study Frequency shift keying. (Using Circuit board / Simulation software)
8. To study time division multiplexing. (Using Circuit board / Simulation software)
9. To study sample and hold circuit. (Using Circuit board / Simulation software)
10. To study Amplitude modulation. (Using Circuit board / Simulation software)
11. To study Frequency modulation. (Using Circuit board / Simulation software)
12. To study Amplitude Shift Keying (ASK). (Using Circuit board / Simulation software)
13. To study Phase Shift Keying (PSK). (Using Circuit board / Simulation software)
14. Case study on different noises occurs during data (Analog/Digital) transmission and its remedy.
15. Case study on cellular technology used in communication

Course Type: OE

Course Code: OOE-208-COMT

Course Title: Personality Development for Business Professionals

Course Objectives:

- To introduce students to the importance of personality development in professional contexts.
- To enhance students' self-awareness, confidence, and communication skills.
- To develop essential soft skills for effective interpersonal and professional interactions.
- To prepare students for real-world business environments by aligning personal and professional growth.

Course Outcomes: After completion of the course, students will be able to:

- Understand key aspects of personality and its impact on professional success.
- Demonstrate improved communication, grooming, and interpersonal skills.
- Apply techniques for self-motivation, stress management, and goal setting in a professional environment.
- Exhibit enhanced leadership and team-building skills for business success.

Unit 1: Understanding Self and Professional Persona:

- 1.1 Introduction to Self-Development – Meaning, Importance, and Link to Professional Success
- 1.2 Self-Discovery and Self-Assessment – Tools and Techniques (including SWOT, Johari Window, and Personality Inventories)
- 1.3 Personal Branding – Concept, Strategies, and Benefits in Professional Context
- 1.4 Professional Image and Grooming – Attire, Body Language, and Business Etiquette

Unit 2: Interpersonal and Professional Skills:

- 2.1 Communication Skills – Verbal, Non-Verbal, and Business Communication
- 2.2 Time and Stress Management – Techniques and Strategies
- 2.3 Leadership and Team Building – Essentials for Business Professionals
- 2.4 Goal Setting and Motivation – SMART Goals and Professional Success

Course Objectives:

- To study contributions of Indian scholars to computation and logic.
- To understand Indian methods for Number representations
- To know use of Sanskrit in Natural language processing
- To learn ancient cryptography techniques

Course Outcomes: After successful completion of this course, the learners will be able to

- List India's contributions to Computing
- Apply Ancient Indian Mathematical concepts in Computing
- Utilize Linguistic and Computational aspects of Sanskrit from IKS in Modern Computing
- Describe Cryptographic techniques from IKS
- Make use of Cybersecurity techniques from IKS
- Illustrate the Role of IKS in Emerging Technologies

Course Contents

Unit I	Introduction to Indian Knowledge Systems (IKS)
1.1	Introduction IKS
1.2	Defining Indian Knowledge System (IKS) and its components,
1.3	Contribution of Aryabhata and Brahmagupta, Buddhist logico-epistemology
1.4	The knowledge triangle
1.5	Prameya -A vaiśeṣikan approach to physical reality
1.6	Dravyas -the constituents of the physical reality
1.7	Attributes -the properties of substances and Action -the driver of conjunction and disjunction
1.8	sāmānya, viśeṣa, samavāya
1.9	Pramāṇa -the means of valid knowledge
1.10	Samsaya-ambiguities in existing knowledge.
Unit II	Number Systems and Units of Measurement
2.1	Number systems in India -Historical evidence
2.2	Salient Features of the Indian Numeral System
2.2.1	Concept of zero and its importance,
2.2.2	Large numbers and their representation
2.2.3	Place Value of Numerals
2.2.4	Decimal System
2.3	Unique approaches to represent Numbers
2.3.1	Bhūta-Saṃkhyā system
2.3.2	Śūnyabindu System
2.3.3	Piṅgala and the Binary system
2.4	Measurements for time, distance, and weight in ancient India

Unit III	Linguistics
3.1	Introduction to Linguistics
3.2	Aṣṭādhyāyī
3.3	Phonetics
3.4	Word generation
3.5	Computational aspects
3.6	Mnemonics
3.7	Recursive operations -Introduction to use of Kaprekar Constant 6174 in recursion
3.8	Rule based operations
3.9	Sentence formation
3.10	Verbs and prefixes
3.11	Role of Sanskrit in natural language processing
Unit IV	Ancient Cryptography and Security Systems
4.1	The Evolution of India's Intelligence Culture-Kautilya's Discourse on Secret Intelligence in the Arthashastra
4.2	Kaṭapayādi system
4.3	Steganography in Kautilya's Arthashastra
4.4	Cryptographic methods in ancient Indian texts
4.5	Relevance to modern-day cybersecurity and encryption
4.6	Introduction to use of Kaprekar Constant (6174) in cryptography

Course Type: AEC

Course Code: OAEC-201-ENG

Course Title: Advanced Professional & Applied Communication – I

Course Objectives:

- To introduce the foundational principles of effective communication.
- To introduce non-verbal communication.

Course Outcomes: After successful completion of this course, the learners will be able to

- Apply the C's of effective communication to structure clear corporate interactions while systematically eliminating active interpersonal and environmental barriers.
- Interpret and utilize non-verbal cues alongside active listening strategies to run collaborative IT team projects efficiently.

Course Contents

1. Conversational Skills	1.1 C's of effective communication 1.2 Joining and leaving conversations 1.3 Telephone etiquette 1.4 Barriers to communication 1.5 Overcoming barriers to communication
2. Non-Verbal Communication & Listening Skills	2.1 Nonverbal communication: 2.1.1 Gestures, Postures, Facial Expression, Eye Contacts, Body Language (Kinesics), Silence 2.1.2 Tips for Improving Non-Verbal Communication 2.2 Listening Skills: 2.2.1 Types of Listeners 2.2.2 Tips to be good listener

Course Objectives

Local history provides a close understanding of historical processes at the community and regional levels. This course introduces students to the study of local history through historiography, micro-history, and the systematic use of written, oral, material, and audio-visual sources. Emphasis is laid on oral history methods, fieldwork, documentation, and digital archiving. The course aims to develop research skills, historical sensitivity, and an appreciation of local cultural heritage, enabling students to relate local historical experiences to broader national narratives.

Course Outcomes (COs)

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

- Explain the concept, scope, and significance of local history, historiography, and micro-history, and relate local historical developments to national history.
- Identify, classify, and evaluate written, oral, material, and audio-visual sources used in the study of local history.
- Apply oral history methods and interview techniques to collect reliable local historical data while adhering to ethical standards.
- Demonstrate practical skills in historical documentation by collecting, classifying, cataloguing, and digitally recording local historical information.
- Produce well-structured reports, projects, or case studies on local history using appropriate writing styles, citation methods, and digital archiving tools.

Unit 1: Concept of Local History

- Introduction to historiography
- Importance of local and regional history
- Relationship between local history and national history
- Micro History

Unit 2: Sources of History

Written Sources: Inscriptions, Copper plates, Official records & documents, Administrative files

Unwritten / Oral Sources: Folk tales and legends, Folk songs, Customs and traditions

Material Sources: Temples, Forts, Traditional houses (e.g. Wadas), Memorials and tombs

Audio-Visual Sources: Photographs, Maps, Films and documentaries, etc.

Unit 3: Oral History

- Methodology of oral history
- Interview techniques
- Ethics, authenticity, and reliability

Unit 4: Process of Documentation

- Collection of historical data
- Classification and cataloguing
- Use of registers, questionnaires, and field diaries
- Photography, audio recording, and video documentation

Unit 5: Writing and Presentation

- Style and techniques of writing local history
- Citation and bibliography methods
- Reports, projects, and case studies
- Digital documentation and archiving

Co-curricular Activities:

1. This course can be conducted as an individual initiative or as group activities.
2. There should be few orientation and introductory lectures related to above topics.
3. Students should read about history writing and documentation process.
4. The mentor should organize ideation and brainstorming session. Students should select the topic about documentation of local history, communities, places and institutions, traditions, yatra and jatras, etc.
5. The mentor should guide the students about primary and secondary sources. Sources for gathering data should be discussed and identified. Based on this a plan for data gathering and interviews should be devised.
6. Students should study historical documents, use oral history methods, make field observations, click photos of personalities & places, record videos, etc.
7. Students should analyze and interpret the data and write an essay in around 4000 to 5000 words giving proper references.
8. CDOE should check the documents for plagiarism, use of AI and misinformation, if any.
9. Students should present the topic before the class.

Syllabus for Semester – IV

Course Title: Database Management Systems**Course Objectives:**

- To understand the fundamental concepts of Relational database management systems
- To study and understand systematic approaches for design of database systems
- To learn SQL - the database Query language
- To know about transaction management and data security

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

- Solve real world problems using appropriate relational data model.
- Construct E-R Model for given requirements and convert it into database tables.
- Write efficient SQL queries and use PL/SQL
- Apply database management operations
- Describe mechanisms for transaction management
- Demonstrate understanding of database security

Unit I	Introduction	
1.1	Introduction to DBMS	
1.2	File system Vs. DBMS	
1.3	Data models -relational, hierarchical, network	
1.4	Levels of abstraction	
1.5	Data independence	
1.6	Structure of DBMS	
1.7	Users of DBMS	
1.8	Advantages and disadvantages of DBMS	
Unit II	Conceptual and Relational Database Design	
2.1	Overview of DB design process.	
2.2	Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)	
2.3	Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets) and symbols. Extended ER Features, ER to Relational Mapping	
2.4	Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null Constraint, Domain Constraint, Check constraint, Mapping constraints, Column level and Table Level Constraint)	
2.5	Keys in Database (primary key, foreign key, Candidate key, super key)	
2.6	Extended features - Specialization, Aggregation, Generalization (Pictorial representation).	
2.7	Structure of Relational Databases (concepts of a table)	
2.8	Concept of Normalization -Normal forms (only definitions) with example (1NF,2NF,3N, BCNF, 4NF)	
2.9	Functional dependency - Concept, Closure of Attribute set, Armstrong axioms, Closure of relation(F^+)	
2.10	Decomposition - Concept, Properties of Decomposition (Lossless joins and Dependency preservation)	

