GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Science

CURRICULUM AND SYLLABUS

3 Year Undergraduate Programme
UCSCI01: B.Sc. Computer Science with Cognitive Systems (in collaboration with TCS)

w.e.f. 2024-25 admitted batch

(Updated on July 2024)

GITAM INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University, Estd. u/s 3 of UGC Act 1956)
VISAKHAPATNAM, HYDERABAD, BENGALURU
Accredited by NAAC with 'A^{++}' Grade

REGULATIONS AND SYLLABUS
of
UCSCIO2: B.Sc. Computer Science with Cognitive Systems
(in collaboration with TCS)

(w.e.f 2024-25 Admitted batch)

Website: www.gitam.edu

<center>
B.Sc Computer Science with Cognitive System
REGULATIONS
(w.e.f. 2021-22 admitted batch)
</center>

1. **ADMISSION**

   • Admission into B.Sc Computer Science with Cognitive Systems program of GITAM University in collaboration with TCS is governed by GITAM University admission regulations.

2. **ELIGIBILITY CRITERIA**
   a. A pass in intermediate / +2 with a minimum aggregate of 50% marks in the qualifying examination.
   b. Admission into B.Sc (Computer Science with Cognitive Systems) will be based on an All India GITAM Science Admission Test (GAT) conducted by GITAM University and the rule of reservation, wherever applicable.

3. **CHOICE BASED CREDIT SYSTEM**
   Choice Based Credit System (CBCS) is introduced with effect from the admitted Batch of 2015-16 based on UGC guidelines to promote:
   1. Student-Centered Learning
   2. Cafeteria approach
   3. Inter-disciplinary learning
   Learning goals/ objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

4. **STRUCTURE OF THE PROGRAM**
   • The Program Consists of
     • Foundation Courses (compulsory) which give general exposure to a Student in communication and subject-related area.
     • Core Courses (compulsory).
     • Discipline centric electives which
       • are supportive of the discipline
       • give an expanded scope of the subject
       • give interdisciplinary exposure
       • Nurture the student skills
     • Open electives are general either related or unrelated to the discipline.
     • Practical Proficiency Courses Laboratory and Project work.
   • Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.
   • In general, credits are assigned to the courses based on the following contact hours per week per semester.
     1. One credit for each Lecture / Tutorial hour per week.

2. One credit for two hours of Practical per week.
3. Eight credits for project.

- The curriculum of the six semesters B.Sc Computer Science with Cognitive System program is designed to have a total of 122 credits for the award of B.Sc Computer Science with Cognitive Systems degree.

5. MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register himself/herself for each semester individually at the time specified by the Institute / University.

7. ATTENDANCE REQUIREMENTS

- A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend that end - semester examination and he/she will not be allowed to register for the subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

- However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 66% and 74% genuine grounds and on payment of the prescribed fee.

8. EVALUATION

- The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

- A student has to secure an aggregate of 40% in the course in continuous evaluation and semester-end examination, the two components put together to be declared tohave passed the course, subject to the condition that the candidate must have secureda minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

- Practical / Viva-voce etc. courses are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table1.

1. Table 1: Assessment Procedure

S. No.	Component of assessment	Marks allotted	Type of Assessment	Scheme of Examination
1	Theory	40	Continuous Evaluation	1. Three mid semester examinations shall be conducted for 15 marks each. The performance in best two shall be taken into consideration. 2. 5 marks are allocated for quiz. 3. 5 marks are allocated for assignments.
		60	Semester-end Examination	The semester-end examination shall be for a maximum of 60 marks.
	Total	100		
2	Practicals	100	Continuous Evaluation	60 marks for performance, regularity, record/and case study. Weightage for each component shall be announced at the beginning of the semester. 40 marks (30 marks for the experiment(s) and 10 marks for practical Viva-Voce.) for the test conducted at the end of the Semester conducted by the concerned Lab Teacher.
	Total	100		
3	Project Work	200	Project Evaluation	150 marks for evaluation of the project work dissertation submitted by the candidate. 50 marks are allocated for the project Viva-Voce. The project work evaluation and the Viva-Voce shall be conducted by one external examiner outside the University and the internal examiner appointed by the Head of the Department.

9. RETOTALING & REVALUATION

- Re-totaling of the theory answer script of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the results.

- Revaluation of the theory answer scripts of the semester-end examination are permitted on request by the student by paying the prescribed fee within one week after the announcement of the result.

10. PROVISION FOR ANSWER BOOK VERIFICATION & CHALLENGE EVALUATION:

- If a student is not satisfied with his/her grade after revaluation, the student can apply for, answer book verification on payment of the prescribed fee for each course within one week after the announcement of revaluation results.
- After verification, if a student is not satisfied with revaluation marks/grade awarded, he/she can apply for challenge valuation within one week after announcement of answer book verification result/ two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e.,one Internal and one External examiner in the presence of the student on payment of the prescribed fee. The challenge valuation fee will be returned if the student is succeeded in the appeal with a change for a better grade.

11. SUPPLEMENTARY EXAMINATIONS & SPECIAL EXAMINATIONS:

- The odd semester supplementary examinations will be conducted on a daily basis after conducting regular even semester examinations in April/May.
- The even semester supplementary examinations will be conducted on a daily basis after conducting regular odd semester examinations during November/December
- A student who has completed his/her period of study and still has an "F" grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

12. PROMOTION TO THE NEXT YEAR OF STUDY

- A student shall be promoted to the next academic year only if he/she completes the academic requirements of 60% of the credits until the previous academic year.
- Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the Board of Studies (BoS) to continue his/her further studies.

13. BETTERMENT OF GRADES

- A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in 'n' (where 'n' is no.of semesters of the program) theory courses of any semester of his/her choice, conducted in summer vacation along with the Special Examinations.
- Betterment of Grades is permitted 'only once', immediately after completion of the program of study.

14. REPEAT CONTINUOUS EVALUATION

- A student who has secured an 'F' grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks up to a maximum of 50% by attending special instruction classes held during summer.
- A student who has secured an 'F' grade in a practical course shall have to attend Special Instruction classes held during summer

- A student who has secured an 'F' grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks up to a maximum of 50% by attending special instruction classes held during summer.

- The RCE will be conducted during summer vacation for both odd and even semester students. Students can register a maximum of 4 courses. Biometric attendance of these RCE classes has to be maintained. The maximum marks in RCE are limited to 50% of Continuous Evaluation marks. The RCE marks are considered for the examination held after RCE except for final semester students.

- RCE for the students who completed course work can be conducted during the academic semester. The student can register a maximum of 4 courses at a time in a slot of 4 weeks. Additional 4 courses can be registered in the next slot.

- A student is allowed to Special Instruction Classes (RCE) 'only once' per course.

15. GRADING SYSTEM

- Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

2.   Table 2: Grades & Grade Points

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab. (Absent)	0	-

- A student who earns a minimum of 4-grade points (P grade) in a course is declared to have completed the course, subject to securing an average GPA(average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program.
  Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same.

16. GRADE POINT AVERAGE

- A Grade Point Average (GPA) for the semester will be calculated according to the formula:

  $$\text{GPA} = \frac{\Sigma \, [\, C * G \,]}{\Sigma \, C}$$

C = number of credits for the course,

G = grade points obtained by the student in the course.

To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken, in all the semesters up to the particular point of time.

- CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	≥ 8.0*
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

* In addition to the required CGPA of 8.0 or more the student must have necessarily passed all the courses of every semester in first attempt.

- **ELIGIBILITY FOR AWARD OF THE B.SC COMPUTER SCIENCE WITH COGNITIVE SYSTEMS DEGREE**

- Duration of the program: A student is ordinarily expected to complete B. Sc Computer Science with Cognitive Systems program in Six semesters of three years. However a student may complete the program in not more than Six years including the study period.
- However, the above regulation may be relaxed by the Vice- Chancellor in individual cases for cogent and sufficient reasons.
- A student shall be eligible for the award of the B.Sc Computer Science with Cognitive Systems Degree if he/she fulfill all the following conditions.
  - Registered and successfully completed all the courses and projects.
  - Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.
  - Has no dues to the Institute, hostels, Libraries, NCC / NSS, etc. and
  - No disciplinary action is pending against him/her.
- The degree shall be awarded after approval by the Academic Council.

- **DISCRETIONARY POWER**
  Notwithstanding anything contained in the above sections, the Vice- Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

VISION AND MISSION OF THE UNIVERSITY

VISION

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

MISSION

- Build a dynamic application-oriented education ecosystem immersed in holistic development.

- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.

- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.

- Permeate a culture of kindness within GITAM, fostering passionate contributors

QUALITY POLICY

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

VISION AND MISSION OF GITAM SCHOOL OF SCIENCE

VISION

Nurturing a high-quality Science Education and Research by providing a best learning ecosystem to create world class academicians and researchers

MISSION

- To teach the most renewed curriculum that lay the foundation for students to start exciting careers in academia, research, and industry.

- To foster an environment of healthy curiosity, an innovative mindset, and a strong desire to contribute to the science world.

- To advance our understandings of the natural processes of Physical, Chemical and Biological systems for a better habitable world.

- To inculcate a strong sense of empathy, integrity, and trust in the GITAM Fraternity with a strong commitment towards society and environment.

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER SCIENCE

Bachelor of Computer Applications

VISION

To become a leading hub for education and innovation in computer science, empowering Students with emerging technologies to achieve global tech leadership through pioneering research and active community engagement.

MISSION

- Foster a new generation of skilled computer science professionals through a well-structured curriculum that encourages continuous learning and prepares students for diverse, dynamic careers in emerging technologies.

- Conduct robust research in emerging fields of computer science and engage in strategic collaborations with industry and community partners to make significant contributions to society.

- Uphold the highest ethical standards, transparency, and accountability while fostering inclusivity and diversity in pushing the boundaries of technological advancement.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: Comprehensive Knowledge
Graduates will have a solid foundation in both theoretical and practical aspects of computer science and cognitive systems, enabling them to understand and innovate at the intersection of these fields.

PEO2: Professional Competence
Graduates will demonstrate professionalism, ethical conduct, and effective communication skills, enabling them to work productively in the global IT industry.

PEO3: Problem Solving and Innovation
Graduates will be equipped with problem-solving skills that blend technical and human-centric approaches to develop solutions that are technologically advanced and cognitively attuned.

PEO4:Social Impact
Graduates will understand the impact of their professional activities on social, economic, environmental, and ethical issues.

PROGRAM OUTCOMES (POS)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering Fundamentals, and an Engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering 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 engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to asassess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledgeof, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering 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 engineering activities with the engineering 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 engineering 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Technical Expertise
Graduates will demonstrate proficiency in the core areas of computer science such as programming, data structures, artificial intelligence, and software engineering, as well as in understanding cognitive psychology and human factors.

PSO2:Design and Development Skills
Graduates will be capable of designing, implementing, and evaluating a computer-based system, process, component, or program to meet desired needs of the real world problems.

PSO3: Interdisciplinary Knowledge
Graduates will apply knowledge of mathematics, science, and engineering to identify, formulate, and to solve real world problems of computer science with cognitive systems.

PSO4: Ethical and Social Awareness
Graduates will engage in decision-making, understanding professional, ethical, legal, security, and social issues .

B.Sc Computer Science with Cognitive Systems

Semester - I

Course Code	Category	Title	L	T	P	C
LANG1241	AECC-I	Communicative English - I	0	0	4	2
MATH1271	CC	Linear Algebra	3	0	0	3
CSCI1161	CC	Problem Solving and Programming with Python	3	0	0	3
CSCI1181	CC	Operating Systems	3	0	0	3
CSCI1141	CC	Introduction to Information Technology	3	0	0	3
CSCI1151	PCC	IT Workshop	0	0	2	1
CSCI1171	PCC	Programming with Python Lab	0	0	2	1
CSCI1191	PCC	Operating Systems Lab	0	0	2	1
PSYC1031	SEC-I	Psychology	2	1	0	2
		Semester Total				**19**

Semester - II

Course Code	Category	Title	L	T	P	C
LANG1251	AECC -II	Communicative English - II	0	0	4	2
IENT1051	SSE	Fundamentals of Entrepreneurship	2	0	0	2
CSCI1201 CSCI1211	GE-I	**General Elective-I** Design Thinking E-commerce	3	0	0	2
MATH1281	CC	Probability and Statistics	3	1	0	3
CSCI1221	CC	Introduction to Computer Networks	3	0	0	3
CSCI1241	CC	Programming with C++	3	0	0	3
CSCI1251	PCC	Programming with C++ Lab	0	0	2	1
CSCI1231	PCC	Computer Networks Lab	0	0	2	1
						17

Semester - III

Course Code	Category	Title	L	T	P	C
LANG1091 LANG1121 LANG1131	AECC-III	Hindi German French	2	0	0	2
MATH2101 CSCI2131	GE-II	**General Elective-II** Optimization Techniques Web Technologies	3	0	0	2
ENVS1001	MC	Environmental Studies	3	0	0	3
CSCI2141	CC	Data Structures with C++	3	0	0	3
CSCI2161	CC	Fundamentals of Cloud and Virtualization	3	0	0	3
CSCI2181	CC	Database Management Systems	3	0	0	3
CSCI2151	PCC	Data Structures with C++ Lab	0	0	2	1
CSCI2191	PCC	Database Management Systems Lab	0	0	2	1
CSCI2171	PCC	Cloud and Virtualization Lab	0	0	2	1
		Semester Total				**19**

Semester - IV

Course Code	Category	Title	L	T	P	C
CSCI2201	CC	Introduction to Artificial Intelligence	3	0	0	3
CSCI2221 SOLIA103	GE-III	**Generic Elective-III** Blockchain Technologies Legal Aspects of IPR	3	0	0	2
CSCI2231	CC	Programming with Java	3	0	0	3
CSCI2251	CC	IT Infrastructure Management	3	0	0	3
CSCI2271	CC	Process Management	3	0	0	3
CSCI2281 CSCI2291 CSCI2301	DSE-I	**Department Specific Elective–I** Introduction to Cryptography Mobile Computing Mean Stack Development	3	0	0	3
CSCI2261	PCC	IT Infrastructure Management Lab	0	0	2	1
CSCI2211	PCC	Artificial Intelligence Lab	0	0	2	1
CSCI2241	PCC	Programming with Java Lab	0	0	2	1
FPEA2131	SEC-III	Introduction to Indian Philosophy	2	0	0	2
Semester Total						**22**

Semester - V

Course Code	Category	Title	L	T	P	C
GAP-706	CC	Cognitive Psychology	4	0	0	4
CSCI3111	CC	Client Relationship Management	3	0	0	3
CSCI3121	CC	Digital Technology	3	0	0	3
CSCI3141	CC	Software Testing	3	0	0	3
CSCI3161 CSCI3171 CSCI3181	DSE - II	**Department Specific Elective-II** Cyber Security Data Mining DevOps	3	0	0	3
CSCI3131	PCC	Digital Technology Lab	0	0	2	1
CSCI3151	PCC	Software Testing Lab	0	0	2	1
CSCI3191	SEC - IV	IT Infrastructure Library	3	0	0	3
CSCI3201	PCC	Minor Project	0	0	2	2
Semester Total						**23**

Semester-VI

Course Code	Category	Title	L	T	P	C
CSCI3211	CC	Fundamentals of Neural Learning	3	0	0	3
CSCI3231	CC	Introduction to Machine Learning	3	1	0	3
CSCI3241	CC	Statistical Computing with R	3	0	0	3
CSCI3261	DSE-III	**Department Specific Elective-III** Introduction to IoT				
CSCI3271		Python for Data Analysis				
CSCI3281		Data Center Management	3	0	0	3
CSCI3221	PCC	Neural Learning Lab	0	0	2	1
CSCI3251	PCC	Statistical Computing with R Lab	0	0	2	1
CSCI3291	PCC	Major Project	0	0	2	8
		Semester Total				22

Total Credits - 122

AECC	Ability Enhancement Compulsory Course
SEC	Skill Enhancement Course
CC	Core Course
PCC	Practical Course
MC	Mandatory Course

LANG1241   **COMMUNICATIVE ENGLISH** - I

L	T	P	S	J	C
0	0	4	0	0	2

Pre-requisite   None

Co-requisite   None

Preferable Exposure   None

Course Description:

The course is designed to enhance students' English proficiency through various interactive and practical modules. The course focuses   on developing effective oral and written communication skills in diverse situations. It includes modules on self-introduction, situational conversations, formal and informal greetings, telephonic conversations, and writing tasks such as formal emails, essays, and descriptive stories. The course aims to improve listening and comprehension, enhance public speaking and presentation skills, and encourage literary analysis and creative expression. Through continuous assessment and term-end examinations, students will gain confidence and competence in using English effectively in academic and professional contexts.