Unit III	Structured Query Language (SQL)	
3.1	Introduction to SQL.	
3.2	DDL commands with examples (Create, Drop, Alter)	
3.3	DML commands with examples (Insert, Update, Delete)	
3.4	Basic structure of SQL Select query	
3.5	SQL Operations (Aggregate functions, Set operations, Date, Time, String functions and Null values, Nested Sub queries)	
3.6	Join Queries (Cartesian Product, Inner joins, Outer - Left, Right, Full)	
3.7	Views (Create, Alter, Drop)	
3.8	Examples on SQL (case studies)	
Unit IV	Introduction to PL/Postgres SQL	
4.1	PL/Postgres SQL: Language structure	
4.2	Control structures (Conditional Statements and loops)	
4.3	Stored Procedures.	
4.4	Functions	
4.5	Handling errors and exceptions	
4.6	Cursors	
4.7	Triggers	
Unit V	Transaction Management	
5.1.	Transaction	
5.1.1	Properties of transaction	
5.1.2	States of transactions	
5.1.3	Concurrent execution of transactions	
5.1.4	Conflicting operations	
5.2	Schedules	
5.2.1	Types of schedules	
5.3	Concept of serializability	
5.3.1	Precedence graph for serializability	
5.4	Basic timestamp protocol for concurrency, Thomas Write Rule.	
5.5	Two-phase Locking protocol, Timestamps vs. Locking.	
5.6	Deadlock and Deadlock Handling - Deadlock Avoidance, Deadlock Detection and Deadlock Recovery	
5.7	Log Base Recovery Techniques - Deferred and Immediate Updates	
Unit VI	Database Security	
6.1	Introduction to database security concepts	
6.2	Methods for database security	
6.3	Access Control Method	
6.3.1	Discretionary access control method	
6.3.2	Mandatory access control	
6.3.3	Role based access control for multilevel security	
6.4	Use of views in security enforcement	
6.5	Overview of encryption technique for security	
6.6	Statistical database security.	

Course Type: MJ

Course Code: OCA-252-MJP

Course Title: Lab course on Database Management Systems (OCA-251-MJ)

Course Objectives:

- To study DDL and DML Queries
- To understand SQL and PL/SQL

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

- Design E-R Model for given requirements and convert the same into database tables.
- Design and create relational database systems.
- Use SQL DDL and DML commands
- Apply constructs in PL/PGSQL

List of Lab Assignments	
Assignment No 1	Simple table design (DDL) Commands
Create simple tables including all data types. • Primary key constraint (as a table level constraint and as a column level constraint) • Check constraint (All types) • Unique constraint, Null/Not null constraint	
Assignment No 2	Simple tables using referential constraint (DDL) commands
• Create more than one table and access them using referential integrity constraint.	
Assignment No 3	DDL commands
• Drop a table, Alter schema of a table. • Insert / Update / Delete records using tables created in previous Assignments	
Assignment No 4	DML commands
• Write queries on the tables using SQL select query ➤ Select <field-list> from table [where <condition> order by <field list>], Select <field-list, aggregate functions> from table [where <condition> group by <> having <> order by <>] • To create views and retrieve data using the views	
Assignment No 5	DML commands
• Write queries using set operations (minus operation, union, union all, intersect, intersect all)	
Assignment No 6	Nested Queries
• Write nested queries using Except, Except all, Exists, Not exists etc.	
Assignment No 7	Stored Procedure
• Create a Simple Stored Procedure • Create a Stored Procedure with IN, OUT and IN/OUT parameter	

Assignment No 8	Function
• Create and use a Simple Stored Function • Create and use a simple Stored Function that returns • Create and use a simple Stored recursive Function	
Assignment No 9	Cursor
• Create and use a Simple Cursor • Create and use a Parameterized Cursor	
Assignment No 10	Exception Handling
• Create and use a Simple Exception-Raise Debug Level Messages • Create and use a Simple Exception-Raise Notice Level Messages • Create and use a Simple Exception-Raise Exception Level Messages	
Assignment No 11	Triggers
• Create and perform insert, update, delete using a Before Trigger & an After Trigger • Creating EER Diagram and schemas using MySQL- Workbench or any such tools • Store data in simple DBMS and retrieve it in spreadsheets using SQL query	

Course Type: VSC

Course Code: OCA-271-VSC

Course Title: Python Programming

Course Objectives:

- To introduce programming concepts using Python
- To understand various constructs in Python
- To test and execute Python programs.

Course Outcomes: After successful completion of this course, the learners will be able to

- Write Python programs to solve a given problem
- Choose appropriate data structures such as lists, dictionaries, tuples, and sets.
- Develop Python programs to implement the given small applications.

List of assignments

The instructor shall cover theoretical aspects such as Data types, declarations, input / output, control flow, Strings and Functions List, Tuples, Dictionary and Sets etc.

Assignment No.	Topics for the Assignments
1	Basic Python
2	Control structures and operators
3	Python Strings
4	Python Functions
5	Python Lists
6	Python Tuples
7	Python Dictionary
8	Python Sets

Course Type: CEP

Course Code: OCA–281–CEP

Course Title: Community Services

Course Objectives:

- To provide exposure to the students and sensitize them for community issues/problems
- To know levels of community engagements (Informative, participative and decision-making participations)

Course Outcomes: After successful completion of this course, the learners will be able to

- Identify and define community engagement service to address community problem
- Choose appropriate community engagement level to solve the problem
- Analyze and propose possible solution to solve community problem

Guidelines for the faculty

A faculty shall be assigned as a guide for each upto 4 students.

The guide assigned for each group shall assist the assigned student group(s) for identifying topic/area (topic list is provided below for reference) for the community engagements, objectives and outcomes, preparation of questionnaire, resources/tools needed and guide the students for possible solutions and report preparation. The guide assigned for each group shall monitor, track and assess the progress of work carried out by students throughout the semester

Guidelines for Students

The student shall work in a group of upto 4 students. Each group shall select topic/area for the community engagement to be undertaken in consultation with their assigned guide.

The group shall discuss and decide objectives, outcomes, overall plan for possible activities during community engagement, methodology to be adopted, such as preparation of a questionnaire for conduction of survey or methods for data gathering, tools to be used for analysis etc. and get the plan approved from their guide.

Each group shall carry out activities. The students shall maintain a diary giving details of tasks performed by them, observations/study notes etc.

The suggested timelines for the field work are

- Formation of group – 1 week
- Selection of topic for community engagement – 2 Week
- Discussions and finalization of objectives, outcomes and methodology to be used – 3 Weeks
- Activities for community engagement - Conduction of survey / gathering data, Awareness programs, interviews, group discussions and meeting with guide — 4Weeks
- Preparation of report and presentation – 2 weeks

Each group shall submit a report at the end of the semester consisting of Title, Abstract, Rational of the study, problem definition, objectives, outcomes, methodology used, details of activities undertaken, analysis, findings, details of proposed solution (paper design/prototype/mobile app etc.) and conclusions. Students should also submit photographs, audio-video clips etc.

List of suggested topics / areas for Community Services (but not limited to)

1. Schools and colleges – Awareness about environment issues, cyber security, health and nutrition, new policies by government, Training programs for students and teachers, etc.
2. Agriculture - Awareness programs for farmers, in association with agriculture officers on Plantation and Soil protection, Bio-diversity, Organic farming, promotion of local crops, marketing, sales and logistics for agro products etc.
3. Old age homes and organizations working of differently abled people – Awareness programs for Senior Citizens and differently abled people and their interviews etc.
4. Organizations/NGOs working on food habits, nutrition, adulterations – Awareness programs for students staying in hostels
5. Urban Region - Smart Cities, Traffic Management, Renewable energy and Solar Systems
- Interviews with officers and citizens, social and community leaders, Drives for waste collection and disposal, testing water quality Drives for River and garden Cleaning, etc.
6. Government offices and offices of Local Civic Bodies (Corporation/Municipal Corporation/ Grampanchayat) – Interviews with officers and devise mechanism for promotion of Schemes and services for citizens through websites, street plays etc.
7. Pollution control boards – Interviews with officers and arranging drives/awareness programs for Air/Sound/Water pollutions
8. Department of disaster Management – Arranging mock drills
9. Office of Local city bus transportation – Interviews with officers, employees and passengers and suggest solutions with optimised bus routes, frequency, stoppages and fares
10. Prominent Local social events such as “Sinhasta Kumbhamela”, “Pundharpur Vari” etc. – Crowd and traffic management, surveillance, security, Environmental issues etc.
11. Women education and empowerment – Training programs for house wives and Mahila Udyog and Bachat Gat
12. Community engagement platforms – Study / develop platform for community members to report issues, share ideas and collaborate on local issues.
 - Conduction of workshops or awareness drives on topics such as digital literacy, environmental sustainability, mental health, career guidance and planning for local stakeholders in a nearby community or village.

Course Type: MN

Course Code: OCA–291–MN

Course Title: Communication Networks

Course Objectives:

- To understand the fundamental concepts of network model.
- To understand IP address and routing.
- To understand wireless communication protocol.
- To study wireless sensor network.

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

- Define basic concepts in network model.
- Understand IPv4, IPv6 address.
- Understand short range technologies and their applications.
- Understand the wireless sensor network.

Unit I Network Models

Review of basic concepts in Data Communication, network.

Computer network model: OSI Model – layered architecture, peer-to-peer processes, encapsulation;

TCP/IP Model – layers and Protocol Suite

Addressing: Physical, Logical, Port addresses, Specific addresses.

Unit II Address Mapping and Routing

IPv4 addresses: Address space, Notations, Classful and Classless addressing,

IPv6 addresses: Structure, address space, packet format, Extension headers;

Address mapping – ARP, RARP, BBOTP and DHCP; Introduction to ICMP;

Routing: Concept, types, routing protocol: unicast, multicast

Unit III Wireless Communication Protocol

Short range Technologies: Infrared (IR): frequency band, range, and applications,

Bluetooth: Bluetooth architecture, Bluetooth frame format; **Zigbee:** Characteristics, System Structure (Coordinator, router, end device), Topology, applications;

Z wave: Components of Z-wave network, characteristics, applications

RFID: Working of RFID system, types of RFID tags, RFID frequencies,

GPS system: Components of GPS system (space segment, control segment, user segment), Applications

Unit IV Wireless Networks

Long range wireless technology: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, Sigfox, NB-IoT, Cat –M.

Wireless Sensor Network: WSN Architecture, WSN topologies, Types of nodes (Coordinator, Router and End Device).

Satellite communication: Basic concept, segments, orbits, applications.

Course Type: MN

Course Code: OCA-292-MNP

Course Title: Lab course on Communication Networks (OCA-291-MN)

Course Objectives:

- To familiar with MAC and IP address
- To understand how to setup LAN.
- To understand wireless sensor node for WSN.
- To understand short- and long-range wireless technology.

Course Outcomes: After successful completion of this course, learner will be able to- • Understand the concept of MAC and IP address.

- Set up LAN.
- Understand wireless sensor node for WSN.
- Understand practical use of short- and long-range technology.

Course Contents (Any 13)

- 1 To study Configuration of IP and MAC address.
- 2 To study Local Area Network setup.
- 3 To convert the given IP addresses from dotted-decimal notion to binary notation.
- 4 To convert the given IP addresses from binary to dotted decimal notion.
- 5 To find NetID and Host ID of the given IP addresses
- 6 To find class of the given IP addresses.
- 7 To study Arduino based LED pattern generation.
- 8 To study of Bluetooth.
- 9 To study the RFID.
- 10 Point to point communication using Zig-Bee.
- 11 Wireless sensor node used for street light control.
- 12 Wireless sensor node used for environment monitoring.
- 13 Wireless sensor node used for security system.
- 14 Wireless sensor node used for Door control.
- 15 Study of LoRa Communication

Course Type: OE

Course Code: OOE-258-COMT

Course Title: Principles and Functions of Management

Course Objectives:

- To provide basic knowledge and understanding about various concepts of Business Management.
- To help the students to understand the importance of management principles.
- To create an understanding about various functions of management.
- To provide them tools and techniques to be used in the decision making.

Course Outcomes: After Completion of the course, student will be able to:

- Understand the importance of management and its evolution process in detail.
- Learn various functions of management and their applicability.
- Have strong foundation in understanding management at work.
- Understand various tools and techniques used for decision making.

Unit 1: Introduction, Process and Functions of Management:

- 1.1 Definition, Nature or Characteristics, and Five M's of Management
- 1.2 Management Vs Administration and its difference.
- 1.3 Management as an Art, Management as a Science, Management as a Profession
- 1.4 Levels of Management, Managerial Skills and Managerial Roles
- 1.5 Management Process and its Elements
- 1.6 Functions of Management and Universality of Management

Unit 2: Historical Development of Management:

- 2.1 Pre-scientific Management Era
- 2.2 Modern Management Thoughts:
 - 2.2.1 Classical Theories: a) Max Weber's Bureaucracy Theory, b) F. W. Taylor's Scientific Management Theory, and c) Henri Fayol's Administrative Management Theory
 - 2.2.2 Neo-classical Theories: a) Human Relations Approach, and b) Behavioural Science Approach
 - 2.2.3 Modern Theories: a) Quantitative Approach, b) Systems Approach, and c) Contingency Approach

Unit 3: Functions of Management:

- 3.1 Planning: Concept, Features, Advantages, Limitations, Principles, Types, and Steps in Planning Process
- 3.2 Forecasting: Concept, Features, Importance, Limitations, Process of Forecasting, and Forecasting Techniques
- 3.3 Decision-Making: Concept, Characteristics, Process, Principles, Techniques of Decision-Making, Types of Managerial Decisions, and Rationality in Decision-Making or Models of Decision-Making Behaviour

Course Title: Spreadsheet Applications

Course Objectives:

- To know Excel interface, basic and advanced Data Entry and Formatting
- To understand Excel Formulas and Functions, Charts
- To learn to automate tasks with Macros and VBA

Course Outcomes: After successful completion of this course, the learners will be able to

- Navigate and utilize spreadsheet applications effectively for data organization and management
- Apply formulas, functions and logical operations to automate tasks.
- Analyze and visualize data using charts, pivot tables and conditional formatting
- Implement data validation, sorting and filtering for efficient data handling
- Develop practical spreadsheet solutions for business scenarios like financial planning, inventory management and project management.

List of Assignments

1. Create, Open, Save Spreadsheet, Basic Data Entry and Formatting and conditional formatting, Formula and function, Sorting, importing data from various formats (csv/text)
2. Lookup and Reference Functions - VLOOKUP, HLOOKUP, XLOOKUP
3. INDEX and MATCH (for dynamic lookups) - INDIRECT, OFFSET, CHOOSE
4. Logical Functions - IF, AND, OR, XOR, IFERROR, IFS
5. Text Functions - CONCAT, TEXTJOIN, PROPER, LEFT, RIGHT, MID
6. Date and Time Functions - TODAY, NOW, EOMONTH, NETWORKDAYS
7. Math and Statistical Functions - SUMIF, COUNTIF, AVERAGEIF RANK, LARGE, SMALL
8. Array Formulas and Dynamic Arrays
 - a. Basic example of Arrays using ctrl + shift + enter
 - b. Array with if, len function and mid function formula
 - c. Advanced use of formula with Array.
9. Power Query for Data Cleaning
 - a. Automates data cleaning and transformation.
 - b. Can merge, split, remove duplicates, and reshape data.
10. Histogram, Waterfall, Gantt and Combo Charts
11. Pivot Tables
 - a. Creating simple Pivot Tables
 - b. Basic and Advanced value field
 - c. Classic Pivot Tables
 - d. Filtering Pivot Tables
 - e. Modifying Pivot Tables
 - f. Grouping data in pivot table based on numbers, category and Dates
12. VBA
 - a. Creating a Macro, Procedures and Functions in VBA, Variables in VBA
 - b. If statement and Select statement - if and Else if, Select case Statement
 - c. Loops in VBA - For and Do loop, Exit Loop, Advanced Loop
 - d. Mail Functions in VBA - Send automated mail, Merge multiple excel files into one sheet, Split worksheets using VBA filters
13. Micro Projects
 - a. Financial Calculation and Budget Planning or
 - b. Sales and Inventory Management or
 - c. Project and Time Management

Course Type: AEC

Course Code: OAEC-251-ENG

Course Title: Advanced Professional & Applied Communication – II

Course Objectives:

- To develop practical, real-world verbal abilities for navigating daily office interactions and corporate environments.
- To train students in formal workplace drafting

Course Outcomes: After successful completion of this course, the learners will be able to

- Demonstrate professional conversational etiquette during virtual meetings, video conferencing, telephonic calls, and routine workplace requests or complaints.
- Deploy persuasive English and specialized vocabulary to draft promotional materials, product demonstrations, and marketing frameworks tailored for the software/IT industry.
- Construct well-structured business letters, formal offers, letters of appreciation, letters of recommendation, and functional corporate notes following standard industry layouts.

Course Contents

1. Everyday Workplace Communication	1.1 Making requests 1.2 Asking for information 1.3 Inviting and accepting/declining an invitation 1.4 Making a complaint 1.5 Describing objects, people, places and processes 1.6 Conduction of meetings 1.7 Video Conferencing
2. Advanced Vocabulary & Applied Drafting	2.1 The Use of English for advertising, demonstration, promotion, presentations 2.2 Vocabulary 2.2.1 Phrasal verbs 2.2.2 Word formation 2.2.3 Effective ways of building vocabulary 2.3 Everyday Drafting at Workplace 2.3.1 Note making 2.4 Business Letters Dynamics 2.4.1 Letter of recommendation 2.4.2 Offer letter 2.4.3 Letter of appreciation 2.4.4 Structure and Components of Business letters

Course Title: Basics of Fire Safety

Course Objectives:

This basic course introduces students to core fire safety principles, everyday hazard prevention, and emergency exit procedures. It is designed to equip students with essential life safety skills for home, college labs, and office workplaces.

Course Outcomes:

- By the end of this course, students will be able to:
- Identify basic fire classes and common fire hazards at home and in IT labs.
- Know how to select and operate a standard fire extinguisher using the P.A.S.S. method.
- Follow proper exit routes and safety steps during a fire emergency (R.A.C.E. method).

Course Content:

Unit 1: What is Fire?

1.1 The Fire Triangle: Fuel, Heat, and Oxygen (how fire starts and how to stop it).

1.2 Common Classes of Fire (Simplified):

Class A: Solid materials (paper, wood, plastic).

Class B: Flammable liquids (petrol, cleaning solvents).

Class C/E: Electrical fires (cables, computers, appliances).

1.3 Stages of Fire: How a small spark turns into a big fire.

Unit 2: Preventing Fires at Home & IT Labs

2.1 Common Electrical Hazards: Overloaded power strips, damaged cords, short circuits.

2.2 Lab & Office Safety Basics: Proper ventilation around computers, organized cable routing, safe phone/UPS battery charging.

2.3 Smoke Detectors & Alarms: How basic smoke detectors work and what to do when the alarm sounds.

Unit 3: Fire Extinguishers

3.1 Types of Extinguishers: Water, Powder (DCP), and Carbon Dioxide (CO_2).

3.2 The P.A.S.S. Technique:

- * Pull the pin
- * Aim at the base of the fire.
- * Squeeze the handle.
- * Sweep side-to-side.

3.3 When to fight a fire vs. when to run (safety first rule).

Unit 4: Emergency Response & First Aid

4.1 The R.A.C.E. Emergency Protocol (Rescue, Alarm, Contain, Evacuate).

4.2 How to Evacuate Safely: Finding emergency exits, avoiding elevators during a fire, crawling under smoke.

4.3 Basic First Aid: Immediate care for minor thermal burns and smoke inhalation basics.

Online Delivery & Learning Mode

Virtual Demonstrations: Video walk-throughs of fire extinguisher usage, alarm components, and emergency exits.

Interactive Quizzes: Short multiple-choice quizzes after each module to check understanding.

Co-curricular Activities:

1. Instructional & Preparatory Phase

- **1.1 Orientation & Expert Lectures:** Introductory and orientation lectures delivered by subject matter experts and faculty to introduce fundamental fire safety concepts, hazard identification, and safety protocols.
- **1.2 Guided Self-Paced Learning:** Students are expected to explore and analyze open-source e-content, regulatory guidelines (e.g., National Building Code fire safety norms), and digital learning repositories to build foundational knowledge.

2. Experiential Learning & Field Study (e-Report Generation)

Students will conduct a field-based and open-source investigation to prepare a comprehensive digital report (**e-Report**) focused on fire safety awareness in their immediate surroundings (residential area or workplace).