Course Educational Objectives:

- Enable students to articulate their thoughts clearly and confidently in various situations, including self-introduction, situational conversations, and formal greetings.
- Improve students' ability to listen for specific information, comprehend spoken and written content, and engage in note-making and note-taking activities.
- Equip students with the skills to write formal emails, applications, and essays and create descriptive and story-writing pieces.
- Enhance the ability to deliver speeches, participate in elocution, and create video blogs, enhancing students' public speaking and presentation capabilities.
- Promote an appreciation for literature by analyzing prose, poetry, and plays while encouraging creative expression through various writing genres and video blogging.

List of Experiments

S.no	Topic	Type
1	About Oneself and Others (*A1, Module 1)	Exercise
2	Situational Conversation (*B1, Module 1-)	Exercise
3	Expressional Greeting: Formal Vs Informal Greeting (*A1, Module 2)	Exercise
4	Telephonic Conversation (*A2, Module 2)	Exercise
5	Instructions & Announcements - All (*A1, Module S)	Exercise
6	Bus Terminals (*A2, Module 4)	Exercise
7	Notes and Messages - All (*A1, Module 6)	Exercise
8	Application Form (*A1, Module 7)	Exercise
9	Formal Email/Paragraph Writing (*B1, Module 7)	Exercise
10	Video Blogs (*C1, Module 5)	Exercise
11	Speech & Elocution (*A2, Module 5)	Exercise
12	Time Expressions (*B1, Module 6)	Exercise
13	Prose and Poems (*A1, Module 4)	Exercise
14	Plays — Macbeth (*C2, Module 4)	Exercise
15	Descriptive & Story Writing (*A1, Module 7)	Exercise
16	Story Genres - Literary Fiction (*B2, Module 3)	Exercise
17	Situational Conversations — ALL — essay writing ("A2, Module 1)	Exercise
18	Situational Conversations — Scientific Developments (*C2, Module 1)	Exercise

Textbook(s):

1. Dutt, P. K., & Rajeevan, G. , Basic Communication Skills. , Foundation Books., 2007

Reference(s):

1. Hewings, M., & McCarthy, M., Cambridge Academic English B2 Upper Intermediate Student's Book (Vol. 1)., Cambridge University Press., 2012
2. Bohlke, D., & Richards, J. C., Four corners., Cambridge University Press., 2012
3. Philpot, S., & Curnick, L., New Headway-academic skills: reading, writing, and study skills.Level 2: student's book. Oxford, UK.:, Oxford University Press., 2007
4. Latham-Koenig, C., Oxenden, C., & Lambert, J., American English File 3E Level S Student Book., Oxford University Press., 2020
5. McCarthy, M., & O'dell, F., Academic vocabulary in use edition with answers., Cambridge University Press., 2016
6. Zemach, D. E., & Islam, C., Writing paragraphs: from sentence to paragraph., 2006
7. Bradbury, A. J. ., Successful presentation skills (Vol. 111)., 2006

Course Outcomes:

1. Develop and apply active listening strategies to understand and analyze spoken content in diverse contexts, improving comprehension and retention.
2. Utilize different writing techniques to produce varied written forms, including persuasive essays, research papers, and creative stories, demonstrating versatility in writing.
3. Conduct detailed analyses of written texts, identifying nuanced arguments and rhetorical strategies, enhancing interpretive and evaluative reading skills.
4. Develop communication skills to articulate complex ideas clearly and persuasively in spoken interactions.
5. Apply integrated language skills in practical settings, demonstrating the ability to use listening, speaking, reading, and writing comprehensively.

Course Articulation Matrix:

CO	POs																PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4
1																				
2																				
3																				
4																				
5																				

3 — High, 2 — Medium & 1 — Low Correlation

APPROVED **IN MEETINGS HELD** ON:

BOS : 31-05-2024   Academic Council Number: 30   Academic Council : 04-07-2023

SDG No(s). & Statement(s) :

4 & Quality Education : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification(s):

Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

B. Sc Computer Science with Cognitive Systems
I SEMESTER
MATH 1271: LINEAR ALGEBRA

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Preamble: This course covers the concepts on theory of matrices and linear operators, bases and vector spaces, orthogonal and symmetric linear operators, Eigen values and factorizations of linear operators, solving system of linear equations and apply their knowledge to psychological problems and their formalization in terms of computational methods.

Course Objectives:
- To familiarize the students with the theory of Matrices, main operations and properties of matrices.
- To understand the linear independence, span, basis and properties of Eigen value and Eigen vectors.
- To acquire computational proficiency involving procedures in Linear Algebra.
- To demonstrate the intersection of linear algebra, calculus, and psychology

UNIT - I

Matrix and their Properties: Definition of Matrices, Matrix Multiplication, Algebraic Properties of Matrix Operations, Rank of a matrix by echelon form, solving system linear equations.   (10)

Learning Outcomes:

By the end of this Unit, the student will be able to
- Apply the different algebraic operations on matrices. (L3)
- Find the rank of matrix and know the solution of nature of system of equations. (L2)
- Solve system of homogeneous and non-homogeneous linear equations. (L3)

UNIT - II

Vector spaces and Linear transformation: Vector space, subspace and span of a set, Linear dependence and independence of a set of vectors, basis and dimension, Linear transformation. (10)

Learning Outcomes:

   By the end of this Unit, the student will be able to
- Know the linear dependence and independence properties of vectors. (L2)
- Find the span of vectors space and dimension of basis. (L2)

UNIT - III

Eigen values, Eigenvectors: Eigen values, Eigenvectors, and their properties, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.   (8)

Learning Outcomes:

After completion of this unit, the student will be able to
- Find the Eigen values and eigenvectors of a matrix. (L2)
- Perform diagonalization of a matrix. (L3)

UNIT - IV

Matrix Decompositions: UL Decomposition, Singular value decomposition.   (6)

Learning Outcomes:

After completion of this unit, the student will be able to
- Decompose the matrix into lower and upper triangular matrices. (L2)
- Factorize a matrix, into singular vectors and singular values. (L2)

UNIT - V

Numerical linear algebra: Gauss elimination with partial pivoting and scaling, Iterative methods for solving linear system of equations. (8)

Learning Outcomes:

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

- Solve the systems of equations by elementary row operations. (L3)
- Solve the systems of equations numerically by iteration method. (L3)

Suggested Readings:

1. K Hoffman and R Kunze, Linear Algebra, Pearson Education, 2nd Edition, 2005.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Other Resources:

1. Gilbert Strang , Introduction to Linear Algebra, Fifth Edition, 2016.
2. Gene H. Golub , Charles F. Van Loan , Matrix Computations , Johns Hopkins, 4th Edition, 2015.
3. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

Course Outcomes:

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

1. Carry out matrix operations, including inverses and determinants. (L2)

2. Demonstrate the concepts of vector space and subspace, linear independence, span, and basis. (L2)

3. Determine eigen values and eigen vectors and solve eigen value problems and apply decomposition technique on linear transformations to find the desire results. (L3)

4. Solve systems of linear equations using multiple methods, including Gaussian elimination and iteration method. (L3)

5 .Apply the linear algebra towards modeling of neural and cognitive data and systems. (L3)

B. Sc Computer Science with Cognitive Systems
I SEMESTER
CSCI 1161: PROBLEM SOLVING AND PROGRAMMING WITH PYTHON

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Preamble: The course enhances computational thinking and develops problem solving skills. The function-oriented programming and visualization along with data structures in python are introduced.

Course Objectives:

- To introduce problem solving through Flowchart and algorithms.
- To elucidate problem solving through python programming language.
- To introduce function-oriented programming paradigm through Python.
- To outline different concepts of data structures and file handling in Python.
- To demonstrate visualization of data in python.

UNIT - I

Computational Thinking, Algorithms and Flowchart design: Introduction to computational thinking, Introduction to the idea of an algorithm, Pseudo code and Flow charts. Flowchart symbols Input / Output, Assignment, operators, conditional if, repetition, procedure and sub charts. Algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).   (10)

Learning Outcomes:

After completion of this unit the student will be able to

- Select flowchart symbols for solving problems. (L1)
- Develop basic flowcharts for performing Input, Output and Computations (L3)
- Problem solving using algorithms (L3)

UNIT – II

Introduction to Python: Features of Python, Python interpreter and interactive mode; Data, Expressions, Statements, values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; control statements, Idiomatic approach to solve programming problems.   (8)

Learning outcomes:

After completion of this unit the student will be able to

- Interpret numbers, strings, variables, operators, expressions and math functions using Python Interactive Mode. (L2)
- Solve simple problems using control structures, input and output statements. (L3)
- Demonstrate best practices of "Idiomatic Python". (L2)

UNIT - III

Functions and Exception Handling: Modules and functions, function definition and use, flow of execution, parameters and arguments, User defined functions, parameters to functions, recursive functions, errors and exceptions, handling exceptions, user defined exceptions.   (8)

Learning Outcomes:

After completion of this unit the student will be able to

- Learn about modular programming using function (L1)
- Develop user defined functions (recursive and non-recursive). (L3)
- Apply exception handling mechanism to identify errors in problem solving (L3)

UNIT - IV

Data Structures: Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; sets, Operations on sets, Dictionaries: operations and methods; Strings. (8)

Learning outcomes:

After completion of this unit the student will be able to

- Summarize the features of lists, tuples, dictionaries, strings and files. (L2)
- Demonstrate use of data structures for efficient storage and retrieval of data during problem solving. (L3)

UNIT - V

File handling and Packages: Text files, reading and writing files, format operator; command line arguments, Numpy - Create, reshape, slicing, operations such as min, max, sum, search, sort, math functions etc. Matplotlib - Visualizing data with different plots, use of subplots, User definedpackages.

(8)

Learning outcomes:

After completion of this unit the student will be able to

- Read data from files of different formats and perform operations insert, delete, update (L3)
- Manipulate and visualize the data using different standard packages (L4)
- Ability to define packages (L3)

Suggested Readings:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Shroff/O'Reilly Publishers, 2016.
2. Reema Thareja, Python Programming: Using Problem Solving Approach, 1st edition, Oxford University Press, 2018.
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
4. Wes McKinney , Python for Data Analysis, O'Reilly, 2017.

Course outcomes:

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

1. Develop flowcharts and algorithms to solve the given problems. (L3)
2. Translate algorithms and flowchart to build python programs to solve problems (L3)
3. Utilize different data structures and packages for efficient python programming (L2)
4. Develop visualization and file handling operations using Python (L3)

CSCI 1181: OPERATING SYSTEMS

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Preamble: The course provides a clear description of the concepts that underlie operating systems. The outline of operating system services, processes, process management, and memory managementis presented.

Course Objectives:
- To understand the general structure of modern computers, purpose, functions of operating systems.
- To understand concept of process and general CPU Scheduling Algorithms.
- To understand different approaches of memory management.
- To understand the structure and organization of the file system.
- To understand the process of installation, administer and manage Linux and Windows OS.

UNIT – I

Introduction to Operating Systems
- Computer Basics: Definition of a Computer - Characteristics and Applications of Computers – Block Diagram of a Digital Computer – Classification of Computers based on size and working
- Hardware Basics: Central Processing Unit – I/O Devices-Memory Devices- Secondary storage devices
- Operating System Basics: OS Definition, Functions, OS as a Resource Manager, Types of OS, Evolution of OS, Operating System Operations, Operating System Services, User Operating System Interface, System Calls, Types of System Calls. (8 Hours)

Learning Outcomes:

After completion of this unit the student will be able to
- Understand the basic blocks of a digital computer (L1)
- Understand the evolution, functions of Operating Systems (L1)
- Understand different services provided by the operating system. (L1)

UNIT - II

Process Management: Basic Concepts, Process Scheduling, Operations on Processes, Inter-processCommunication, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling. (8 Hours)

Learning Outcomes:

After completion of this unit the student will be able to
- Identify the information stored about a process. (L2)
- Explain the goals of CPU Scheduling, difference between pre emptive and non preemptive scheduling algorithms. (L2)
- Understand various CPU Scheduling algorithms. (L1)
- Understand the concept of interprocess communication. (L1)

UNIT - III

Memory Management: Memory Management Strategies, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory Management, Demand Paging, Page Replacement Techniques and Algorithms. (10 Hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Understand the need of memory management. (L1)
- Analyze various memory management algorithms and paging systems. (L3)

UNIT - IV

Storage Management: File Concept, Access Methods, Directory Structure, Protection, Implementing File Systems, File System Structure, Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery. (10 Hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Understand the function of file systems. (L1)
- Differentiate various file access methods. (L3)
- Understand the directory structure, allocation methods. (L1)
- Understand free space management techniques. (L1)

UNIT – V

Operating Systems:

Introduction to Linux: Versions, Components, Features; Installation of Linux OS, Managing Directories, Managing Files.