The e-Report must cover the following key areas:

1. **Local Fire Administration Mapping:** Contact protocols and operational readiness of the local municipal/district firefighting system.
2. **Hazard Identification & Risk Assessment:** Analysis of potential fire risks present in the learner's residential neighbourhood or workplace.
3. **Current Safety Infrastructure:** Survey and documentation of existing fire safety measures and equipment installed in the designated area.
4. **Gap Analysis & Recommendations:** Identification of critical safety deficiencies and actionable recommendations for missing or needed fire safety measures.
5. **Local Fire History Case Study:** Historical documentation of past fire incidents in the local region, including root causes, emergency response efficacy, and lessons learned.

Methodology & Data Collection:

- Students are encouraged to use multi-modal data collection techniques, including field observations, digital photography, video recording, interviews using oral history methods, and open-source data gathering.

3. Student Presentation & Knowledge Sharing

- **3.1 Presentation Topic Allocation:** Mentors will assign specific topics or case-study points from the course syllabus to individual learners or small groups for presentation.
- **3.2 Classroom Seminar:** Students will design and deliver a multimedia PowerPoint presentation summarizing their core findings and syllabus topic before the class.

4. Submission, Citation & Academic Integrity Standards

- **4.1 Academic Referencing:** All e-Reports and presentation materials must explicitly list all sources using standard citation styles for data sources.
- **4.2 Digital Quality Assurance:** Submitted e-Reports will undergo mandatory digital screening by the Centre for Distance and Open Education (CDOE) / Assessment Cell for **Plagiarism Check, AI Content Detection &** screening for misinformation.

Syllabus for Semester – V

Course Type: PCC

Course Code: OCA-301-PCC

Course Title: Software Engineering and Testing

Course Objectives:

- To study fundamental concepts of system and the software engineering.
- To understand models for software development.
- To learn process of system analysis and design using standard modeling and documentation tools.
- To be familiarize with principles, objectives, and life cycle of software testing.
- To know different software testing techniques, methods, and levels of testing.

Course Outcomes: At the end of the course, students will be able to:

- Define system and software engineering and process of development life cycle.
- Compare different SDLC models and select suitable models for given problem scenario.
- Analyze, and document software requirements using requirement engineering techniques.
- Apply techniques and tools for system analysis and design and software testing.
- Describe software quality factors, and software testing life cycle.

Course Contents

Unit I Introduction to System Engineering	1.1 Introduction, Definition of Software 1.2 Elements of the System 1.3 Characteristics of the System 1.4 Definition of Software Engineering 1.5 Need for Software Engineering 1.6 Types of System 1.7 System Analyst 1.7.1 Role of System Analyst 1.7.2 Skill Set Required by an Analyst
Unit II Software Development Models and Requirement Engineering	2.1 Introduction - A Generic Process Model 2.2 SDLC, and Umbrella Activities 2.3 Waterfall Model 2.4 Spiral Model 2.5 Prototyping 2.6 RAD 2.7 Incremental Model 2.8 Agile Model Principles 2.8.1 Agile Process 2.8.2 Scrum 2.9 Requirement Engineering tasks - Inception, Elicitation, Elaboration, Negotiation 2.9.1 Fact-Finding Techniques - Questionnaires, Interviews, Observation, Record Review 2.9.2 Feasibility study 2.10 SRS : Characteristics of SRS 2.11 Introduction to Object oriented modelling and design

Unit III System Analysis and Design Tools	3.1 Introduction 3.2 Data Flow Diagram (Process Modeling) 3.3 E-R Model (Data Modelling) 3.4 Decision Table 3.5 Decision Tree 3.6 Input and Output Design 3.7 Coupling and Cohesion 3.8 Case Study on the above topics 3.9 Introduction to UML diagrams
Unit IV Introduction to Software Testing	4.1 Introduction, Nature of errors, 4.2 Testing Objectives 4.3 Testing principles 4.4 Testing fundamentals, 4.5 Software reviews, Formal Technical reviews, 4.6 Inspection and walkthrough 4.7 Testing Life Cycle 4.8 Basic Metrics –size-oriented metric, Function–oriented metric 4.9 Cyclometric Complexity 4.10 Software Quality Assurance And Audit Trail 4.11 McCall’s Quality Factors
Unit V Software Testing Methods	5.1 White Box Testing and types of white box testing 5.2 Test Case Design 5.3 Black Box Testing and types of black box testing 5.4 Gray Box Testing 5.5 Software Testing Process 5.6 Unit Testing 5.7 Integration- Top-down, Bottom up 5.8 System Testing 5.9 Acceptance Testing (alpha, Beta Testing) 5.10 Validation and Verification 5.11 Performance Testing 5.12 Regression Testing 5.13 Smoke Testing 5.14 Load Testing
Unit VI Testing Tools and Software Quality Assurance	6.1 JUnit, Apache JMeter, Selenium 6.2 Load runner, Rational Robot 6.3 Quality Concepts, Quality Movement, Background Issues, SQA activities 6.4 Formal approaches to SQA 6.5 Statistical Quality Assurance 6.6 Software Reliability 6.7 The ISO 9000 Quality Standards 6.8 SQA Plan 6.9 Six sigma

Course Type: PCC

Course Code: OCA-302-PCC

Course Title: Fundamentals of Artificial Intelligence

Course Objectives:

- To learn the core concepts of AI, evolution and different paradigms of AI
- To know the expert systems, knowledge bases and inference engines.
- To study the concepts in machine learning, including supervised, unsupervised and reinforcement learning.
- To understand fundamentals of game theory.

Course Outcomes: At the end of the course, students will be able to:

- Demonstrate understanding of the fundamentals of Artificial Intelligence, including its history, types, applications, intelligent agents, system structure, and ethical considerations.
- Apply problem-solving techniques in AI using state-space search, knowledge representation, and reasoning methods.
- Identify, analyze, and apply appropriate uninformed and informed search strategies, including constraint satisfaction techniques, for solving AI problems.
- Use game theory concepts and game search algorithms, and evaluate their effectiveness and limitations under conditions of uncertainty, incomplete information, and computational complexity.
- Describe the core concepts of Machine Learning and Deep Learning, including types, key terminology, and real-world applications across various domains.

Course Contents

Unit I	Introduction to Artificial Intelligence
1.1 Introduction and History of Artificial Intelligence 1.2 Applications and Techniques of Artificial Intelligence 1.3 Types of Artificial Intelligence (ANI, AGI, ASI) 1.4 Machine Learning, Deep Learning and Artificial Intelligence – Comparative Overview 1.5 Agents and Environments: Types of Agents 1.6 Structure of Intelligent Agents and Rationality 1.7 Ethics and Risks in Artificial Intelligence	
Unit II	Problem, Problem Space and Search
2.1 Defining the problem as a State Space Search (e.g- Water Jug Problem) 2.2 Problem Characteristics 2.3 Heuristic Search, Hill Climbing Method 2.4 Game Playing: Min-Max algorithm, Alpha beta Pruning 2.5 Additional Problems: The Missionaries and Cannibal Problems, The Tower of Hanoi, Monkey Banana Problem	

Unit III	Game Theory
3.1 Optimal Decisions in Games 3.2 Heuristic Alpha–Beta Tree Search 3.3 Monte Carlo Tree Search 3.4 Stochastic Games 3.5 Partially Observable Games 3.6 Limitations of Game Search Algorithms 3.7 Constraint Satisfaction Problems (CSP)	
Unit IV	Machine Learning
4.1 Introduction to Machine Learning (Definition, Relationship between Artificial Intelligence and Machine learning, Need and Importance of Machine Learning) 4.2 Types of Machine Learning (Supervised, Unsupervised and Reinforcement Learning) 4.3 Key concept of Machine Learning (Dataset, Training Data, Testing Data, Features, Labels, Model, Learning Algorithm with example, prediction, Over fitting, Under fitting) 4.4 Deep Learning: Definition, Basic concepts, ANN, Structure of neural network, Activation function (concept only) Natural Language Processing, Computer Vision, Speech Recognition, Robotics, Generative AI. 4.5 Ethical issues in Machine Learning. 4.6 Applications: Healthcare, Banking and finance, education, E-commerce, Recommendation System	

Course Type: PCC

Course Code: OCA-303-PCCP

Course Title: Lab course on Fundamentals of Artificial Intelligence (OCA-302-PCC)

Prerequisites:

- Basic knowledge of computers and programming concepts.
- Fundamental understanding of Python programming.
- Familiarity with basic concepts of machine learning and data handling.

Course Objectives:

- To understand the basic concepts and foundations of Artificial Intelligence using Python.
- To study different problem-solving methods, problem spaces and search techniques used in Artificial Intelligence.
- To learn the principles of Game Theory and decision-making strategies in intelligent systems.
- To understand Machine Learning fundamentals and data preprocessing techniques.
- To implement supervised learning algorithms for solving real-world problems.

Course Outcomes: At the end of the course, students will be able to:

- Describe the fundamental concepts and applications of Artificial Intelligence.
- Apply problem representation methods and search algorithms to solve AI problems.
- Analyze decision-making strategies using Game Theory concepts.
- Perform data preprocessing and handling techniques for Machine Learning.
- Implement and evaluate supervised learning models for prediction and classification tasks.

Operating Environment / Software –

- **Operating Environment:** Windows/Linux/Mac
- **Software:** Python 3.8+, Python Shell
IDE: - Jupyter Notebook/ Google Colab

List of Lab Assignments

Sr. No.	Title of Assignment	No. of Sessions
1	Foundations of Artificial Intelligence using Python	2
2	Problems, Problem Spaces and Search	3
3	Game Theory	2
4	Machine Learning - Introduction to Data Preprocessing	2
5	Machine Learning - Supervised Learning	3

Course Type: PCC

Course Code: OCA-304-PCC

Course Title: Fundamentals of Data Science

Course Objectives:

- To know the fundamental concepts, scope, and lifecycle of Data Science
- To understand different types of data, data sources, and data formats
- To study descriptive and inferential statistical techniques for data analysis
- To learn data preprocessing, wrangling, and transformation techniques
- To be familiarize with data visualizations and ethical issues in Data Science

Course Outcomes: At the end of the course, students will be able to:

- Explain the core concepts, scope, and lifecycle of Data Science
- Identify and classify various types of data, data sources, and data formats
- Apply descriptive and inferential statistical techniques to analyze datasets
- Perform data preprocessing, wrangling, and data transformation tasks
- Design and interpret effective data visualizations using appropriate tools
- Recognize ethical, privacy, and security issues in Data Science applications

Course Contents

Unit I	Introduction to Data Science
	1.1 Introduction to Data Science 1.1.1 Definition and scope of Data Science 1.1.2 Evolution of Data Science 1.1.3 Data Science vs Data Analytics vs Big Data 1.2 Data Science Lifecycle 1.2.1 Problem understanding 1.2.2 Data collection 1.2.3 Data preprocessing 1.2.4 Data analysis 1.2.5 Data visualization 1.2.6 Decision making and deployment 1.3 Types of Data 1.3.1 Based on Structure 1.3.1.1 Structured data 1.3.1.2 Semi-structured data 1.3.1.3 Unstructured data 1.3.2 Based on Nature 1.3.2.1 Qualitative data 1.3.2.2 Quantitative data 1.3.3 Based on Values 1.3.3.1 Discrete data 1.3.3.2 Continuous data

1.4 Data Sources

- 1.4.1 Primary data sources
- 1.4.2 Secondary data sources
- 1.4.3 Databases
- 1.4.4 Web data
- 1.4.5 APIs
- 1.4.6 Sensor and IoT data
- 1.4.7 Social media data

1.5 Data Formats

- 1.5.1 Text data
- 1.5.2 Numeric data
- 1.5.3 Time-series data
- 1.5.4 Image data
- 1.5.5 Audio and video data
- 1.5.6 Common file formats:
 - 1.5.6.1 CSV
 - 1.5.6.2 JSON
 - 1.5.6.3 XML
 - 1.5.6.4 Excel
 - 1.5.6.5 Database tables

Unit II

Statistical Data Analysis

2.2 Introduction to Statistics

- 2.2.1. Importance of statistics in Data Science
- 2.2.2 Types of data in statistical analysis

2.3 Descriptive Statistics

- 2.3.1. Measures of Central Tendency
 - 2.3.1.1. Mean
 - 2.3.1.2. Median
 - 2.3.1.3. Mode
- 2.3.2. Measures of Dispersion
 - 2.3.2.1. Range
 - 2.3.2.2. Variance
 - 2.3.2.3. Standard Deviation
- 2.3.3. Measures of Position
 - 2.3.3.1. Quartiles
 - 2.3.3.2. Percentiles
- 2.3.4. Graphical representation of descriptive statistics

2.4 Inferential Statistics 2.4.1. Population and Sample 2.4.2. Sampling techniques 2.4.3. Concept of estimation 2.4.4. Hypothesis testing 2.4.5. Levels of significance 2.4.6. Type I and Type II errors 2.5 Measuring Data Similarity and Dissimilarity 2.5.1. Data Matrix versus Dissimilarity Matrix 2.5.2. Proximity Measures 2.5.2.1. Nominal Attributes 2.5.2.2. Binary Attributes 2.5.3. Dissimilarity measures 2.5.3.1. Euclidean distance 2.5.3.2. Manhattan distance 2.6 Concept of Outliers 2.6.1. Definition of outliers 2.6.2. Types of outliers 2.6.3. Detection of outliers 2.6.3.1 Statistical methods	
Unit III	Data Collection, Data Preprocessing and Data Transformation
3.1 Data Collection 3.1.1 Data collection methods 3.1.2 Data sources: databases, web data, APIs, sensors 3.2 Introduction to Data Preprocessing 3.2.1 Need for data preprocessing 3.2.2 Data quality issues 3.2.2.1 Missing values 3.2.2.2 Noisy data 3.2.2.3 Inconsistent data 3.3 Data Cleaning 3.3.1 Handling missing values 3.3.2 Noise reduction techniques 3.3.3 Outlier handling 3.3.4 Removing duplicate data 3.4 Data Munging / Data Wrangling 3.4.1 Concept of data munging and wrangling 3.4.2 Data merging and joining 3.4.3 Data reshaping and restructuring 3.4.4 Filtering and sorting data 3.4.5 Feature selection and feature extraction	

- 3.5 Data Transformation
 - 3.5.1 Concept and need for data transformation
 - 3.5.2 Rescaling methods
 - 3.5.2.1 Min–Max normalization
 - 3.5.2.2 Standardization (Z-score normalization)
 - 3.5.3 Encoding Techniques
 - 3.5.3.1 Label Encoding
 - 3.5.3.2 One-Hot Encoding
- 3.6 Data Integration and Data Reduction
 - 3.6.1 Data integration techniques
 - 3.6.2 Data redundancy removal
 - 3.6.3 Data reduction methods
 - 3.6.3.1 Dimensionality reduction
 - 3.6.3.2 Sampling

Unit IV	Data Visualization
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- 4.1 Introduction to Data Visualization
 - 4.1.1. Importance of data visualization
 - 4.1.2. Role of visualization in Data Science
 - 4.1.3. Data Visualization libraries
- 4.2. Types of Data Visualization
 - 4.2.1. Comparison visualizations (bar chart, column chart)
 - 4.2.2. Trend visualizations (line chart, area chart)
 - 4.2.3. Distribution visualizations (histogram, box plot)
 - 4.2.4. Relationship visualizations (scatter plot, bubble chart)
 - 4.2.5. Composition visualizations (pie chart, stacked bar chart)
 - 4.2.6. Geographical visualizations (maps, geo-plots)
- 4.3. Specialized Data Visualization Techniques
 - 4.3.1. Heat maps
 - 4.3.2. Tree maps
 - 4.3.3. Geo-spatial visualizations (maps)
 - 4.3.4. Network graphs
 - 4.3.5. Time-series visualizations
 - 4.3.6. Multivariate visualizations

Unit V	Data Science Tools, Ethics, Security and Case Studies
	5.1 Data Science Tools 5.1.1. Programming languages for Data Science: 5.1.2. Python (overview) 5.1.3. R (overview) 5.2 Libraries and frameworks: 5.2.1. NumPy 5.2.2. Pandas 5.2.3. Scikit-learn (intro) 5.2.4. Development environments: 5.2.5. Jupyter Notebook 5.2.6. Google Colab 5.3 Ethics and Security 5.3.1. Data privacy and confidentiality 5.3.2. Data ethics 5.3.3. Bias in data and algorithms 5.3.4. Data security challenges 5.3.5. Legal and ethical issues in data handling 5.4 Case Studies and Applications 5.4.1. Predictive analytics case study 5.4.2. Recommendation systems (intro) 5.4.3. Fraud detection (concept) 5.4.4. Future trends and career opportunities in Data Science

Course Type: PCC

Course Code: OCA-305-PCCP

Course Title: Lab course on Fundamentals of Data Science (OCA-304-PCC)

Prerequisites:

- Fundamental understanding of mathematics (especially statistics basics)
- Basic programming knowledge (preferably Python)
- Familiarity with data concepts such as tables, rows, and columns

Course Objectives:

- To learn the Data Science environment and tools
- To study statistical data analysis for extracting insights
- To understand techniques for data preprocessing and cleaning
- To know process of effective data visualizations
- To build a foundation for real-world data-driven problem solving

Course Outcomes: At the end of the course, students will be able to:

- Use data science environment using Python and relevant libraries.
- Apply statistical methods to analyze and interpret datasets.
- Perform data preprocessing including cleaning, transformation, and handling missing data.
- Create and interpret various data visualizations for decision-making.
- Demonstrate the ability to work with real-world datasets and derive meaningful insights.

Operating Environment / Software –

Operating Environment: Windows 10/11, Linux (Ubuntu), or Mac

Software: Python (Version 3.x)

Development Tools / IDEs: Jupyter Notebook, Google Colab (online platform), VS Code / PyCharm

List of Lab Assignments

Sr. No.	Title of Assignment	No. of Sessions
1	The data Science Environment	3
2	Statistical data Analysis	3
3	Data Preprocessing	3
4	Data Visualization	3

Course Type: PEC

Course Code: OCA-314-PEC

Course Title: Cyber Security

Course Objectives:

- To understand the fundamental concepts, principles, and terminology of cyber security.
- To study various types of cyber threats, attacks, and vulnerabilities affecting information systems.
- To know security requirements for computer systems, networks, and applications.

Course Outcomes: At the end of the course, students will be able to:

- Explain basic concepts of cyber security, cybercrimes, CIA triad, and cyber threats.
- Classify cyber offenses and cyber stalking and analyze their impact.
- Enumerate cybercrime tools and techniques including malware, phishing, and network attacks.
- Apply basic cryptographic concepts and encryption techniques for secure communication.
- Describe fundamentals of cyber forensics, digital evidence, and investigation tools.

Course Contents

Unit I	Introduction to Cyber Security
	1.1 Definition and Importance of Cyber Security 1.2 Cyber Space and Cyber Crime 1.3 Who are Cybercriminals? 1.4 Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup, Online Frauds, Computer Sabotage, Email Bombing/Mail Bombs, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft 1.5 Security Goals: (CIA Triad) 1.6 Types of Cyber Threats: 1.6.1 Malware (Virus, Worm, Trojan, Ransom ware, Spyware) 1.6.2 Phishing and Social Engineering 1.6.3 Insider Attacks 1.7 Cyber Security Challenges in AI and Modern Systems 1.8 Introduction to use of AI in Security
Unit II	Cyber Offenses and Cyber Stalking
	2.1 Introduction to Cyber Offenses: Meaning and scope of cyber offenses, Difference between traditional crime and cybercrime, Evolution of cybercrime in the digital era, Impact on individuals, organizations, and society 2.2 Techniques Used in Cyber Offenses: Password attacks (brute force, credential stuffing), Network based attacks: MITM, packet sniffing 2.3 Cyber Stalking: Definition and Characteristics of cyber stalking, Key behaviours: persistent monitoring, unwanted contact, intimidation, Types of Cyber Stalking: Email

harassment, social media stalking, Impersonation and fake profiles, Continuous monitoring of online activity, Real-Life Incident of Cyber stalking 2.4 Tools and Methods Used by Stalkers: Tracker links and IP grabbers, Misuse of social network features, GPS/geolocation misuse, Account takeover techniques	
Unit III	Tools and Methods Used in Cybercrime
3.1 Introduction 3.2 Proxy Servers and Anonymizers 3.3 Phishing 3.4 Password Cracking 3.5 Keyloggers and Spywares 3.6 Trojan Horses and Backdoors 3.7 Steganography 3.8 DoS and DDoS Attacks 3.9 Attacks on Wireless 3.10 SQL Injection	
Unit IV	Cryptography and Encryption
4.1 Data Encryption standards. 4.2 Symmetric and Asymmetric Encryption 4.3 RSA Cryptosystem, ECC Cryptography, SSL and TLS in cryptography 4.4 Digital Signature 4.5 Block Cipher 4.6 Types of Encryption methods 4.7 Process of Encrypting and Decrypting data	
Unit V	Cyber Forensics
5.1 Introduction to Cyber Forensics:- 5.1.1 Meaning, Objectives and importance of cyber forensics 5.1.2 Scope and application of cyber forensics 5.2 Cyber Crimes and Digital Evidence: - 5.2.1 Types of Cyber Crimes: -Hacking, Identity theft, Cyber stalking 5.2.2 Concept of Digital Evidence 5.2.3 Types of Digital Evidence - Volatile evidence, on-volatile evidence 5.3 Cyber Forensics Investigation Process: - 5.3.1 Phases of Cyber Forensic Investigation 5.4 Cyber Forensics Tools and Techniques 5.4.1 Software Tools: -EnCase, FTK (Forensic Toolkit), Autopsy 5.4.2 Hardware Tools: Write blockers 5.4.3 Basic forensic techniques: -Disk imaging, Data recovery, Log analysis	