Introduction to Windows: Versions, GUI Components, Features; Installation of Client OS and Server OS, Installation of Roles and Features, Managing Users and Groups, Managing Devices and Printers, Storage Management, Managing and Monitoring of Server, Backup & Restoration.

(10 hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Understand the features of Linux and Windows operating system. (L1)
- Install and administer the windows and Linux OS. (L3)
- Create users, groups and Manage users, devices. (L3)

Suggested Readings:

1. Silberschatz, A., Galvin, P. B., & Gagne, G. Operating system concepts, Seventh Edition, John Wiley &Sons,2009.
2. Operating System- Neso Academy.
3. Greg Tomsho, "Guide to Operating System", 5th Edition, 2017.

Course Outcomes:

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

1. Understand the design of operating systems. (L1)
2. Utilize the different file management functions for organization of files and directories. (L4)
3. Evaluate the process management policies and scheduling of processes by CPU. (L2)
4. Describe and analyze the memory management and its allocation policies. (L3)
5. Manage the windows server OS with its different administrative tools. (L3)

B. Sc Computer Science with Cognitive Systems
I SEMESTER
CSCI 1141: INTRODUCTION TO INFORMATION TECHNOLOGY

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Preamble: The course deals with introductory concepts in Information technology that includes basics of Computer system, Input output devices, binary codes, Computer Software and World Wide Web.

Course Objectives:
- To familiarize with the working principle of computers and their components.
- To understand the different types of memory and input/output devices.
- To provide knowledge on different type of representation of information used in computer systems.
- To introduce the computer software systems and their functionality.
- To learn and utilize the World Wide Web.

UNIT - I

Introduction to Computers: Basics of computer, Characteristics of computers, Limitations of computers, System Components, Input devices, Output devices, Computer Memory, Central Processing Unit, Motherboard, Computer Generations, Evolution of computers, Classification of Computers.   (8)

Learning outcome:
 After completion of this unit, the student will be able to
- Understand the basics of computer system. (L1)
- Identify the components of computers. (L2)

UNIT - II

Types of Memory- RAM and ROM, Cache memory, Input/output devices: Monitor, Mouse, Keyboard, Disk, joysticks, Printers Types of printers, Scanner, Modem, Video, Sound cards, Speakers, Storage Devices, floppy disk, CD, DVD, Pen drive, trackballs.   (8)

Learning outcome:
After completion of this unit, the student will be able to
- Understand about different types of memory and input/output device. (L1)
- Utilize different types of devices for specified operation depending on requirement. (L3)

UNIT - III

Definition of Information, Difference between data and information, Importance of Binary Number System, Various number systems, Conversion from Decimal to Binary, Conversion from Binary to Decimal, Binary number into Hexadecimal number, Hexadecimal number into binary number, Memory Addressing and its Importance, ASCII and EBCDIC coding System.   (10)

Learning outcome:
 After completion of this unit, the student will be able to
- Understand different mechanism of information representation. (L1)
- Demonstrate uses of different type of number system for information coding. (L2)
- Perform conversion of one type of number system to another. (L3)

UNIT - IV

Introduction to Computer Software: Computer Software, Overview of different operating systems, Overview of different application software, Overview of proprietary software, Overview of open-source technologies. Generations of Programming Languages, Characteristics of Programming Languages, Categories of Programming Languages, Popular high-level Languages, Factors affecting Programming Languages, Developing Programs, Running a program. (10)

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

- Understand the overview of computer software. (L1)
- Uses of software for performing specific task. (L3)
- Troubleshoot the software related issues. (L3)

UNIT - V

Internet and Its Working: History of Internet, WWW, Web browsers, Web servers, Hypertext Transfer Protocol, Internet Protocols Addressing, Internet Connection Types, How Internet Works, Internet Security, Uses of Internet, Virus, Antivirus. (8)

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

- Understand the worldwide web, its protocols and its threats. (L1)
- Uses of the world wide web. (L3)
- Protect and troubleshoot the system in case of threats of attack. (L3)

Suggested Readings:

1. Balagurusamy, E., Fundamentals of Computers, Tata McGraw Hill Education Pvt. Ltd, New Delhi.
2. Shelly, Gary B. Introduction to Computers and data processing. Shelley Cashman Series, 2010.
3. Vikas Gupta, Comdex Information Technology Course Tool Kit, Wiley Dreamtech, 2009.
4. ITL Education Solutions limited, Introduction to Information Technology, Pearson Education, 2006.

Course Outcomes:

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

1. Work with computer system and its different components. (L4)
2. Demonstrate use of different number systems for information representation. (L2)
3. Use various software tools to perform their requisite tasks. (L3)
4. Work with world wide web and protect their systems from threats. (L4)

B. Sc Computer Science with Cognitive Systems

I SEMESTER

CSCI 1151: IT WORKSHOP

Hours per week: 2 P

Credits: 1   Continuous Assessment: 100 Marks

Internet and World Wide Web (WWW)

Task 1: Web Browsers and Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 2: Search Engines and Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. On completion, the outcome should be demonstrated to the instructor.

Task 3: Cyber Hygiene: Students would be exposed to various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install antivirus software, configure their personal firewall and windows update on their computer. Then, they need to customize their browsers to block pop-ups, block ActiveX downloads to avoid viruses and/or worms.

Excel

Task 4: Excel Orientation: The mentor needs to tell the importance of MS office 2007/equivalent,(FOSS) tool Excel as a Spreadsheet tool.

Task 5: Using Excel: Accessing, overview of toolbars, saving excel files, using help and resources, creating a Scheduler: Features to be covered: Gridlines, Formatting Cells, Summation, Auto fill, Formatting Text.

Task 6: Calculating GPA: Features to be covered: Cell Referencing, Sheet referencing, Formulae in excel: Count, Average, Standard deviation etc., Charts, Renaming and Inserting worksheets, Hyper linking, LOOKUP/VLOOKUP, Sorting, Conditional formatting.

Power Point

Task-7: PPT Orientation: Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows.

Task-8: Making interactive presentations: Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Visual Basic for Applications:

Task 9: Create sales dashboard (such as Market wise, Product wise, quarter wise sales) in Excel using VBA code.

 Task 10: Create randomized quiz question paper in Excel using VBA code.

Task 11: Design an attendance tracker using login time of the employee in Excel using VBA code to perform the operation like if employee is late, and then lock the system.

B.Sc Computer Science with Cognitive Systems
I SEMESTER
CSCI 1171: PROGRAMMING WITH PYTHON LAB

Hours per week: 2 P

Credits: 1   Continuous Assessment: 100 Marks

Course Objectives:
- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

Course Outcomes:
- Understand the basic concepts scripting and the contributions of scripting language (L1)
- Ability to explore python object-oriented concepts, and the built-in objects of Python(L3).
- Ability to create Programming applications (L3)

1. Construct flowcharts to
    a. Calculate the maximum, minimum and average of given N numbers.
    b. Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
2. Construct flowcharts with separate procedures to
    a. Calculate simple and compound interest for various parameters specified by the user.
    b.Calculate the greatest common divisor using iteration and recursion for two numbers as given by the user.
3. Construct flowcharts with procedures to
    a. Generate first N numbers in the Fibonacci series.
    b. Generate N Prime numbers.
4. Design a flowchart to perform Linear search on list of N unsorted numbers.
   (Iterative and recursive)
5. Design a flowchart to perform Binary search on list of N sorted numbers. (Iterative and recursive).
6. Design a flowchart to determine the number of characters and lines in a text file specified by the user.
7. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect Number.
8. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
9. Design a Python script to determine if a given string is a Palindrome by using recursion.
10. Design a Python script to sort numbers specified in a text file using lists.
11. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
12. Design a Python Script to determine the time difference between two given times in HH:MM: SS format. (0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59).
13. Design a Python Script to find the value of (sine, cosine, Log, PI, e) of a given number using infinite series of the function.
14. Design a Python Script to convert a given number to words.
15. Design a Python Script to generate the frequency of words in a text file.

16. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.

17. Design a Python Script to implement Gaussian Elimination method.

18. Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on the given data.

19. Design a Python program that takes command line arguments a paragraph and find the most frequently occurring word in the provided text.

20. Design a python program that takes two filenames (source and destination file) as arguments and copy the contents of one file to another.

CSCI 1191: OPERATING SYSTEMS LAB

Hours per week: 2 P

Credits: 1   **Continuous Assessment: 100 Marks**

Course Objectives:

- To familiarize students with the architecture of Unix OS.
- To provide necessary skills for developing and debugging programs in UNIX environment.

Course Outcomes:

- Understand and illustrate the architecture of Unix Operating System.
- Able to use right set of commands and statements to debug programs in Unix Environemnt.

1. Installation of Linux OS(CentOS)
   o Explain the steps to Install the Linux OS
   o Demonstrate Working with Directories in Linux(pwd,cd,absoluteandrelativepaths, ls,mkdir,rmdir,file,touch,rm,cp.mv,rename, head,tail,cat,tac,more,less,strings,chmod)
   o Demonstrate Working with Files in Linux (ps, top, kill, pkill, bg, fg, grep, locate,find,date,cal,uptime,whoami,finger,uname,man,df,du,free,whereis,which)
2. Installation of Windows Client OS
   o Explain the steps to Install the Client OS
   o Installa Virtual Machine with Windows Client OS
3. Managing Windows Client OS
   o Explain the steps to Create Users and Groups
   o Demonstrate the usage of Devices and Printers
   o Demonstrate the usage of Disk Management Console
4. Installation of Windows Server OS
   o Explain the steps to Install the Server OS
   o Install a Virtual Machine with Windows Server OS
5. Managing Windows Server OS
   o Demonstrate how to Install Roles and Features
   o Demonstrate the Usage of Server Storage Management
   o Explain various Management and Monitoring requirements
   o Explain the Backup Types and steps to take Backups

References:
- Lab Requirements–Linux
  o CentOS Linux ISO
- Lab Requirements-Windows
  o Windows10Evaluation –90Days
  o WindowsServer2019Evaluation–180Days
  o WindowsServer2016Evaluation–180Days
  o ExtendWindows10orWindowsServerEvaluationPeriod
- CentOS Linux
  o Installation Guide
  o CentOS Overview
  o Basic CentOS Linux Commands
  o File and Folder Management
- Windows10
  o Windows10–TutorialsPoint
  o Windows10Tutorial

- WindowsServer2016
  - WindowsServer–Channel9
  - Windows Server Administration for Beginners
  - Windows Server2016 Tutorial Step by Step Full
  - WindowsServer2016AdministrationFullCourse
  - Windows Server deployment, configuration, and administration

B.Sc Computer Science with Cognitive Systems
I SEMESTER
PSYC1031: PSYCHOLOGY

Hours per week: 2 L + 1 T

Credits: 2   Continuous Assessment: 100 Marks

Preamble: The course involves the study of internal mental processes all of the things that go on inside your brain, including perception, thinking, memory, attention, language, problem-solving, and learning.

Objectives:
- To introduce students to the basic concepts of the field of psychology with an emphasis on applications of psychology in everyday life.
- To understand the concept of Perception.
- To know the theory of emotions.

UNIT – I

Introduction: What is psychology? Perspectives on behavior; Methods of psychology (special emphasis on experimentation); subfields of psychology; Psychology in modern India.   **(8)**

Learning Outcomes:

After completion of this unit, the student will be able to
- Define what Psychology is?(L1)
- Identify the sub fields of Psychology. (L1)

UNIT – II

Perception: Perceptual processing, Role of attention in perception, Perceptual organization, Perceptual sets, Perceptual constancies, depth perception, distance and movement; Illusions.

Thinking and Language: Mental imagery, concepts, decision making; nature of language, language development.   (10)

Learning Outcomes:

After completion of this unit, the student will be able to
- Understand the Role of Perception. (L1)
- Define Perceptual constancies. (L2)
- Identify the importance of thinking and language. (L1)

UNIT - III

Learning and Motivation: Principles and applications of Classical conditioning, operant conditioning, and observational learning; Learning strategies; Learning in a digital world; Self-regulated learning; Perspectives on motivation, types of motivation, motivational conflicts.   (10)

Learning Outcomes:

After completion of this unit, the student will be able to
- Understand the Principles and applications of Classical conditioning. (L2)
- Able to explain learning Strategies. (L1)

UNIT – IV

Memory: Models of memory: Levels of processing, Parallel Distributed Processing model, Information processing, Forgetting, Improving memory.   (8)

Learning Outcomes:

After completion of this unit, the student will be able to
- Improve decision making process. (L3)

- Know Memory models. (L1)
- Describe Information Processing. (L3)

UNIT - V

Emotions: Components, theories. (8)

Learning Outcomes:

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

- Identify the process of emotions. (L1)
- Understand the benefits of Identifying Emotions. (L1)
- Explore the theories of emotions. (L3)

Suggested Readings:

1. Baron, R. & Misra. G. (2013). Psychology. Pearson.
2. Chadha, N.K. & Seth, S. (2014). The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi.
3. Ciccarelli, S. K., & Meyer, G. E. (2010). Psychology: South Asian Edition. New Delhi: Pearson Education. Passer, M.W. & Smith, R.E. (2010).
4. Psychology: The science of mind and behavior. New Delhi: Tata McGraw-Hill.

Course Outcomes:

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

1. Interpret and respond to the world around. (L3)
2. Identify what constitutes our emotions and our behavioral and physical reactions to them.(L2)

B. Sc Computer Science with Cognitive Systems

II SEMESTER

LANG1251	COMMUNICATIVE ENGLISH - II	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable Exposure	NO						

Course Description:

The course focuses on enhancing students' written and oral English communication proficiency. It encompasses a variety of practical skills, such as conducting effective phone conversations, engaging in situational dialogues, and excelling in public speaking. Students will participate in numerous writing exercises, including the creation of posters, brochures, journal articles, and book reviews. Additionally, the course focuses on enhancing listening and comprehension abilities in various real-world contexts. Through interactive activities like debates, presentations, and collaborative projects, students will build their capability to communicate clearly and confidently in various situations.

Course Educational Objectives:

- Enhance students' ability to handle conversations in various real-life contexts.
- Equip students with the skills to write posters, travel brochures, journal articles, and book reviews.
- Enable students' abilities in public speaking, including delivering presentations and speeches and engaging in debates.
- Strengthen students' listening and reading skills through comprehension exercises, particularly in diverse real-world contexts.
- Promote teamwork and creativity through group activities like collaborative journal writing and creating various written materials.