Course Type: PEC

Course Code: OCA-315-PECP

Course Title: Lab course on Cyber Security (OCA-314-PEC)

Prerequisites

- Basic Python programming, understanding of data hiding techniques
- Understanding of data hiding techniques, Basic networking (TCP/IP, HTTP, DNS), Cryptography

Course Objectives:

- To understand and evaluate system security policies and identify phishing attacks.
- To study security programs like phishing simulation and hashing using Python.
- To know password cracking methods (dictionary vs brute force) and apply prevention techniques.
- To learn steganography and memory forensics to hide, extract, and analyze digital data.
- To be familiarized with creating digital evidence using forensic tools

Course Outcomes: At the end of the course, students will be able to:

- Describe basics of digital forensics, legal issues, and chain of custody.
- Use forensic tools like Autopsy and FTK Imager to collect and analyze evidence.
- Evaluate anonymity tools and steganography for data hiding and security.
- Identify and prevent phishing, social engineering, and password attacks.
- Apply security practices to protect against cyber threats.

Operating Environment / Software –

- **Operating Environment:** Windows/Linux/Mac
- **Software:** Python 3.x - Text editor / IDE (VS Code, PyCharm), FTK Imager (Lite), Autopsy, Wireshark, USBDeview, LastActivityView.

List of Lab Assignments

Sr. No.	Assignment Title	No. of Sessions
1	Check the security policies in the system Identify phishing emails	1
	• Write a Python program for Phishing Simulation. • Write a Python Program to Simple Hash Simulation.	
2	Case Study	2
	• Investigating Password Cracking methods (Dictionary vs. Brute Force)	
3	Demonstration of Steganography tools to hide and retrieve data within image files	1
4	Capture and analyze RAM to extract processes, network connections, and user sessions.	2
5	Create Forensic Image using FTK Imager/Encase Imager and Check Integrity of Data	2
6	Analyze a PCAP file to detect malicious network activity	2
7	Encrypt and Decrypt and RSA Algorithm	2
	• Implement the Caesar Cipher to encrypt and decrypt a given message. • Implement the RSA Algorithm to encrypt and decrypt a numeric message.	

Course Type: VSC

Course Code: OCA-321-VSEC

Course Title: Core JAVA Programming

Prerequisites:

- Basic Programming Knowledge and logic building.
- Understanding of Object-Oriented Programming (OOP) Concepts.

Course Objectives:

- To learn implementation of object-oriented concepts with Java.
- To understand implementation interfaces and packages.
- To know the process of exception handling and file handling.
- To acquire knowledge of collections in Java.
- To study multithreading implementation.

Course Outcomes: At the end of the course, students will be able to:

- Identify classes, objects, class members and relationships for a given problem.
- Design end to end applications using object oriented constructs.
- Apply collection classes for storing java objects.
- Use Java APIs for program development.
- Handle abnormal termination of a program using exception handling.

Operating Environment / Software –

- **Operating Environment:** Windows/Linux/Mac
- **Software:** JDK (OpenJDK or Oracle JDK)/Visual Studio Code/ Eclipse IDE /Notepad++

List of Lab Assignments

Sr. No.		No. of Sessions
1	Basics of Java, Classes and Objects Classes and objects, Array of objects, Static keyword, Constructor	4
2	Inheritance , Interface and Packages	3
3	Exception Handling and I/O	2
4	Collections: List, Set, Map interface related classes	2
5	Applet Programming and Threading	1

Course Objectives:

- To provide exposure to students and sensitize them to real-world field issues and societal problems.
- To know appropriate methodologies for conducting field work and data-driven analysis.

Course Outcomes: At the end of the course, students will be able to:

- Identify and define real-world problems in community, organizational, or industrial settings using systematic field investigation methods.
- Design and implement appropriate fieldwork methodology including survey design, data collection techniques, documentation, and use of analytical tools.
- Analyze and interpret collected data using suitable IT tools and techniques to derive meaningful insights.
- Develop and propose feasible technology-based solutions (software prototype, database system, web/mobile application, automation model, etc.) to address the identified problem.
- Communicate findings effectively through structured documentation, presentation, and professional reporting practices.

Guidelines for the faculty:

- A faculty member shall be assigned as a guide for each group of 3–4 students.
- The assigned guide shall assist the group in:
 - Identifying an appropriate topic/area (from the suggested list or beyond).
 - Defining objectives, problem statement and expected outcomes.
 - Designing questionnaires or strategy for data collection.
 - Selecting appropriate technologies and analytical tools.
 - Suggesting feasible IT-based solutions.
 - Structuring and reviewing the project report.
- The guide shall continuously monitor, track, mentor, and assess the progress of the group throughout the semester.
- Regular review meetings must be conducted and documented.

Guidelines for Students:

- Students shall work in groups of 3 or 4.
- Each group shall select a topic in consultation with the assigned guide.
- The group shall finalize:
 - Objectives
 - Problem statement
 - Expected outcomes
 - Methodology
 - Data collection techniques (survey, interviews, observation, case study, etc.)
 - Tools for analysis (Excel, Power BI, Python, SPSS, Database tools, etc.)
 - The project plan must be approved by the guide before execution.
 - Each student must maintain an individual Daily Diary/Log Book recording:
 - Tasks performed
 - Observations
 - Field visit details
 - Learning reflections

Suggested Timeline:

- ❖ Week 1: Identification of Organization
- ❖ Week 2: Define Objectives, problem statement, outcomes and Obtain Approval
- ❖ Week 3–7: Execution of Field Tasks and Daily Diary Maintenance
- ❖ Week 8–9: Report Compilation and Documentation
- ❖ Week 10: Final Presentation and Submission

FP Activities:

Students are expected to engage in practical IT-oriented tasks such as:

- ✚ Software/Application Development
- ✚ Website Design & Development
- ✚ Database Design and Automation
- ✚ Data Analysis and Visualization
- ✚ Testing and Debugging
- ✚ IT Support and System Maintenance
- ✚ Digital Marketing / Content Management
- ✚ Requirement Analysis and Documentation
- ✚ Any domain-specific IT-related implementation work

Note:

- ❖ The Field Project must be distinct from CEP/NSS/NCC activities.
- ❖ Students should preferably work on real-world problems or live projects.
- ❖ Online field work may be permitted but with proper verification and monitoring.
- ❖ Students are encouraged to adopt interdisciplinary approaches and innovative technologies.

Project Report Structure:**The FP report should include:**

- Title Page
- Certificate from Organization
- Acknowledgement
- Abstract
- Organization Profile
- Objectives of the project
- Technologies Used
- Work Done / Tasks Performed
- Learning Outcomes
- Challenges Faced
- Solutions Implemented
- Conclusion
- Annexure (Screenshots, Code, Certificates, etc.)

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

- To understand the basics of programming.
- To know about the script language Python
- To get familiar with different data types, statement and loops used in Python
- To develop python programs for various identified problems

Unit 1: Introduction to Python Programming

Introduction to python as scripting language and comparison with programming language, Advantages, features and applications of Python. Basic structure of Python program, keywords and identifiers, variables and data types, input and output statements, Operators, conditional statements (if, if-else, nested if, elif). Demonstration of python programs on:

1. Basic calculator operations.
2. Even-odd numbers or prime numbers

Unit 2: Control Structures and Functions

Looping statements: for loop, while loop, break, continue and pass statements, nested loops. Functions: defining and calling functions, function arguments, return statement, recursive functions, scope of variables. Demonstration of python programs on:

1. Factorial of number (Recursive).
2. Fibonacci Series.

Unit 3: Data Structures and File Handling

Python data structures: lists, tuples, sets and dictionaries, operations on data structures. String handling and string operations

File handling: opening and closing files, reading and writing files, text file operations. Demonstration of python programs on:

1. Variable swapping of numbers
2. Create/rename/delete files.

Unit 4: Python for Scientific and Electronic Applications

Introduction to scientific computing in Python. Introduction to Python libraries: NumPy and Matplotlib. Basic array operations using NumPy. Plotting graphs using Matplotlib: line graph, bar graph and scatter plot. Basic idea of Python communication with hardware such as Arduino using serial communication. Applications of Python in electronics, automation and data analysis. Demonstration of python programs on:

1. Use of NumPy.
2. Ohm's Law: Graph plotting using Matplotlib

Syllabus for Semester – VI

Course Type: PCC

Course Code: OCA-351-PCC

Course Title: Software Project Management

Pre-requisite Course:

- Software Engineering

Course Objectives:

- To understand the fundamentals of Software Project Management
- To learn tools for Software project planning and management
- To study software project scheduling and tracking
- To know the agile project management

Course Outcomes: At the end of the course, students will be able to:

- Comprehend Software Project Management Concepts
- Use tools for Software Project Management
- Track a project and manage changes
- Apply Agile Project Management concepts

Course Contents

Unit I	Introduction to Software Project Management
1.1 Project Definition 1.2 Project versus Flow type work 1.3 Project Lifecycle 1.4 Processes and Knowledge Areas in Project Management (PM) 1.5 Build or Buy decision 1.6 Work Breakdown Structure (WBS) and its types 1.7 Introduction to PMBOK 1.8 Program and Portfolio Management	
Unit II	Project Planning and Project Management Tools
2.1 Project Planning 2.2 Steps for Project Planning, 2.3 PERT and Gantt Charts 2.4 Introduction to Project Management using Gantt Project 2.5 Objectives of Activity planning 2.6 Project Schedules, Activities, Sequencing and Scheduling 2.7 Network Planning Models, 2.8 Formulating Network Model.	

Unit III	Activity based Scheduling
3.1 Introduction 3.2 Objectives of Activity Planning 3.3 Activity relationships (FS, SF, SS, FF) 3.4 Forward Pass technique 3.5 Backward Pass techniques 3.6 Critical Path concept and remedies	
Unit IV	Project Tracking and Control
4.1 Introduction 4.2 Collection of Project data 4.3 Visualizing progress 4.4 Cost monitoring 4.5 Earned Value Analysis 4.6 Project tracking 4.7 Change Control 4.8 Software Configuration Management 4.9 Managing contracts and Contract Management.	
Unit V	Agile Project Management
5.1 Predictive versus Empirical Management 5.2 Comparison between Non-Agile and Agile Project 5.3 Three stages of Agile Project 5.4 Estimation 5.5 Scope Management 5.6 Role and Responsibilities 5.7 Scheduling and Tracking	

Course Objectives:

- To learn how to build dynamic web pages using client-side and server-side web technologies.
- To understand architecture of WWW, Internet
- To know use of SQL/PLSQL programming in data driven website development
- To know Client-side and Server-side programming concepts and techniques.
- To be familiarized with the process of testing and debugging of web pages.

Course Outcomes:

- At the end of the course, students will be able to:
- Describe the role of Java Script in web programming.
- Build Dynamic web pages.
- Write PHP scripts to interact with users and handle form data.
- Develop simple data-driven web applications.

Course Contents

Unit I	Client-Side Web Programming
	1.1 Introduction to JavaScript: Overview of JavaScript, Need and applications, Advantages and Limitations 1.2 Using JavaScript in HTML: Embedded JavaScript, External JavaScript 1.3 JavaScript Basics: Variables, Data types 1.3 Control Structures: if-else statement, switch case 1.4 Loop Control Statements: for loop, while loop, “for..in” loop 1.5 Functions and Dialog Boxes: Functions, Alert, Confirm, Prompt boxes 1.6 Events and Cookies: JavaScript events, Cookies.
Unit II	Server-Side Web Programming - PHP
	2.1 Introduction to server-side scripting, Role of server-side scripting vs client-side 2.2 Introduction to PHP, PHP - Lexical structure, Language basics. 2.3 Control Structures 2.4 Defining and calling a function, Function parameters, String Functions 2.5 Indexed Vs Associative Arrays, identifying elements of an array, storing data in array, Multidimensional arrays, Extracting multiple values, Traversing arrays
Unit III	Core OOP Concepts in PHP
	3.1 Classes and Objects: Defining classes and creating objects, Class templates vs object instances Using \$this keyword 3.2 Properties and Methods: Public, private, and protected members, Static properties and methods 3.3 Constructors and Destructors: construct () and destruct () functions 3.4 Encapsulation: Data hiding and access modifiers, Getters and setters. 3.5 Inheritance: Extending classes (extends), Parent vs child behavior. 3.6 Polymorphism and Method Overriding, Use in class hierarchies 3.7 Abstract Classes and Interfaces: Abstract classes, Interfaces and contract-based design

Unit IV	Database Connectivity
4.1 Introduction to relational databases (MySQL) 4.2 CRUD operations: SELECT, INSERT, UPDATE, DELETE 4.3 PHP-MySQL integration: connecting to database, executing queries 4.4 Displaying database results in web pages	
Unit V	Introduction to XML
5.1 Introduction to XML 5.2 Uses of XML 5.3 Simple XML examples 5.4 XML key components 5.5 DTD and Schemas 5.6 Using XML in web applications.	

Course Type: PCC

Course Code: OCA-353-PCCP

Course Title: Lab course on Web Programming (OCA-352-PCC)

Prerequisites

- VSEC-101-CA -HTML and Web Page Designing

Course Objectives:

- To be familiar with basics of the Web Programming.
- To acquire knowledge and skills for creation of website using client and server side programming
- To understand process of developing responsive web applications
- To explore different web extensions and web services standards

Course Outcomes: At the end of the course, students will be able to:

- Design and implement static and dynamic web sites using appropriate client side and server-side technologies
- Build Dynamic web site using PHP Programming and Database connectivity.
- Create applications using XML and web services.

Operating Environment / Software –

- **Operating Environment:** Windows
- **Software:** WAMP/XAMPP

List of Lab Assignments

Sr. No.	Assignment Title	No. of Sessions
1	PHP Programming	2
2	Class and Object	2
3	Use of Functions, Arrays	2
4	Use of Inheritance and Interfaces	2
5	Accessing Databases	2
6	Use XML	2

Course Objectives:

- To understand the concept of operating system.
- To study the various functions and services provided by operating system
- To learn algorithms for CPU/process scheduling and disk scheduling
- To be familiar with process synchronization, deadlocks and memory management

Course Outcomes: At the end of the course, students will be able to:

- Apply algorithms for Processes, CPU and Disk scheduling
- Describe process synchronization and deadlocks
- Compare and contrast techniques for memory management.
- Define operating system services

Course Contents

Unit I Introduction to Operating System

- 1.1 Operating Systems Overview- System Overview and Functions of operating systems
- 1.2 What does an OS do?
- 1.3 Operating system Operations
- 1.4 Operating system structure
- 1.5 Protection and security
- 1.6 Computing Environments- Traditional, mobile, distributed, Client/server, peer to peer computing
- 1.7 Open-source operating System
- 1.8 Booting
- 1.9 Operating System services
- 1.10 System calls Types of System calls and their working.

Unit II Process and Process Scheduling

- 2.1 Process Concept – The processes, Process states, Process control block.
- 2.2 Process Scheduling – Scheduling queues, Schedulers, context switch
- 2.3 Operations on Process – Process creation with program using fork (), Process termination
- 2.4 Basic Concept - CPU I/O Burst Cycle, Scheduling Criteria, CPU Scheduler, Preemptive Scheduling, Dispatcher
- 2.5 Scheduling Algorithm – FCFS, SJF, Priority Scheduling, Round-Robin Scheduling, Multiple Queue Scheduling, Multilevel Feedback Queue Scheduling

Unit III Synchronization

- 3.1 Background
- 3.2 Critical Section Problem
- 3.3 Semaphores: Usage, Implementation
- 3.4 Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem

Unit IV Deadlock

- 4.1 What is deadlock?
- 4.2 Deadlock Characterization – Necessary Conditions
- 4.3 Resource Allocation Graph
- 4.4 Deadlock Prevention
- 4.5 Deadlock Avoidance - Safe state, Resource-Allocation-Graph Algorithm, Banker's Algorithm
- 4.6 Deadlock Detection
- 4.7 Recovery from Deadlock – Process Termination, Resource Preemption

Unit V Memory Management

- 5.1 Background – Basic Hardware, Address Binding, Logical Versus Physical Address Space, Dynamic Loading, Dynamic Linking and Shared Libraries, Overlays
- 5.2 Swapping
- 5.3 Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation
- 5.4 Paging – Basic Method, Hardware support, Protection, Shared Pages
- 5.5 Segmentation – Basic concept, Hardware
- 5.6 Virtual Memory Management – Demand paging, Performance of demand paging, Page replacement – FIFO, Optimal, LRU, Second Chance Algorithm

Unit VI File System Management and Disk Scheduling

- 6.1 Basic Concepts: File, File attributes, File operations.
- 6.2 Allocation Methods – Contiguous allocation, Linked allocation, Indexed allocation
- 6.3 Free Space Management and Disk Structure–Free space management techniques: Bit vector, linked list, Grouping, Counting.
- 6.4 Disk structure
- 6.5 Introduction to Disk Scheduling- Need of disk scheduling, Disk access time components (Seek time, Rotational latency, Transfer time)
- 6.6 Goals of disk scheduling-Minimize seek time, maximize throughput, Fairness, Reduce response time.
- 6.7 Disk Scheduling Algorithms- First Come First Serve (FCFS), Shortest Seek Time First (SSTF), SCAN (Elevator Algorithm), C-SCAN (Circular SCAN), LOOK, C-LOOK
- 6.8 Performance Evaluation-Head movement calculation, Average seek time, Comparison of disk scheduling algorithms, Numerical problems based on (Total head movement and Average seek time)
- 6.9 Disk Management (Basic Concepts)-Disk formatting, Disk partitioning, Booting from disk.

Course Type: PCC

Course Code: OCA-355-PCCP

Course Title: Lab course on Operating system Design (OCA-354-PCC)

Prerequisites:

- Basic knowledge of Operating System
- Understanding of System calls
- Familiarity with Process and Process Scheduling.
- Basic concept of Deadlock, Memory Management

Course Objectives:

- To know in detail System Calls
- To implement the Process Scheduling algorithms
- To understand concept of Deadlock
- To know the working of Page replacement algorithms
- To implement Disk Scheduling algorithms

Course Outcomes: At the end of the course, students will be able to:

- System calls on Operating System.
- Process and Scheduling algorithms.
- Deadlock and Bankers algorithm.
- To Know the details of Memory Management.
- Disk Scheduling Algorithms.

Operating Environment / Software –

- **Operating Environment:** Windows/Linux/Mac
- **Software:** VS Code / TurboC

List of Lab Assignments

Sr. No.	Assignment Title	No. of Sessions
1	Operating system commands, useful utilities	3
2	Process Scheduling	2
3	Deadlock Handling	2
4	Memory Management	3
5	Disk Scheduling	2

Course Title: Prompt & Generative AI**Course Objectives:**

- To understand fundamental concepts of Generative Artificial Intelligence.
- To study generative AI applications, including chatbots and automated content generation workflows.
- To learn how AI tools like ChatGPT work at a conceptual level.
- To know ethical, legal, and societal implications of AI

Course Outcomes: At the end of the course, students will be able to:

- Use prompt engineering on large language models.
- Describe concepts of Generative AI and Large Language Models
- Evaluate AI-generated responses for clarity, correctness, bias, and usefulness.
- Create small AI-assisted applications/projects
- Apply generative AI techniques for idea generation, documentation, summarization etc.