List of Experiments

S.no	Topic	Type
1	Customer Service - Inquiry (*C1, Module 3)	Exercise
2	Taking and Making a Call (*C2, Module 2)	Exercise
3	Telephonic Conversation – Ordering Food Online (*B2, Module 2)	Exercise
4	Situational Conversations – Marine Species (*C1, Module 1)	Exercise
5	Telephonic Expressions – Thoughtful Present (*B1, Module 2)	Exercise
6	Theatre /Movies - Life of Pi (*B1, Module 4)	Exercise
7	Poster writing/Notice Board Writing (*A1, Module 7)	Exercise
8	The Art of Writing – Travel Brochure (*C2, Module 7)	Exercise
9	Elements of Journal Article (*B2, Module 7)	Exercise
10	Presentation Skills (*C1, Module 4)	Exercise
11	Speech & Elocution (*B2, Module 6)	Exercise
12	Steps to write a book review (*C1, Module 3)	Exercise
13	Steps to write a summary (*C2, Module 5)	Exercise
14	Debate - How does debating work? (*B2, Module 4)	Exercise
15	Story Genre – Literary Fiction (*B2, Module 3)	Exercise
16	The Critic – Steps to write a book review (*C1, Module 3)	Exercise

Textbook(s):

1. Kumar, S., & Lata, P., Communication skills., Oxford University Press., 2011

Reference(s):

1. Hewings, M., Thaine, C., & McCarthy, M., Cambridge academic English C1 advanced student's book: An integrated skills course for EAP., Cambridge University Press., 2012
2. Berlin, A., 50 Conversation Classes., Createspace Independent Publishing Platform., 2022
3. McCarthy, M., English idioms in use advanced–Cambridge., 2010
4. Hollihan, T. A., & Baaske, K. T., Arguments and arguing: The products and process of human decision making., Waveland Press., 2022
5. Seo, B., Good Arguments: What can the art of debating teach us about listening better and disagreeing well? Simon and Schuster., 2022
6. Philpot, S., & Curnick, L., New Headway-academic skills: reading, writing, and study skills. Level 3: student's book. Oxford, UK.:, Oxford University Press., 2007
7. Hahn, F. E., Do-it-yourself advertising and promotion: how to produce great ads, brochures, catalogs, direct mail, websites, and more!, John Wiley & Sons., 2003

Course Outcomes:

1. Students will be able to confidently engage in conversations across a variety of real-life scenarios, demonstrating appropriate conversational strategies and cultural awareness.
2. Students can create clear, persuasive, and visually appealing posters, travel brochures, journal articles, and book reviews tailored to specific audiences and purposes.
3. Students will be able to deliver well-organized and impactful presentations and speeches and participate effectively in debates, using appropriate rhetorical techniques and presentation aids.
4. Students can accurately comprehend and critically analyze spoken and written texts from diverse real-world contexts, demonstrating improved listening and reading skills.
5. Students can work collaboratively in groups to produce creative written materials, such as collaborative journals and other projects, showcasing their ability to integrate ideas and engage in constructive teamwork.

Course Articulation Matrix:

CO	POs																PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4
1																				
2																				
3																				
4																				
5																				

3 – High, 2 – Medium & 1 – Low Correlation

APPROVED IN MEETINGS HELD ON:

BOS : 31-05-2024   Academic Council Number: 30   Academic Council :   04-07-2023

SDG No(s). & Statement(s) :

16 & Peace and Justice Strong Institutions : Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG Justification(s):

By relating to people with empathy, employing creative problem-solving strategies and engaging meaningfully in a diverse world will create inclusive societies for sustainable development.

IENT1051	FUNDAMENTALS OF ENTREPRENEURSHIP	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable Exposure	NO						

Course Description:

Entrepreneurship is a vital life skill that fosters curiosity, creativity, and a focus on seizing opportunities. By embracing entrepreneurship, individuals can achieve professional independence, tackle complex challenges with innovative solutions, and take calculated risks. This course, "Introduction to Entrepreneurship," is designed to provide students with essential knowledge and practical skills for their entrepreneurial journey. Contrary to popular belief, entrepreneurship can indeed be learned, and this course dispels those myths. It offers a comprehensive understanding of the entire entrepreneurial process, from generating ideas to launching a minimum viable product (MVP). Through a combination of theory and hands-on activities, students will explore various aspects of entrepreneurship, such as identifying opportunities, discovering customers, designing solutions, and employing lean startup methods. To succeed, students must demonstrate self-direction and a genuine enthusiasm for learning, whether independently or in collaboration with peers.

Course Educational Objectives:

• Understand the fundamental concepts and processes of entrepreneurship.
• Identify and evaluate business ideas and opportunities.
• Know the techniques for effective problem-solving.
• Understand the customer and the customer discovery process and how to develop market insights.
• Effectively pitch your Venture Idea

MODULE 1   ENTREPRENEURIAL PROCESS AND MINDSET   **6 Hrs**

Introduction to Entrepreneurship, Pilot Your Purpose, Innovation, Risk-Taking and Value Creation, Myths around Entrepreneurship, Distinct Types of Entrepreneurship, Entrepreneurial vs. Managerial Mindset.

MODULE 2   PROBLEM IDENTIFICATION AND IDEATION   **6 Hrs**

Entrepreneurship Opportunity identification, Market and Need Analysis, Problem Discovery, Problem Statement Identification and definition, Evaluating and Selecting Ideas

MODULE 3   CUSTOMER DISCOVERY & MARKET INSIGHTS   **6 Hrs**

Users and Buyers, Target Group and Persona, Customer Research Methods (People Shadowing, laddering etc.), Use Cases, Market Sizing & Segmentation, Customer Value Proposition

MODULE 4   SOLUTION DESIGN   **6 Hrs**

Principles of Effective Solution Design, Prototyping Methods and Tools, Building and Testing Prototypes, Gathering Feedback on Prototypes, Iterating and Refining Solutions, Building Minimum Viable solution.

MODULE 5   CRAFTING YOUR VENTURE NARRATIVE   **6 Hrs**

How you can launch a successful venture. Tell your venture story

Textbook(s):

1. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses,

Reference(s):

1. Blank, S. and Dorf, B., The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company., BookBaby, Pennsauken., 2012
2. Neck, Heidi & Greene, Patricia & Brush, Candida., Teaching entrepreneurship: A practice-based approach., 2014

Course Outcomes:

1. To discover skills and competencies needed for entrepreneurial career
2. Effectively utilize frameworks for business planning and development.
3. Implement customer research methods such as shadowing, laddering etc to gather insightful data.
4. Build and refine a minimum viable product (MVP) based on real customer feedback.
5. Present a process pitch that integrates learnings across all units to propose a viable entrepreneurial venture.

Course Articulation Matrix:

CO	POs																PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4
1																				
2																				
3																				
4																				
5																				

3 – High, 2 – Medium & 1 – Low Correlation

APPROVED IN MEETINGS HELD ON:

BOS :   10-06-2024   Academic Council Number: 30   Academic Council :   04-07-2023

SDG No(s). & Statement(s) :

8 & Decent Work and Economic Growth : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG Justification(s):

To achieve sustained per capita income growth and ensure higher economic productivity,focus should be on youth by grooming them to be creative and innovative, have productive employment and quality of life through Skill development and Entrepreneurship

B.Sc Computer Science with Cognitive Systems
II SEMESTER
General Elective - I
CSCI 1201: DESIGN THINKING

Hours per week: 3 L   Continuous Assessment: 100 Marks

Credits: 2

Course Objectives:

- To familiarize product design process.
- To introduce the basics of design thinking.
- To bring awareness on idea generation.
- To familiarize the role of design thinking in services design.

UNIT - I

Introduction to design, characteristics of successful product development, product development process, identification of opportunities, product planning, Innovation in product development.   (8)

Learning Outcomes:

After completing this unit, the student will be able to

- Identify characteristics of successful product development.(L3)
- Identify opportunities for new product development.(L3)
- Plan for new product development.(L3)

UNIT - II

Design Thinking: Introduction, Principles, the process, Innovation in Design Thinking, benefits of Design thinking, design thinking and innovation, case studies.   (10)

Learning Outcomes:

After completing this unit, the student will be able to

- Explain the principles of Design Thinking.(L2)
- Identify the benefits of Design Thinking.(L3)
- Use innovations in Design Thinking.(L3)

UNIT - III

Idea generation: Introduction, Techniques, Conventional methods, Intuitive methods, Brainstorming, Gallery method, Delphi method, Synectic etc, Select ideas from ideation methods, case studies. (10)

Learning Outcomes:

After completing this unit, the student will be able to

- Explain the techniques in idea generation.(L2)
- Select ideas from ideation methods.(L3)
- Identify the methods used in idea generation in some case studies.(L3)

UNIT - IV

Design Thinking in Information Technology, Design Thinking in Business process model, Design Thinking for agile software development, virtual collaboration, multi user and multi account interaction, need for communication, TILES toolkit.   (10)

Learning Outcomes:

After completing this unit, the student will be able to

- Use Design Thinking in business process model.(L3)
- Apply Design Thinking for Agile software development.(L3)
- Use TILES toolkit.(L3)

UNIT - V

Design thinking for service design: How to design a service, Principles of service design, Benefits of service design, Service blueprint, Design strategy, organization, principles for information design, principles of technology for service design. (10)

Learning Outcomes:

After completing this unit, the student will be able to

- Use principles of service design. (L3)
- Explain the benefits of service design. (L5)
- Apply principles of technology for service design. (L3)

Suggested Readings:

1. Pahl, Beitz, Feldhusen, Grote – Engineering Design: a systematic approach, Springer, 2007.
2. Christoph Meinel and Larry Leifer, Design Thinking, Springer, 2011.
3. Aders Riise Maehlum - Extending the TILES Toolkit – from Ideation to Prototyping
4. Marc stickdorn and Jacob Schneider, This is Service Design Thinking, Wiely, 2011.

Course Outcomes:

At the end of this course, the student will be able to

- Innovate new methods in product development. (L6)
- Apply Design Thinking in developing the new designs. (L3)
- Select ideas from ideation methods in new product development. (L5)
- Use Design Thinking in developing software products. (L3)
- Apply principles of Design Thinking in service design.(L3)

II SEMESTER
General Elective - I
CSCI 1211: E-COMMERCE

Hours per week: 3 L   Continuous Assessment: 100 Marks

Credits: 2

Preamble: The extensive penetration of computer networks, in particular the Internet, into everyday life has changed the way the business is executed and is now changing the way commerce is conducted. The development of the World Wide Web (WWW) has made access to information easy for the common user. It is now common place for businesses to have a "Web presence" in terms of providing product information and customer service. Some amount of commerce activity has alreadystarted on the Internet and expectations are high that it will become a major form of trade and commerce in the future.

Course Objectives:
- To inculcate the technology of E-Commerce.
- To understand the real world business in terms of E-Commerce.
- To nourish with EDI standards.
- To introduce knowledgeable on threats and issues and how to overcome them.

UNIT-I

Electronic Commerce: Frame work, anatomy of e-commerce applications, e-commerce consumer applications, e-commerce organization applications, and consumer oriented electronic commerce, mercantile process model.   (8)

Learning Outcomes:

Upon completion of the Unit, the student will be able to
- Introduce the frame work of E-commerce.(L2)
- Explain the applications of e-commerce.(L3)

UNIT-II

E-Commerce – A Consumer Oriented Approach: Traditional v/s E-Retailing, key success factors in E-Retailing, Models of E-Retailing, and Characteristics of E-Retailing

E-Services: Categories of E-Services, Web-Enabled Services, Information selling on the web, E-Entertainment, Auctions and specialized services.   (8)

Learning Outcomes:

Upon completion of the Unit, the student will able to
- Understands E-retaining. (L2)
- Acquire knowledge on E-Services.(L2)

UNIT-III

Electronic Data Interchange: EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems.

Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for creditcard payment.   (10)

Learning Outcomes:

Upon completion of the Unit, the student will able to
- Memorize the EDI standards and implementations.(L1)
- Illustrate the EDI technology and barriers.(L2)
- Well illustrate the security breaches of EDI.(L2)
- Understand and implement the electronic payment system.(L1)

UNIT - IV

Security in E Commerce Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server. (10 Hours)

Learning Outcomes:

Upon completion of the Unit, the student will able to

- Analyze the security threats that are involved in e-commerce.(L4)
- Finds means of how to defend the security threats involved in web-server, network, proxy server. (L3)

UNIT – V

Issues in E-Commerce Understanding- Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles. Privacy and Information Rights: Information collected at E-Commerce Websites, TheConcept of Privacy, Legal protections, Intellectual Property Rights: Types of Intellectual Property protection, Governance. (10 Hours)

Learning Outcomes:

Upon completion of the Unit, the student will be able to

- Organize the issues.(L2)
- Analyze the ethical dilemmas. (L3)
- Memorize the candidate ethical principles.(L1)
- Understand the privacy and information rights with relation to e-commerce websites. (L2)
- Implement e-commerce legal protections.(L3)
- Memorize the intellectual property rights. (L1)

Suggested Readings:

1. Henry Chan, Raymond Lee, Tharam Dillon and Elizabeth Chang "Ecommerce Fundamentals and Applications" (chapter 1 : Introduction).
2. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.[Latest Edition Chapter: 10]
3. Dave Chaffey, "E-Business and E-Commerce Management – strategy, Implementation and Practice (Fifth Edition) [Chapter 8]
4. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
5. RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.
6. Efraim Turban, Jae Lee, David King, H.Michael Chung, "Electronic Commerce–A ManagerialPerspective",
7. Addison-Wesley.
8. Elias M Award, "Electronic Commerce from Vision to Fulfilment", 3rd Edition, PHI, Judy Strauss, Adel El-Ansary, Raymond Frost, "E-Marketing", 3rd Edition, Pearson Education.

Course Outcomes:

Upon completion of the course, the student will be able to

1. Understand the basic concepts and technologies E-Commerce. (L2)
2. Have the knowledge of e-retailing and e-services involved in E-Commerce. (L2)
3. Understand the processes involved in EDI. (L2)
4. Memorizing the security threat implications of professional practice with E-commerce. (L2)
5. Be aware of the ethical and intellectual property rights involved in E-Commerce. (L2)

B.Sc Computer Science with Cognitive Systems
II SEMESTER
MATH 1281: PROBABILITY AND STATISTICS

Hours per week: 3 L +1 T   End Examination: 60 Marks
Credits: 3   Continuous Assessment: 40 Marks

Preamble: This course is an introduction to Probability and Statistics for cognitive sciences. The objective of the course will be to learn the basic probability distribution and statistical distribution and to use statistical principles to evaluate, interpret and quantify uncertainty. The topics will be divided in three main areas: Probability theory, statistical theory and the linear model. Probability theory will cover axioms of probability, discrete and continuous probability models, law of large numbers and the Central limit theorem. Statistical theory will cover estimation, likelihood theory, hypothesis testing, confidence intervals, elementary design of experiments principles and goodness-of-fit. The linear model theory will cover the simple regression model and the analysis of variance. This course will compensate this technical information using examples drawn broadly from current topics in neuroscience, economics, sports and current events.

Course Objectives:
 The students who succeeded in this course will be able to
- Understand the concept of Probability theory, Bayes Theorem and Application of Bayes Theorem.
- Understand and build the concept of Random variable and probability distribution: discrete and continuous random variables.
- Evaluate problems on discrete and continuous probability distributions.
- Understand the concept of testing hypothesis for large and small samples.
- Translate real-world problems into probability models.
- Explore certain statistical concepts in practical applications neuroscience, economics, sports and current events.

UNIT - I

Probability Theory*: Axioms of Probability Theory, Counting Rules, Conditional Probability, Bayes' Rule and Independence.   (8)

Learning Outcomes:
By the end of this Unit, the student will be able to
- Define probability and basic probability axiom. (L2)
- Solve the problem using rules of multiplication and addition in probability computation. (L3)
- Understand the concept of condition probability and total probability and will solve the problem using Bayes theorem. (L2)

UNIT - II

Random variables: Definition of random variables, continuous and discrete random variables; cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties; expectation: mean, variance and moments of a random variables.   (8)

Learning Outcomes:
  By the end of this Unit, the student will be able to
- List the difference between discrete random variable and continuous random variables. (L3)
- Describe the basic concepts of probability distributions and its properties. (L2)
- Understand the concept of Expectation. (L2)
- Explore the mean and variance and moments of a random variables. (L3)

UNIT - III

Special Distributions: Binomial Distribution, Poisson Distribution, Hypergeometric Distribution, Normal Distribution, Relation between Binomial, Poisson and Normal distributions, Properties of the Normal distribution, The Law of Large Numbers and the Central Limit Theorem.   (8)

Learning Outcomes:

After completion of this unit, the student will be able to
- Explain Binomial and Poisson distributions. (L2)
- Explain difference between Binomial and Poisson distributions. (L3)
- Explain Hypergeometric distribution. (L3)
- Explain the need of Normal distribution. Explain properties of Normal distribution. (L3)
- Evaluate difference between Binomial, Poisson and Normal distributions. (L5)
- Understand the concept of Law of Large Number and Central Limit Theorem. (L3)

UNIT - IV

Testing of Hypothesis: Procedure of Testing Hypothesis, Standard error and Sampling Distribution, confidence intervals, Estimation, Test of significance large samples, Tests of significance for small samples, Student's t-distribution, Chi-square test, goodness of fit. (8)

Learning Outcomes:

After completion of this unit, the student will be able to
- Explain the procedure of testing of hypothesis and Evaluate standard error. (L3)
- Explain tests of significance for large samples. (L3)
- Explain tests of significance for small samples. (L3)
- Explain tests of significance for small samples using t-distribution.(L3)
- Explain chi-square test and goodness of fit. (L3)

UNIT - V

Linear Regression: Covariance, Correlation, Sum of Least Squares, Simple linear regression, Assumptions of linear regression, Multiple linear regression. (8)

Learning Outcomes:

After completion of this unit, the student will be able to
- Explain different types of correlation. (L2)
- List the difference between correlation and regression analysis. (L3)
- Discuss basic concepts of regression analysis. (L2)
- Evaluate the problems on regression lines (X on Y and Y on X) . (L5)
- Demonstrate basic concepts of multiple regression analysis). (L3)

Course Outcomes:

After completion of this unit, the student will be able to
- Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances. (L3)
- Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the typical phenomena that each distribution often describes. (L2)
- Apply the basic rules and theorems in probability including Bayes theorem and the Central Limit Theorem. (L3)
- Define and demonstrate the concepts of estimation and properties of estimators. (L2)
- Apply the concepts of interval estimation and confidence intervals. (L3)
- Apply the concepts of hypothesis testing and p-value.(L3)
- Apply the method of least squares to estimate the parameters in a regression model. (L3)
- Use standard software (e.g., R-Programming) to facilitate statistical analysis. (L3)

Suggested Readings:

1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, (2009).
2. Jay L Devore, Probability and Statistics for Engineering and Sciences,8th Edition, Cengage Learning (2012) .

Other Readings:

D. C. Montgomery and G.C. Runger, Applied Statistics and Probability for Engineers", 5th edition, John Wiley & Sons, (2009).
1. Miller and Freund's Probability and statistics for Engineers, 8th Edition, PHI.
2. Anderson, Sweeney and Wiliams, Statistics for Business and Economics, CENAGE learning.

B.Sc Computer Science with Cognitive Systems
II SEMESTER
CSCI 1221: INTRODUCTION TO COMPUTER NETWORKS

Hours per week: 3 L	End Examination: 60 Marks
Credits: 3	Continuous Assessment: 40 Marks

Course Objectives:

- To understand the network architecture and protocols.
- To build a foundation in computer network concepts like Bandwidth Utilization and Multiplexing.
- To familiarize the students with IP Addressing concepts.
- To acquaint the student with the Routing algorithms.
- To enable the student to learn the concept of wide area networks and wireless networks.

UNIT – I

Need of Network: Network classifications LAN, MAN, WAN, Data and signals analog and digital, periodic analog signals, digital signals, bit rate, baud rate, bandwidth, Transmission impairments - attenuation, distortion and noise, Data Communication protocols & standards, Network models - OSI model layers and their functions, TCP/IP protocol suite. (10)

Learning Outcomes:

After completion of this unit the student will be able to

- Understand different types of network technologies. (L1)
- Explain different types of signals and protocols. (L2)
- Illustrate different layered approaches of OSI and TCP/IP models. (L2)

UNIT - II

Bandwidth Utilization and Multiplexing: Multiplexing - FDM, TDM , Spread spectrum Frequency hopping spread spectrum, Direct sequence spread spectrum , Transmission media - guided and unguided media, Switching message, circuit and packet switched networks, Datagram networks and virtual circuit networks. (8)

Learning Outcomes:

After completion of this unit the student will be able to

- Explain the Multiplexing concepts (L2)
- Explain the different types of spread spectrum and Transmission Media . (L2)
- Describe about different switching and Data Grams. (L2)

UNIT – III

IP Addressing: IP Addressing Version 4 – IP Addressing Version 6, Subnetting Advanced VLSM - Switch Basic, VLAN - VTP /CDP - Subnetting Basic Version 4, Network Quiz - Routing Static. (10)

Learning Outcomes:

After completion of this unit the student will be able to

- Discuss about IP Addressing. (L2)
- Describe about VLSM and related Concepts (L3)

UNIT - IV

Routing algorithms – Congestion Control Algorithms, CISCO IOS / Managing / Password recovery, Routing Dynamic Routing protocols OSPF RIP EIGRP, Network Advanced Routing Dynamic Routing protocols – OSPF RIP EIGRP**.** (10 Hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Describe about the Routing Concepts and Protocols. (L2)

- Describe about Congestion Control Algorithms. (L3)

UNIT - V

Overview of Access Control List, Network Address Translation, Wide Area Networks, Wireless Networks. (10 Hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Describe the Access Control List, Network Address Translation. (L2)
- Describe about Wide Area Networks, Wireless Networks. (L3)

Recommend Books:

1. A Forouzan, Data Communications and Networking, 4th Ed, M C Graw Hill Publications.
2. David J.Wetherall, Andrew S.Tanenbaum, Computer Networks, 5th Edition, Pearson Education,2012.

Course Outcomes:

After completion of this course the student will be able to

1. Learn about different networks, signals, transmission, data grams and virtual Networks. (L2)
2. Experiment with various multiplexing and Transmission Media Issues. (L4)
3. Develop applications with IP4 addressing and related concepts. (L6)
4. Construct small applications with dynamic routing and congestion control algorithms. (L6)
5. Utilize various wide area networks and wireless networks. (L3)

B.Sc Computer Science with Cognitive Systems
II SEMESTER
CSCI 1241: PROGRAMMING WITH C++

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Course Objectives:

- To understand the concepts of object oriented and generic programming.
- To understand the object-oriented concepts and writing modular programming using functions.
- To design applications using object-oriented features.
- To analyze problems and implement simple C++ applications using anobject-oriented approach.

UNIT - I

Concepts of Object-Oriented programming: Object oriented paradigm, Basic concepts of Object-Oriented Programming, Differences between Object Oriented Programming and Procedure oriented programming.

Overview of OOP Principles: Encapsulation, Inheritance and Polymorphism. Benefits of OOP.
Structure of a C++ program, Program structure, namespace, Data types, identifiers, variables, constants, enum, operators, typecasting, control structures & loops.   (10)

Learning Outcomes:

After completion of this unit students will be able to

- Understand the differences between object-oriented programming and procedure-oriented programming. (L2)
- Construct loops in C++. (L3)
- Explain programming fundamentals, including statement and control flow and recursion. (L1)

UNIT - II

Functions, Classes and Objects: Introduction of Classes, Class Definition, Defining a Members, Objects, Access Control, Class Scope, Scope Resolution Operator, Inline functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Default Arguments, Function Overloading, Friend Functions.   (10)

Learning Outcomes:

After completion of this unit students will be able to

- Program using objects and data abstraction, class, and methods in function abstraction. (L2)
- Apply the concepts of class, method. (L3)
- Program with inline function, friend function. (L4).

UNIT - III

Constructors, Destructors, Inheritance: Introduction to Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors.

Inheritance: Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi-Level Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Abstract Classes, Constructors in Derived Classes, Operator overloading, Rules for Operator overloading, overloading of binary and unary operators.   (10)

Learning Outcomes:

After completion of this unit students will be able to

- Apply the concepts of class, method, constructor, instance, data abstraction, function abstraction,

inheritance, overriding, overloading.(L3)

- Identifies base and derived classes. (L2)
- Distinguishes constructors, default constructor. (L3)

UNIT - IV

Pointers, Virtual Functions and Polymorphism: Introduction, Memory Management, new Operator and delete Operator, Pointers to Objects, this Pointer, Pointers to Derived Classes, Polymorphism, compile time polymorphism, Run time polymorphism, Virtual Functions, Pure Virtual Functions, Virtual Base Classes, Virtual Destructors.   (10)

Learning Outcomes:

After completion of this unit students will be able to

- Program using memory management concept. (L3)
- Understand polymorphism (compile time and run time) (L3)
- Develop programs with virtual functions. (L4)

UNIT - V

Templates and Exception handling: Introduction, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Member Function Templates.

Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, re-throwing an Exception, Specifying Exceptions.   (8)

Learning Outcomes

After completion of this unit students will be able to

- Learn about generic programming. (L1)
- Develop template programming using function and class templates. (L3)
- Understand exception handling concept. (L2)

Suggested Readings:

1. Mastering C++ by K.R.Venugopal., published by Tata McGraw- Hill.
2. Object Oriented Programming in C++ by E. Balagurusamy., published by Tata McGraw-Hill.

Other Readings:

1. C++ Complete reference, Herbart Sheildit

Course Outcomes:

After the completion of the course, students will be able to

- Develop simple C++ programs using object oriented concepts. (L1)
- Understand and apply different concepts like abstraction, encapsulation , inheritance , overloading.(L3)
- Develop generic programming using class and function templates.(L3)
- Utilize exceptional handling methodology while developing C++ programming.(L4)

B. Sc Computer Science with Cognitive Systems II SEMESTER
CSCI 1251: PROGRAMMING WITH C++ LAB

Hours per week: 2 P   Continuous Assessment: 100 Marks

Credits: 01

Course Objectives:

- The student Should be able to explain the fundamental properties of the C++ Language
- The student should be able to combine the elements of the c++ language in developing structure programs
- The student should be able to demonstrate the skills necessary to correctly compile debug and test programs in C++

Course Outcomes:

- Explain objected oriented concepts and describe how they are supported by C++(L3)
- Apply C++ features to programming design and implementation (L2)
- Analyse a problem description and design and build objected oriented software using good coding practices and techniques (L5)

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Write a Program to Implement a Class STUDENT having the Data members Member functions to Assign Initial Values to student name, assign Marks of the student to Compute Total, Average to Display the Data.
3. Write a Program to Demonstrate the Operator Overloading.
4. Write a Program to Demonstrate the Function Overloading.
5. Write a Program to Demonstrate Friend Function and Friend Class.
6. Write a Program to Access Members of a STUDENT Class Using Pointer to Object Members.
7. Write a Program to Generate Fibonacci Series by using Constructor to Initialize the Data Members.
8. Write a Program to Demonstrate Multiple Inheritances.
9. Write a Program to Invoking Derived Class Member through Base Class Pointer.
10. Write a Template based Program to Sort the given list of elements.
11. Write a Program to Demonstrate the Catching of all exceptions.
12. Write a Program Containing a possible Exception. Use a Try block to throw it and a catch block to handle it properly.

B. Sc Computer Science with Cognitive Systems
II SEMESTER
CSCI 1231: COMPUTER NETWORKS LAB

Hours per week: 2 P   Continuous Assessment: 100 Marks

Credits: 1

Course Objectives:
- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes

Course Outcomes:
- Identify and use various networking components Understand different transmission media and design cables for establishing a network (L3)
- Implement any topology using network devices (L2)
- Analyze performance of various communication protocols. (L5)

  - Demonstrate Basic Switching Concepts

  - Demonstrate VLAN

  - Demonstrate Routing

  - Demonstrate Dynamic Routing Protocols

  - Demonstrate Static Routing Protocols.

Hours per week: 3 L

Credits: 2   **Continuous Assessment: 100 Marks**

Preamble: This course contains a rich selection from Hindi poetry and prose. Grammar and translations from official language are also included.

COURSE OBJECTIVES

1. To enlighten students about the richness and value of the national language
2. To offer working knowledge of Hindi to the students.

SYLLABUS

oि rT (Prose Detailed Text)

1. ह ा,Uनगह ``न `   ा ा ि ·5 न
ि

2. ि   ा ि ा ा
Uि

3. ` ा ग   ा ि ा ा

TK ि rT (Non Detailed Text)

1. ¸ ा   ¯ ा
2. ा ा ा UT   5 ¯ ाह
3. 5T U   ¸ न

DT ₹ ि rT (Grammar)

I. िन´`न¸ा ा   ि ि प¸

1. ा (Case)
2. ि ग(Gender)
3. न (Number)
4. ा (Voice)

II. ा ग(Make your own sentences)

COURSE OUTCOMES

1. The student learns reading and writing Hindi
2. Understands and learns proper use of Grammar
3. Develops communication Skills.