Course Contents

Unit I	Fundamental of Prompt Engineering
	1.1 Introduction 1.2 What is a prompt? Why prompts are important? 1.3 Types of prompts 1.3.1 Simple prompts 1.3.2 Instruction prompts 1.3.3 Role-based prompts 1.4 Prompt structure or Prompt Components 1.4.1 Context 1.4.2 Task 1.4.3 Input / Output format 1.5 Good vs Bad prompts
Unit II	Advanced Prompting Techniques
	2.1 Prompt Refinement and Optimization 2.2 Advanced Prompt Techniques 2.2.1 Chain-of-Thought Prompting 2.2.2 Role-Based Prompting 2.2.3 Tree of Thought (ToT) Prompting 2.3 Image Generation 2.3.1 Text-to-Image Models 2.3.2 Prompting for Image Quality 2.4 Code Generation using AI 2.5 AI for Data Analysis and Summarization 2.6 Prompt Evaluation Techniques

Unit III	Introduction to Generative AI
3.1 What is Generative AI? 3.2 History and Evolution of Generative Models 3.3 Artificial Intelligence vs Machine Learning vs Deep Learning 3.4 Types of Generative Models 3.4.1 Rule-based Systems 3.4.2 Neural Networks 3.5 Transformer Models 3.6 Applications of Generative AI	
Unit IV	Large Language Models (LLMs) and Prompting Strategies
4.1 Introduction to Large Language Models (LLMs) 4.2 Architecture of Transformer Models 4.3 Tokens, Embeddings, Attention Mechanism 4.4 Advantages and Disadvantages and Application of LLM's 4.5 Prompting for Code Generation 4.6 AI-assisted Debugging and Optimization 4.7 Prompting for Research and Documentation 4.8 Prompting for Data Analysis	
Unit V	Ethical, Legal and Social Aspects of AI
5.1 Ethical Issues in Generative AI 5.2 Responsible AI and AI Ethics 5.3 Data Privacy and Security 5.4 Copyright and Plagiarism Issues 5.5 AI Bias and Fairness 5.6 Misuse of Generative AI 5.7 Responsible AI Guidelines and Future Scope	

Course Type: PEC

Course Code: OCA-361-PECP

Course Title: Lab course on Prompt & Generative AI (OCA-360-PEC)

Prerequisites:

- Basic knowledge of computers and internet usage
- Fundamentals of programming concepts
- Basic understanding of artificial intelligence concepts.

Course Objectives:

- To study Generative AI tools and their practical usage.
- To know skills in prompt writing and prompt optimization.
- To learn to generate and analyze AI-based outputs.
- To be familiar with different prompting techniques.
- To understand prompt engineering concepts for creative and technical tasks.

Course Outcomes: At the end of the course, students will be able to:

- Use Generative AI tools for basic text generation tasks.
- Design effective prompts for structured and role-based outputs.
- Apply zero-shot, one-shot, and few-shot prompting techniques.
- Perform summarization, paraphrasing, and reasoning-based tasks using AI tools.
- Generate and debug simple programs using prompt engineering techniques.

Operating Environment / Software –

- **Operating Environment:** Windows/Linux/macOS
- **Software:** Python 3.11.x / Visual Studio Code - version 1.85 or later / Jupyter Notebook 7.x

List of Lab Assignments

Sr. No.	Assignment Title	No. of Sessions
1	Basics of Prompting	01
• Create instruction-based prompts for writing an email explaining a technical concept and Generating a checklist etc.		
2	Prompt Refinement and Optimization	02
• Apply prompt optimization techniques • Basic Text Generation Using Simple Prompts		
3	Advanced Prompting Techniques	02
• Implement Chain-of-Thought Prompting • Design Role-Based Prompts		
4	Introduction to Generative AI	02
• Identify real-world applications of Generative AI • Explore different generative models		

5	Large Language Models and Code Generation	02
- Analyze effect of prompt specificity on code quality. - Text Summarization Using Prompts		
6	AI-assisted Debugging and Optimization	01
- Provide buggy code and prompt AI to Identify errors and fix the code - Prompt AI for Best practices and Code comments and documentation and Text Paraphrasing Using Prompt		
7	Prompting for Research and Data Analysis	01
- Use prompts for Literature review summary and Research paper outline - Generate structured reports using output formatting prompts.		
8	Ethical, Legal and Social Aspects of AI	01
- Case study on AI bias, Copyright infringement, Data privacy - Identify examples of misuse of Generative AI.		

Course Type: VSC

Course Code: OCA-371-VSC

Course Title: Advanced JAVA Programming

Prerequisites:

- Core JAVA Programming concepts clarity

Course Objectives:

- To understand GUI development using Swing.
- To learn database programming using JDBC.
- To know server-side programming using Servlet.
- To study dynamic web development using JSP.

Course Outcomes: At the end of the course, students will be able to:

- Design and develop GUI based applications using Swing components and event handling.
- Develop database applications using JDBC to perform CRUD operations (Create, Read, Update, Delete).
- Apply server-side programming using Servlets to handle client requests and responses.
- Use JSP for developing dynamic web applications with scripting elements and implicit objects.
- Describe deploying and managing web applications on web servers like Apache Tomcat.

Operating Environment / software –

- **Operating Environment:** Windows/Linux/Mac
- **Software:** JDK (OpenJDK or Oracle JDK)/Visual Studio Code/ Eclipse IDE / JDK Tool Kit with latest version, PostgreSQL, Apache Tomcat

List of Lab Assignments

Sr, No	Assignment Title	No. of Sessions
1	Swing and Event handling	04
2	Database Programming	03
3	Servlets	03
4	JSP (Java Server Pages)	02

Course Objectives:

- To expose students to real-world industry practices.
- To bridge the gap between academic learning and practical implementation.
- To develop professional competency, ethics, communication, and teamwork skills.
- To encourage self-learning and problem-solving abilities.

Course Outcomes: At the end of the course, students will be able to:

- Apply theoretical knowledge to solve real-world engineering problems.
- Demonstrate technical competency in tools/technologies used in industry.
- Exhibit professional ethics and team spirit.
- Prepare technical reports and deliver effective presentations based on industry experience gained during OJT/Internship

Guidelines for Students

1. Students should opt for an internship/OJT that would provide them to gain ample knowledge in the relevant field of computing such that theoretical knowledge gained can be applied to solve the practical/ field problem.
2. Students should start their internship work/OJT immediately after Vth semester examinations, preferably during summer break.
3. Students should take a challenging task, may be a small portion, and apply the knowledge gained to solve it.
4. Internship problem undertaken may involve data collection from different sources, including generating experimental data, collection of data from field etc.
5. Students are expected to carry out internships/OJT at central / state government organizations such as DRDO, CDAC etc., R&D labs, premier institutions like IITs and IIMs, public sector undertakings, renowned IT/ITES or any other industries, BPOs/call centers etc.

Expected Internship Activities

Students are expected to perform the following activities during internship:

- Phase I – Orientation and Requirement Study
 - Understanding organization structure
 - Study of workflow and operational processes
 - Requirement analysis and project allocation
 - Understanding tools and technologies used
- Phase II – Technical Learning and Development
 - Coding and implementation
 - Database design and integration
 - Software testing and debugging
 - API integration and deployment
 - Use of version control systems
 - Documentation practices
- Phase III – Execution
 - Module development
 - Testing and validation
 - Performance optimization

- Client interaction (if applicable)
 - Team collaboration
- Phase IV – Documentation and Presentation
 - Preparation of internship report
 - Preparation of presentation and demonstration
 - Final presentation and viva voce

Documents to maintained and submitted by students:

- Internship Joining Report
- Weekly Logbook
- Mid-term Progress Report
- Supervisor Feedback (Initial)

Internship opportunities:

The internship may be carried out in any one of the following domains:

- Software Development
- Artificial Intelligence and Machine Learning
- Data Science and Analytics
- Cloud Computing and DevOps
- Cyber Security
- Web and Mobile Application Development
- IoT and Embedded Systems
- Networking and System Administration
- Automation and Robotics Software
- Research and Development
- Entrepreneurship and Startup Projects
- Government/NGO Technical Projects

Guidelines for Internship Report Writing

- Initial Section
 - Face Page
 - Certificate from Organization
 - Certificate from Department
 - Acknowledgement
 - Abstract
 - Table of Contents
- Chapter 1 – Organization Profile
 - Company overview
 - Vision and mission
 - Products/services
 - Organizational structure
- Chapter 2 – Problem Statement and Objectives
 - Project title
 - Need of project
 - Objectives
 - Scope
- Chapter 3 – Technologies and Methodology

- Software/hardware tools used
 - Development methodology
 - System architecture
 - Database design
- Chapter 4 – Work Carried Out
 - Tasks completed
 - Screenshots/results
 - Challenges faced
 - Solutions implemented
- Chapter 5 – Learning Outcomes
 - Technical learning
 - Professional skills acquired
 - Industry exposure
 - Future scope
- Chapter 6 – Conclusion
 - Summary of work
 - Achievements
 - Suggestions

**ESE Question Paper Formats
for
BCA (2024 Pattern)
(OL Mode) Programme**

Total No. of Questions: 3]

SEAT No.

[Total No. of Pages:

[]-_____

B.C.A. (OL Mode)

**Paper Code: Title of the Paper
(NEP 2024 Pattern) (Semester-I/II/III/IV)**

Time : 2 Hours]

[Max. Marks : 35

Q1) Multiple Choice Questions with reasoning 12 (Out of 15)

[12*02=24]

- i)
- ii)
- iii)
- iv)
- .
- .
- .
- 15.

Q2) Answer any Five of the following in 3 Sentences (Out of 5)

[03*02=06]

- 1.
- 2.
- 3.
- 4.
- 5.

Q3) Answer any One of the following in 10 Lines (Out of 2)

[01*05=05]

- 1.
- 2.

— — —

Total No. of Questions: 3]

SEAT No.

[Total No. of Pages:

[]-_____
B.C.A. (OL Mode)
Paper Code: Title of the Paper
(NEP 2024 Pattern) (Semester-I/II/III/IV)

Time : 3 Hours]

[Max. Marks : 70

Q1) Multiple Choice Questions with reasoning 25 (Out of 30)

[25*02=50]

- 1.
- 2.
- 3.
- 4.
- .
- .
- .
- 30.

Q2) Answer any Five of the following in 2 Sentences (Out of 7)

[05*02=10]

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Q3) Answer any Two of the following in 10 Lines (Out of 4)

[02*05=10]

- 1.
- 2.
- 3.
- 4.

— — —