TEXT BOOK

1. Prose Text: Dr. Ajaya Kumar Patnaik, **Gadya Gaurav**, Sonam Prakashan, Badamdadi, Cuttak.

2. Non, Detailed Text: Dr. Gulam Moinuddin Khan, **Charchit Kahaniyan**, Shabnam Pustak Mahal, Badamdadi, Cuttak.Text: Dr.T.Nirmala & Dr. S. Mohan, Padya Manjari, Rajkamal Prakashan, New Delhi.* Latest Editions

Hours per week:3 L

Credits:2   **Continuous Assessment: 100 Marks**

Course Objectives:

- To introduce basic knowledge about the German language.
- To encourage preliminary conversation in German.
- To educate basic grammar, speaking & reading skills in German.

UNIT 1: Introduction to the German language, grammar, and pronunciation.
Language: Greetings; introducing oneself,
Grammar: The nouns, gender distinctions, cases, definite and indefinite articles.

UNIT 2: Language: Framing questions Grammar: Conjugation of verbs,
Modal verbs.

UNIT 3: Language: Talking about family and friends;
Grammar: Personal pronouns,

UNIT 4: Language: Talking about places
Grammar: Cases: nominative, accusative, dative.

UNIT 5: Language: Making requests and commands;
Grammar: Imperative sentences

Course Outcomes:
Students are equipped to listen to and understand the German language.
Sufficient skills to converse in the German language are established.

Recommended Books:
1. Deutsch als Fremdsprache IA Grundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language, 2004.
3. Paulina Christensen, Anne Fox , Wendy Foster: German For Dummies

Prepared at: Hyderabad campus

Hours per week:3 L

Credits:2   **Continuous Assessment: 100 Marks**
Preamble:
This course focuses on educating the learner as to the basic rules of French grammar. The student will be equipped to write grammatically correct sentences with the help of appropriate vocabulary.
Course Objectives
- To understand basic grammar for sentence formation.
- To introduce basic French vocabulary.
- To enhance pronunciation.
- To encourage sentence formation.
- To encourage practical usage of the language.

UNIT – I
Alphabets, numbers, self-introduction. Grammar: Verbs 'Avoir' and 'Etre', definite and indefinite articles. Vocabulary: Greetings, countries and nationalities.
Learning Outcomes:
After Completion of the unit, the student is able to
- Understand how to state quantity of any objects. (L3)
- Introduce oneself in a formal or informal setting. (L3)
- Tell greetings of courtesy and politeness. (L3)
- Understand the names of countries in French. (L3)
- Understand the gender of nouns. (L3)

Pedagogy tools: Audio clips, Self-reading, Group discussion.

UNIT – II
Asking or telling time, dialogue at shop. Grammar: Conjugation of verbs in present tense, negative sentences. Vocabulary: Fruits and vegetables, family. (14)
Learning Outcomes:
After Completion of the unit, the student is able to
- Understand how to state quantity of any objects. (L3)
- Introduce oneself in a formal or informal setting. (L3)
- Tell greetings of courtesy and politeness. (L3)
- Understand the names of countries in French. (L3)
- Understand the gender of nouns. (L3)

Pedagogy tools: Audio clips, Self-reading, Group discussion.

UNIT – III
Giving directions, expressing wants or needs. Grammar: Reflexive verbs, 'Vouloir', 'Pouvoir', 'Devoir', 'Falloir'. Vocabulary: Prepositions, colours. (14)
Learning Outcomes:
After Completion of the unit, the student is able to
- Understand the conjugation of reflexive verbs. (L3)
- Express dreams and ambitions. (L3)
- Develop an aptitude for finding places in a foreign country. (L3)
- Express needs. (L3)
- Indicate the color of objects.

Pedagogy tools: Audio clips, Self-reading, Group discussion

UNIT – IV
Expressing feelings, Grammar: Conjugation of 'Aller', conjugation of irregular verbs. Vocabulary: Adjectives of quality, seasons.(5)
Learning Outcomes:
After Completion of the unit, the student is able to

Describe about nature and environment. (L3)

Express thoughts and feelings.(L3)

Increase the possibilities for describing activities.(L3)

Explain about travel plans. (L3)

Describe hobbies.(L3)

Pedagogy tools: Audio clips, Self-reading, Group discussion

UNIT – V

Grammar: Parts of speech, degrees of comparison. Vocabulary: Conjunctions, Clothes, French music, films and books. (10)

Learning Outcomes:

After Completion of the unit, the student is able to

- Identify different parts of speech in a text. (L3)
- Effectuate a comparison between objects. (L3)
- Describe the clothing and appearance of a person. (L3)
- Increase the range of expression by joining simple sentences. (L3)
- Acquire basic knowledge about popular French media and celebrities. (L3)

Text Books :

Saison 1 Textbook

Saison 1 Workbook

B.Sc Computer Science with Cognitive Systems
III SEMESTER
Generic Elective – II
Optimization Techniques

Hours per week: 3 L   **End Examination: 60 Marks**
Credits: 2   **Continuous Assessment: 40 Marks**

Preamble:

Optimization techniques have gained importance to solve many engineering design problems by developing linear and nonlinear mathematical models. The aim of this course is to educate the student to develop a mathematical model by defining an objective function and constraints in terms of design variables and then apply a particular mathematical programming technique.

Course Objectives:

- To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- To state constraint optimization problems.
- To explain linear programming technique to an optimization problem.
- Define slack and surplus variables, by using Simplex method.
- To state transportation and assignment problem as a linear programming problem.
- To determine optimality conditions by using Simplex method.
- To explain optimal solutions for sequencing problems with n jobs.

UNIT-I

Linear Programming: Linear Programming Problem (LPP), Mathematical Formulation, Graphical method of solution of LPP with two variables, Basic solutions, General LPP, Canonical and Standard forms of LPP.(8)

Learning Outcomes:

At the end of the unit, the student is able to

- Define an objective function and constraint functions in terms of design. (L2)
  variables, and then state the optimization problem.(L2)
- State constraint optimization problem.(L2)
- Define basic solutions of a LPP.(L2)

UNIT-II

Simplex Method: Simplex Method, Artificial variables, Big-M and Two-phase simplex Methods, Degeneracy in Linear Programming.(6)

Learning Outcomes:

At the end of the Unit, the student is able to

- Explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.(L3)
- Explain Big-M method. (L3)
- Explain Two-phase simplex method. (L3)
- Explain degeneracy in Linear Programming. (L3)

UNIT-III

Duality in Linear programming: Introduction, Formulation of a dual problem, Properties of duality, Application of duality to solve LPP, Dual simplex method.(6)

Learning Outcomes:

At the end of the Unit, the student is able to

- Formulate dual problem. (L3)

- Explain properties of duality. (L3)
- Explain application of duality to solve Linear programming problem. (L3)
- Explain dual simplex method. (L3)

UNIT-IV

Transportation and Assignment Problems: Introduction and LP formulation of Transportation Problem, Methods to find Initial basic feasible solutions of transportation problem, Transportation Algorithm (MODI Method) to obtain optimal solution. Assignment problem- Mathematicalformulation, Hungarian Method of solution. (8)

Learning Outcomes:

At the end of the Unit, the student is able to

- State transportation and assignment problem as a linear programming. (L2)
- Determine optimal assignment using Hungarian method. (L3)
- Determine optimal allocation for transportation problem using MODI algorithm. (L3)

UNIT-V

Sequencing Problem: Introduction, Basic terminology, Algorithms to obtain optimal solutions for sequencing problems with n jobs and two, three and m machines.

Learning Outcomes:

At the end of the Unit, the student is able to

- Explain basic terminology in sequencing problem. (L2)
- Determine optimal sequencing for n jobs and 2/3/m machines. (L3)

Course Outcomes:

On successful completion of this course, students will be able to

- Formulate real world problems into constraint optimization problems.(L4)
- Explain linear constraint optimization using simplex method .(L3)
- Explain Big-M method and Two-phase simplex method.(L3)
- Explain application of duality to solve Linear programming problem.(L3)
- Explain dual simplex method.(L3)
- Model transportation and assignment problem as a linear programming Problem and their optimal solutions.(L4)
- Explain optimal solutions for job sequencing problems.(L3)

Text Books:

1. Operations Research by S.D Sharma, Kedarnath, Ramnath& Co.

Reference books:

1. Operations Research by Kanti Swarup, P.K Gupta and Manmohan, Sultan Chand and Sons.
2. Operations Research: An Introduction by Hamdy A Taha, Pearson Education.
3. Operations Research: An Introduction by H.M. Wagner, Prentice Hall of India.
4. Linear Programming by G. Hadley Narosa Book Distributors.
5. Linear Programming by Gass, McGraw Hill.

B.Sc Computer Science with Cognitive Systems
III SEMESTER
Generic Elective – II
CSCI2131 Web Technologies

Hours per week: 3 L	End Examination: 60 Marks
Credits: 3	Continuous Assessment: 40 Marks

Preamble:

This course enables the students to associate with Website Development for hosting via intranet or internet. The web development process includes web design, web content development, client- side scripting, server-side scripting. Web development is the coding or programming that enables website functionality as per the owner's requirements.

Course Objectives:

- Design static web pages using Markup languages.
- Design and implement web applications using style sheets.
- Use of java script for designing web applications with dynamic effects.
- Validations on form input entry and adding dynamic content to web applications.
- Design and implementation of complete applications over the web.

UNIT-I

Internet Basics: Basic Concepts, Communicating on the Internet, Internet Domains, Internet Server Identities, Establishing Connectivity on the Internet, Client IP address, Transmission Control protocols.

Overview of HTML5 and Other Web Technologies: HTML5 and its Essentials, New Features of HTML5, Structuring an HTML Document-Elements and Attributes, Tags, The DOCTYPE Element, Exploring Editors and Browsers Supported by HTML5, Creating, Saving, Validating ,Viewing a HTML Document, Hosting Web Pages.

Fundamentals of HTML: Understanding Elements, Describing Data Types, Horizontal Rules, Line Breaks, Paragraphs, Citations, Quotations, Definitions, Comments, Working with Text, Organizing Text in HTML, Exploring Hyperlinks, URL, Understanding and Describing the Table Elements, Inserting Images, Exploring Colors. (12)

Learning Outcomes:

After completion of this unit, student will be able to

- Understand how internet works and how connection is established between web browser and server.(L2)
- Understand various steps to design static websites.(L2)
- Identify the importance of HTML tags for designing webpage.(L2)

UNIT – II

Working with Forms: Exploring the FORM element, Types of INPUT Element, Exploring Button, Multiple Choice, Text Area, Label, Fieldset, Legend, Datalist, Keygen, Output elements, submitting a Form.

Working with Multimedia: Exploring Audio and Video File Formats, Describing the Multimedia elements, defining a Multimedia File Using the EMBED, OBJECT Element, Exploring the FIGURE and FIGCAPTION Elements. (8)

Learning Outcomes:

After completion of this unit, student will be able to

- Develop a static web page along with user interactive elements.(L3)

- Design web pages with multimedia elements such as audio, video, etc.(L3)

UNIT – III

Overview of CSS: Evolution, Syntax of CSS, Exploring CSS selectors, Inserting CSS in a HTML Document, Exploring Background, Color, Font Properties of a Webpage, Properties Table: Using the style Attribute, Creating Classes and IDs, Generating External Style Sheets, Typography, Consistency, Types of styles, Specifying class within HTML document, Style placement: Inline style, Span & div tags, header styles, Text and font attributes: Font Vs CSS, changing fonts, text attributes, Advance CSS properties: Backgrounds, Box properties and Positioning. (8)

Learning Outcomes:

After completion of this unit, student will be able to

- Separate design from content using various levels of Style Sheets. (L4)
- Learn different types of style sheets.(L2)

UNIT – IV

Introduction to JavaScript: JavaScript in web pages, The Advantages of JavaScript, Writing JavaScript into HTML, Basic Programming Techniques, Operators and Expressions in JavaScript, JavaScript Programming Constructs, Conditional Checking, Super controlled-endless loop Functions in JavaScript, User defined functions, Placing text in a Browser, Dialog Boxes. (8)

Learning Outcomes:

After completion of this unit, student will be able to

- Use Java script to validate user input and perform dynamic documents.(L4)
- Design dynamic and interactive web pages by embedding Java script code in HTML.(L3)

UNIT – V

PHP: Introducing PHP, History, Unique Features, Basic Development Concepts, Creating First PHP Script, Mixing PHP with HTML, Escaping Special Characters, Using Variables and Operators, Controlling Program Flow, Working with Arrays.

File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories. (8)

Learning Outcomes:

After completion of this unit, student will be able to

- Understands the components of PHP.(L2)
- Learn the basic constructs of PHP, built in functions.(L1)
- Learn the importance of PHP for web application development. (L1)

Course Outcomes:

Upon completion of this course, student will be able to:

- Demonstrate the importance of HTML & DHTML tags for designing web pages and separate design from content using Cascading Style Sheet.(L3)
- Understand various steps to design dynamic websites. (L2)
- Design interactive web pages with client and server side scripting.(L3)
- Apply validations on user input using java script.(L3)
- Understands the PHP framework and develop a reusable component. (L2)

Text Books:

1. HTML 5 Black Book , CSS 3, Java Script, XML, XHTML, AJAX, PHP and Jquery by DT Editorial Services, , Dream Tech Press, 2nd Edition,2016.

2. Web Enable Commercial Application Development Using HTML, Javascript, DHTML and PHP by Ivan Bayross, BPB Publications, 4th revised edition, 2010 .

3. PHP: A Beginner's Guide by VikramVaswani, Tata McGraw Hill,2017.

Reference Books:

1. Complete Reference HTML by T. A. Powell, 3rd edition, TMH,2003.
2. The Complete Reference - PHP by Steven Holzner, Tata McGraw Hill,2008.
3. Web Technology and Design by Xavier, C, New Age International,2013.

B.Sc Computer Science with Cognitive Systems
III SEMESTER
ENVS1001 Environmental Studies
(Common with BCA III Semester)

Hours per week: 3 L

Credits: 3   **Continuous Assessment: 100 Marks**
Preamble:
The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation that led to pollution. This course helps in finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course Objectives:
- To impart knowledge on natural resources and its associated problems.
- To familiarize learners about ecosystem, biodiversity, and their conservation.
- To introduce learners about environment pollution.
- To acquaint learners on different social issues such as conservation of water, green building concept.
- To make learners understand about the present population scenario, its impacts and role of informational technology on environment and human health.
- To make learners understand about the importance of field visit.

UNIT-I

Multidisciplinary nature of environmental studies & Natural Resources: Multi disciplinary nature of environmental studies Definition, scope and importance. Need for public awareness. Natural resources and problems associated, Use and over exploitation of Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

Activity:
1. Planting tree saplings.
2. Identification of water leakage in house and institute-Rectify or report.

Observing any one day of a week as Car/bike/vehicle free day.
3. Planting tree saplings.
4. Identification of water leakage in house and institute-Rectify or report.

Observing any one day of a week as Car/bike/vehicle free day.

Learning Outcomes:
At the end of the Unit, the student is able to
- List different natural resources and their uses. (L1)
- Relate how the over-exploitation of natural resources impact human life .(L1)
- Find the role of an individual in the conservation of natural resources. (L2)
- Recall the demand of potable water in a community.(L1)
- Explain the equitable use of natural resources for sustainable lifestyles.(L2)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

UNIT-II

Ecosystem and biodiversity Ecosystem: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession. Biogeochemical cycle: (Nitrogen, carbon, Phosphorus cycle).

Biodiversity: Definition, Bio-geographical classification of India, **Values of biodiversity**: consumptive use, productive use, social, ethical, aesthetic and optional values. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching, man wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ Activity.

1. Visit to Zoological Park-Noting different ecosystem.
2. Biodiversity register- Flora and fauna in the campus.

Learning Outcomes:

- Demonstrate how ecosystem functions.(L2)
- Summarize the structure and function of terrestrial and aquatic ecosystems.(L2)
- Explain the values and threats to biodiversity.(L2)
- Identify the importance of conservation of biodiversity. (L3)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading.

UNIT-III

Environmental Pollution-Definition Causes, effects, and control measures of Air pollution. Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards. Solid waste Management: Causes, effects, and control measure. Role of an individual in prevention of pollution, Pollution case studies.

Activity

1. Visit to treatment plant and documentation.

Documentation of segregation of solid waste-Dry and Wet.

Learning Outcomes:

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

- Identify causes, effects, and control measures of pollution (air, water & soil). (L3)
- Choose different types of pollutants.(L3)
- Experiment with the pollution related case studies.(L3)
- Solve solid waste issues but appropriate management techniques.(L3)
- Analyze the role of an individual in prevention of pollution.(L4)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

UNIT-IV

Social Issues and the Environment-From Unsustainable to Sustainable Development Urban problems related to energy. Water conservation, rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns related to mining, dams, Case Studies. Environmental ethics: Issues and possible solutions, Green building concept, Role of remote sensing and GIS in ground water exploration.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case Studies, Wasteland reclamation.

Activity:

1. Observing zero hour at individual level-documentation.
2. Eco friendly idols.

Rainwater harvesting-creating storage pits in nearby area.

Learning Outcomes:

- Examine different water conservation methods.(L2)
- Survey remote sensing and GIS methods in exploration of ground water.(L4)
- Function of green building concept.(L4)
- Discover the consequences of global warming, acid rains and ozone layer depletion.(L4)
- Improve wasteland reclamation.(L5)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading

UNIT-V

Human Population and the Environment and Environment Protection Act and Field Work- Population growth, variation among nations, Family Welfare programme, Environment and human health, HIV/AIDS, Human rights, Value Education. Women and Child Welfare, Role of Information Technology in Environment and human health, Environment Legislation, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act. Wildlife Protection Act, Forest Conservation Act, Environmental Protection Act, Issues involved in enforcement of environmental legislation, Public awareness Activity.

1. Visit to a local polluted site-industry/agriculture

Identify diseases due to inappropriate environmental conditions.

Learning Outcomes:

- Predict population growth and variation among nations. (L4)
- Adapt value education. (L5)
- Discuss women and child welfare. (L5)
- Theorize different environmental legislation acts and issues involved in enforcement of legislation. (L5)
- Justify the role of information technology in environment and human health.(L5)
- Theorize different environmental legislation acts and issues involved in enforcement of legislation.(L5)

Pedagogy tools: Blended learning, Case let, video lectures, self-reading.

Text Books:

1. Textbook of environmental studies for undergraduates courses by ErachBharucha, Universities Press, India Private Limited. 2019.
2. Perspectives in Environmental Studies by KaushikA and KaushikC.P.. New Age International Publishers Edition-VI. 2018.
3. Textbook of Environmental Studies by Dave D Katewa S.S., 2nd Edition. Cengage Learning India. 2012.

Additional Reading

1. Textbook of Environmental Studies by Benny Joseph, 3rd edition, McGraw Hill Publishing company limited. 2017.

Reference Book(s):

1. Environmental Science: Systems and Solutions by McKinney M.L., Schoch R.M., Yonavjak L. MincyG.. Jones and Bartlett Publishers. 6th Edition. 2017.
2. Environmental Science: Earth as a Living Planet byBotkin D.B. John, Wiley and Sons. 5th edition. 2005.

Journal(s):

1. https://www.tandfonline.com/loi/genv20
2. https://library.lclark.edu/envs/corejournals

Website(s):

https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

From Climate Science to Action | Coursera

	Programme Objectives (POs)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2												2		
CO2		2				1							2		
CO3			1						1					1	
CO4				2							2				1
CO5	1													1	
CO6					2							1			1

1- Low, 2-Medium and 3-High Correlation

B.Sc Computer Science with Cognitive Systems
III SEMESTER
CSCI2141 Data Structures with C++

Hours per week: 3 L	**End Examination: 60 Marks**
Credits:3	**Continuous Assessment : 40 Marks**

Preamble:

Data Structures aids the students to implement real world problems that will be used in operating systems, compliers design, computer networks, cyber security etc. Students will learn about different data structures and perform operations on data structures like insertion, deletion, updation and retrieval data. This course will master the implementation of stacks, queues, linked lists, binary trees, graph algorithms such as shortest path and minimum spanning tree.

Course Objective:

- To understand the linear and nonlinear data structures available in solving problems.
- To know about the sorting and searching techniques and its efficiency.
- To use the data structures and algorithms in real time applications.
- To be able to design own data structure according to the application need.

UNIT–I

Introduction to Data Structures: Introduction to Data Structures, Types of Data Structures, Space Complexity, Arrays and Operations on arrays (Insert, Delete, Update Elements).

Analysis of Algorithms: Time Complexity and its notation, Algorithm Analysis, Structured Approach to Programming, Recursion. (10)

Learning Outcomes:

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

- Understand the concept of Dynamic memory management. (L2)
- Understand different types of Data Structures. (L2)
- Understand algorithms, Different Time Complexity notations, Recursion Techniques. (L2)

UNIT–II

Stacks: Introduction to Stacks, Stack as an Abstract Data Type, Representation of Stacks through Arrays, Applications of Stacks.

Queues: Introduction, Queue as an Abstract data Type, Representation of Queues through arrays, Circular Queues, Application of Queues. (8)

Learning Outcomes:

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

- Define the concept of Stack. (L1)
- Develop a stack using an array. (L3)
- Develop a stack using a linked list. (L3)
- Define the concept of queue. (L1)
- Compare pros and cons of arrays and linked lists to implement stacks and queues. (L4)

UNIT-III

Linked Lists: Introduction to Lists and Linked Lists, Dynamic Memory Allocation, Single Linked List and its Operations (insert, deletion, updation), Representation of Stacks, queues through Linked Lists. (8)

Learning Outcomes:

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

- Define Linked List. (L1)
- Implementation of Dynamic Memory Allocation. (L3)

- Design programs using a variety of data structures such as Linked List. (L3)

UNIT– IV

Binary Trees: Introduction to Non- Linear Data Structures, Types of Trees, Basic Definition of Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Binary Search Tree, Representation of Binary Search Trees, Operations on a Binary Search Tree, Binary Tree Traversals. (10)

Learning Outcomes:

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

- Understanding of Tree Structures. (L1)
- Types of Trees and Implementations. (L2)
- Implementation of Tree Traversals. (L3)

UNIT–V

Searching and sorting: Searching – An Introduction, Linear or Sequential Search, Binary Search. Sorting – An Introduction, Bubble Sort, Insertion Sort, Selection Sort.

Graphs: Introduction to Graphs, Terms Associated with Graphs, Sequential Representation of Graphs, Linked Representation of Graphs, Traversal of Graphs, and Application of Graphs. (10)

Learning Outcomes:

After completion of the unit, the student is able is

- Understanding Searching and Sorting Algorithms. (L1)
- Implementation of Search and Sorting Algorithms. (L2)
- Understanding Graphs. (L1)
- Implementation of Graph Applications. (L3)

Course Outcomes:

Upon completion of the course, the student is able to

- Understand the concept of Dynamic memory management, data types, algorithms, Big O notation. (L2)
- Perform operations on Array. (L3)
- Understand and implementing basic data structures stacks and queues. (L2)
- Design programs using a variety of data structures Linked List. (L3)
- Design programs using a variety of data structures such as binary trees, binary search trees, (L3)
- Analyze and implement of Sorting and Searching Techniques. (L4)
- Analyze and implement graph algorithms. (L4)

Text Books:

1. Data Structures using C++ by Varsha H.Patil, Oxford University Press, 2012.

Reference Books:

1. Data Structures Algorithms and Applications in C++ by Sartaj Sahani, University Press, 2nd Edition, 2011.

2. Data Structures Using C and C++ by Yedidyah Langsam, Moshe J Augenstein and Aaron M Tenenbaum, PHI, 2nd Edition, 2009.

3. Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss, Pearson Education, 3rd edition, 2007.

4. Data Structures and Algorithms in C++ by Adam Drozdek, Cengage Learning, 4th Edition, 2013.

B.Sc Computer Science with Cognitive Systems
III SEMESTER
CSCI2161 Fundamentals of Cloud and Virtualization

Hours per week: 3 L   End Examination: 60 Marks

Credits: 3   Continuous Assessment: 40 Marks

Preamble:

This course will help the students to get familiar with Cloud Computing Fundamental concepts, architecture and different services in Cloud Computing and know about the challenges, virtualization and security in cloud computing.

Course Objectives:

- To understand the architecture of cloud computing.
- To learn the services provided by cloud computing.
- To understand the benefits and challenges in cloud computing.
- To understand the concepts of virtualization in cloud computing.
- To learn the concepts of security in cloud computing.

UNIT - I

Introduction: What is a cloud? Hype cycle, Implementation gap, Common Definition, Metaphorical Interpretation, Attributes.

Cloud Architecture: Stack Management Layers, Standards and Interoperability, Private Cloud, Community Cloud, Hybrid Cloud, Cloud Maturity.   (8)

Learning Outcomes:

By the end of the unit the student will be able to

- Define cloud computing. (L1)
- Describe cloud architecture and various types of clouds. (L2)
- Understand the difference between private cloud and community cloud. (L2)

UNIT - II

Infrastructure as a Service: Infrastructure Stack, Servers, Storage, Network, Integration, Management, Payment and Billing, IAAS Landscape. Platform as a Service: Web Application Frameworks, Web Hosting Services, Google App Engine, Microsoft Windows Azure, Force.com, Additional Platforms. Software as a service: Customer Relationship Management, Human Resources, Financial, Collaboration, Backup and Recovery, Industry Solutions.   (10)

Learning Outcomes:

By the end of the unit the student will be able to

- Explain the cloud as infrastructure as service and its related concepts. (L2)
- Describe the cloud as platform as service and its related concepts. (L2)
- Demonstrate the cloud as software as service and its related concepts. (L2)

UNIT - III

Benefits and Challenges: Benefits, Challenges, Recommendations.

Strategic Impact: What is Strategy? Strategic Analysis, External Analysis, Internal Analysis, Strategic Realignment.

Risk Impact: Notion of Risk, Risk Management, Cloud Impact, Enterprise Wide Risk Management.

Financial Impact: Resource Costs, Return on Investment, Cash Flow, Financial Visibility, Return on Assets.   (10)

Learning Outcomes:

By the end of the unit the student will be able to

- Discuss various benefits and challenges of cloud. (L6)
- Explain strategic impact and its related concepts of cloud. (L2)
- Discuss risk impact and its related concepts of cloud. (L6)
- Elaborate financial impact and its related concepts of cloud. (L6)

UNIT – IV

Virtualization: Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples, Xen: Para-virtualization, VMware: Full Virtualization, Microsoft Hyper-V. (8)

Learning Outcomes:

By the end of the unit the student will be able to
- Explain the basic features of virtualization. (L2)
- Identify the different types of virtualization. (L1)
- Describe the concept of VMware. (L2)
- Explain the relation between virtualization and cloud computing. (L2)

UNIT – V

Connectivity: Network connectivity, Content delivery networks, Application connectivity, Information Connectivity.

Security: 10 Security Domains, Access Control, Application Security, Cryptography, Physical (Environmental) Security, Security Architecture and Design, Telecommunications and Network Security. (8)

Learning Outcomes:

- By the end of the unit the student will be able to
- Explain the concept of content delivery networks. (L2)
- List the security domains. (L4)
- Explain the need of physical security. (L2)

Course outcomes:

Upon completion of the course, the student will be able to
- Understand the need of cloud computing. (L2)
- Identify different types of services in cloud computing. (L4)
- Discuss various benefits and challenges in cloud computing. (L6)
- Understand various features of virtualization. (L2)
- Discuss network connectivity and its related concepts of cloud. (L6)

Text Books:
1. Cloud Computing Explained by John Rhoton, Recursive Press, 2013.
2. Mastering Cloud Computing by Rajkumarv Buyya, Christian Vecchiola, S Thamarai Selvi, Morgan Kaufmann, 2013.

Reference Books:
1. Cloud Computing Concepts Technology Architecture by Thomas Erl, Pearson Education,2014
2. Cloud Computing, Principles, Systems and Applications by Nick Antonopoulos and Lee Gilliam Springer International Edition, 2015.

III SEMESTER
CSCI2181 Database Management Systems

Hours per week: 3 L	**End Examination: 60 Marks**
Credits:3	**Continuous Assessment: 40 Marks**

Preamble:

This course provides need for efficient storage and manipulation of data which will be used worldwide and exposed to different applications.

The course also introduces the concepts related to information systems in organizational usage and considers the different models of information modelling.

Course Objectives:

- To introduce concepts of databases, database systems, architecture and classification. (L1)
- To define constraints on the relational model. (L3)
- To design Relational Data model and perform relational model operations. (L3)
- To demonstrate the creation, altering and modification of database with SQL, Learning the techniques for evaluating relational schemas for design quality. (L2)

UNIT - I

Introduction and Conceptual Modelling, Databases and Database Users: Introduction, Characteristics of Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of using DBMS Approach. Database System, Concepts and Architecture: Data Models, Schemas and Instances, Three Schema Architecture and Data Independence, Database Language and Interfaces, The Database System Environment, Centralized and Client/Server Architecture of Database Management Systems, Classification of Database Management Systems. (10)

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn the introductory concepts of databases. (L1)
- Analyze the characteristics of database approach. (L4)
- Understand the database system environment. (L2)
- Know the three schema architecture. (L1)
- Find the different database architectures. (L1)

UNIT-II

Entity-Relationship Model: Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship. classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, constraints on specialization and generalization, aggregation and composition, entity clusters, advantages of ER modelling. (10)

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the introductory concepts: Entity, Attributes and Relationship. (L2)
- Draw an Entity Relationship diagram. (L6)
- Summarize relational model concepts, constraints and database schema. (L2)

UNIT-III

Relational Model: Introduction, CODD Rules, relational data model, concept of key, relational integrity, relational algebra, relational algebra operations, advantages of relational algebra, limitations of relational algebra. (8)

Learning Outcomes:

By the end of this unit, the student will be able to
- Understand the Relational Database Model. (L2)
- Learn relational algebra operations. (L1)
- Transform ER to Relational Model. (L4)

UNIT-IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, DataTypes in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Table Truncation, Imposition of Constraints, Join Operation, Set Operation, View, Sub Query. Correlated Sub-queries.

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relational Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of 2nd and 3rd Normal Forms, Boyce-Codd Normal Form.   (10)

Learning Outcomes:

By the end of this unit, the student will be able to
- Learn Database Language –SQL. (L1)
- Practice DDL, DML and DCL commands. (L3)
- Demonstrate all built in arithmetic, aggregate, string, date and conversion functions. (L3)
- Understand the concepts of functional dependencies. (L1)
- Define Normalization and its normal forms. (L1)

UNIT-V

PL/SQL: Introduction, Shortcoming in SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create aPL/SQL, Program, Iterative Control, Cursors, Steps to create a Cursors, Procedure, Function, Packages, Exceptions Handling, Database Triggers, Types of Triggers.   (8)

Learning Outcomes:

By the end of this unit, the student will be able to
- Understanding the basic concept of PL/SQL. (L1)
- Learn creation of Cursors, Triggers. (L3)
- Implement Functions and Packages. (L3)

Course Outcomes:

At the end of course student will be able to
- Understand the introductory concepts of databases and its architecture. (L1)
- Define program-data independence, data models for database systems, database schema and database instances. (L1)
- Analyze database requirements and determine the entities involved in the system and their relationship to one another. (L3)
- Develop the logical design of the database using data modelling concepts such as entity-relationship diagrams, Enhance Entity Relationship modelling. (L4)
- Convert the ER-model to relational tables, populate relational database &formulate relational algebra queries to extract information to satisfy business reporting requests. (L6)

Reference Books:

1. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe, Pearson education, 5th edition, 2009.
2. Database System Concepts by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill, 2010.
3. Database Management Systems by Raghu Ramakrishnan, McGrawhill, 2002,

4. Fundamentals of Relational Database Management Systems by S. Sumathi, S. Esakkirajan, Springer Publications.
5. An Introduction to Database Systems by Bipin C Desai.
6. Principles of Database Systems by J. D. Ullman.

Hours per week: 2P

Credits: 1   **Continuous Assessment: 100 Marks**

Objectives:

- To teach efficient storage mechanisms of data for an easy access.
- To design and implement various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To develop applications using data structures.
- To teach the concept of protection and management of data.
- To improve the logical ability

List of Programs

1. Implementation of Array operations.
2. To search an element from a list. Give user the option to perform Linear and Binary search.
3. Perform Stack operations using Array.
4. Perform Queue operations using Array.
5. Implement singly Linked List Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List.
7. Perform Queue operations using Linked List.
8. Input polynomial using linked list and add two polynomials.
9. Give user the option to perform sorting using Insertion sort, Bubble sort and Selection sort.
10. Create a Binary Search Tree and include following operations in tree:
    (a) Insertion (b) Deletion (c) Search a no. in binary search tree.

Course Outcomes

Upon completion of this course the students will be able to:

- Choose appropriate data structure as applied to specified problem definition. (L3)
- Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
- Apply concepts learned in various domains like DBMS.
- To use linear and non-linear data structures like stacks, queues, linked list etc.

B.Sc Computer Science with Cognitive Systems
III SEMESTER
CSCI2191 Database Management Systems Lab

Hours per week: 2P

Credits: 1   **Continuous Assessment: 100 Marks**

Course Objective: The aim of this course is to make the student to learn the concepts of SQL.
Demonstrate onvarious DDL, DML and DCL statements.
Student also will learn PL/SQL

1. Creation, altering and dropping of tables using SQL.
2. Implementing integrity Constraints on tables.
3. Implementing DML Operations using SQL-Insert, Delete, Update.
4. Simple Queries to access data from Tables using Select Statement and where condition using Distinct, And, Or, Not and Order By Operators.
5. Queries using Built in Functions:
    i. Arithmetic Functions: Sign, Abs, Ceil, Floor, Exp, Power, Log, Sqrt,
    ii. StringFunctions:Concat,Lpad,Rpad,Ltrim,Rtrim,Lower,Upper,Initcap,L ength,Substr and Instr.
    iii. Aggregate Functions: Count, Sum, Avg, Max and Min, Group by, Having
6. Queries using Set Operators: Union, Intersect, Minus
7. Queries using Joins, Natural Join, Inner join, Outer Join.
8. Queries along with Sub Queries and Correlated Queries using Any, All, In, Exists, Not exists.
9. Creating other Schema Objects**:** Defining Views, Creating Views, using Views to Change Data, Dropping Views, Creating Indexes and Sequences
10. Using DCL Commands: Commit and Rollback.
11. Creation of Simple PL/SQL Program which includes Declaration Section, Executable Section, Select ... into Clause.
12. Develop Programs that include Features of Nested If and Case.
13. Develop Programs using While Loop, For Loop, Nested Loops
14. Develop PL/SQL Program to demonstrate Cursor and Triggers
15. Develop PL/SQL Program to demonstrate Procedures and Functions

Text Books:

1. SQL, PL/SQL The Programming language of ORACLE by Ivan Bayross, BPBpublications, 4th edition, 2009.
2. Programming Oracle triggers and Stored Procedures by Kevin Owens, PHI, 3rd Edition, 2003.

Course outcomes:

At the end of the course students will be able to

- Experiment with DDL, DML, DCL commands. (L3)
- Apply entity integrity (primary key) and referential integrity (foreign key) concepts. (L3)
- Practice all arithmetic, string, date and aggregate functions. (L3)
- Construct simple queries, sub-queries and complex queries. (L4)
- Create other schema objects like views, indexes and sequence. (L2)
- Develop PL/SQL programs. (L3)

B. Sc Computer Science with Cognitive Systems
III SEMESTER
CSCI2171 Cloud and Virtualization Lab

Hours per week: 2P

Credits: 1   **Continuous Assessment: 100 Marks**

Course Objectives:
- Understand the real-life business applications in terms of cloud implementation.
- Understand the cloud architecture and Microservices architecture design.
- Explore Devops Tools and study AWS, Azure and GCP features and use cases.
- Learn how to create API documentations and cloud scaling.

Course outcomes:
- Explain the application of cloud and its services in terms of real-life business applications.
- Summarize the cloud architecture and microservices.
- Use different set of tools and apply it for different use cases.
- Create API documentations for specific domain areas.

1. **Cloud Virtualization Lab**

List of Practical Experiments:
1. Choose a real-life example of a business application that you have used and apply these technologies and concepts to solution it.
2. Cloud Architecture design.
3. Micro-service Architecture design.
4. API development use case and deployment.
5. Micro-service development and deployment.
6. Devops Tools - usages for Automation in development/Testing/Deployment.
7. AWS features use cases -ex, Lambda Functions.
8. Azure features Use cases.
9. GCP Features Use cases.
10. Creating an API and API Documentation.
11. Cloud scaling.

Text Book:
1. Cloud Computing Principles and Paradigms by Rajkumar Buyya, James Broberg, Andrzej Goscinski , Wiley Publishers, 2011

References:
1. Cloud Computing by Barrie Sosinsky, Bible, Wiley Publishers, 2010.
2. Cloud Computing: Web-based Applications that change the way you work and collaborate online by Michael Miller, Pearson Education, 2008.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance by Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, 2010.

B.Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2201 Introduction to Artificial Intelligence

Hours per week: 3 L   **End Examination: 60 Marks**
Credits: 3   **Continuous Assessment: 40 Marks**

Preamble: This course enables the students to think critically about what makes humans intelligent, and how computer scientists are designing computers to act more like us. AI plays an important role inthe design and development of systems with intelligent behavior. The primary objective of this courseis to provide an introduction to the basic principles and applications of Artificial Intelligence.

Course Objectives:
- To make Students to know different types of AI agents, various AI search algorithms.
- To give an overview on the representation of knowledge.
- To build simple knowledge-based systems and to apply knowledge representation.
- To study Markov Models.

UNIT-I

Introduction: AI definition, Foundations, History, State of the Art. **Intelligent Agents**: Agents and Environments, Concept of Rationality, Nature of Environments, Structure of Agents. **Solving Problems by Searching**: Problem Solving Agents, Example problems, Searching for solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems. (12)

Learning Outcomes:
By the end of this unit, the student will be able to
- Define Artificial Intelligence. (L1)
- How agents work in environments. (L1)
- Recall uninformed search techniques. (L1)
- Illustrate the working of informed search techniques. (L2)

UNIT-II

Adversarial Search: Games, Optimal Decisions in Games, Alpha- Beta Pruning, Imperfect real time decisions, Stochastic games, partially observable games, State of art game program. (8)

Learning Outcomes:
By the end of this unit, the student will be able to
- Understand how games improve intellectual abilities of humans. (L1)
- Choose optimal decisions in games. (L1)
- Illustrate alpha-beta pruning. (L2)
- Compare stochastic and partially observable games. (L2)

UNIT-III

Constraint Satisfaction Problems: Defining Constraint Satisfaction problems, Constraint Propagation, Backtracking search for CSPs, Local Searches for CSPs. Logical Agents: Knowledge-Based Agents, Wumpus World, Logic, Propositional Logic and Propositional Theorem proving. (8)

Learning Outcomes:
By the end of this unit, the student will be able to
- Define constraint satisfaction problems. (L1)
- Illustrate inference in constraint satisfaction problems. (L2)
- Contrast backtracking search and local search for constraint satisfaction problems. (L2)

First Order Logic: Syntax and Semantics of First Order Logic, Using First Order Logic, Knowledge Engineering in First Order Logic. Inference in First Order Logic: Propositional Vs First Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. Introduction to Fuzzy Logic.

(10)

Learning Outcomes:

By the end of this unit, the student will be able to

- Infer proofs in propositional and first-order logic. (L2)
- Define propositional and first-order inference. (L1)
- Outline unification and lifting. (L2)

UNIT-V

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and choosing the Best Hypothesis, the theory of Learning, Regression and Classification with Linear Models. Artificial Neural Networks, Nonparametric Models, support vector machines, ensemble learning, practical machine learning. (L2)

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the Concept of Supervised Learning (L1)
- Evaluate the Best Hypothesis(L3)
- Illustrate the Nonparametric Models (L2)

Course Outcomes:

Upon completion of this course, student will be able to:

- Exhibit artificial intelligence, the role of intelligent agents, uninformed and informed search techniques. (L2)
- Examine competitive environments like game problems. (L2)
- Interpret many real-world problems as constraint satisfaction problems. (L3)
- Illustrate what knowledge representation is and able to distinguish propositional and first order logics. (L3)
- Infer proofs using resolution in first-order logic. (L3)
- Understand the practical machine learning Techniques.   (L4)

Text Book:

1. Artificial Intelligence: A Modern Approach by Russell,S. and Norvig,P,Third Edition,Prentice-Hall India,2010.

 Reference book:

 1. Artificial Intelligence by ElaineRich, Kevin Knight,Shivasankar B.

IV SEMESTER

Generic Elective- III

CSCI2221 Blockchain Technologies

Hours per week: 3 L	**End Examination: 60 Marks**
Credits:2	**Continuous Assessment: 40 Marks**

Preamble:

The increase in the amount of digitalization leads to an increase in complexity of systems. It is leading to reduction in trust and accountability among parties. Blockchain can ensure the visibility, transparency &track business activities. The whole point of using Blockchain in a network is to let people trust one another, share valuable data in secure and valuable way.

Course objectives:

- To learn the basic concept of Cryptographic Hash Functions, Hash Pointers and Elliptic Curve Digital Signature Algorithms.
- To get an overview of decentralized digital currencies.
- To get an insight into the working of the Bitcoin network, Wallet, Bitcoin mining and distributed consensus for reliability.

UNIT-I

The Growth of Blockchain Technology Distributed System:

The History of Blockchain and Bitcoin: Electronic cash, blockchain, generic elements of blockchain, benefits and limitation of blockchain, features of blockchain technology.

Types of Blockchain, consensus: Distributed Ledger, distributed ledger technology, public and private blockchains, tokenized and token less blockchains**.** **(8)**

Consensus: Consensus Mechanism, Types of Consensus mechanism.

Learning Outcomes:

After completion of the unit, the student is able to

- Learn the theoretical foundation of block chain. (L2)
- Learn the basic concepts of distributed systems. (L2)
- Understand the history of blockchain technology. (L1)
- Understand the structure of a blockchain. (L1)

UNIT-II

Introduction to Cryptography: Cryptographic Hash Functions, properties and applications, SHA-256, Hash Pointers and Data Structures: Hash Pointer, Blockchain, Tamper-evident log, Merkle tree: Proof of Membership, Proof of non-membership. (10)

Learning Outcomes:

After completion of the unit, the student is able to

- Identify necessity of a HASH function. (L1)
- Learn the importance of digital signature. (L2)
- Understand digital signature algorithms.(L1)
- Learn the mechanism of simple crypto currency. (L2)

UNIT-III

Digital Signatures: DSA Algorithm, Unforgeability game, Elliptic Curve Digital Signature Algorithm (ECDSA): Decentralized identity management, public key as identities.

A Simple Crypto-currency: Goofy Coin, Scrooge Coin, Create Coins transaction. (10)

Learning Outcomes:

After completion of the unit, the student is able to

- Learn the importance of digital signature. (L2)
- Understand digital signature algorithms.(L2)

- Learn the mechanism of simple crypto currency. (L2)

UNIT-IV

Centralization vs Decentralization, Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work.

Mechanics of Bitcoin: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network. (8)

Learning Outcomes:

After completion of the unit, the student is able to

- Understand the structure of a block chain. (L1)
- Learn why it is better than a simple distributed database. (L2)
- Learn the underlying principles and techniques associated with block chain technologies. (L3)
- Familiar with the cryptographic building blocks. (L3)
- Understand typical Cryptocurrency such as Bitcoin. (L2)

UNIT-V

Storage and Usage of Bitcoins: Simple Local Storage, Hot and Cold Storage, Online Wallets and Exchanges, Payment Services, Transaction Fees.

Bitcoin Mining: The Task of Bitcoin miners, Mining Hardware, Mining pools, Mining incentives and strategies. (8)

Learning Outcomes:

After completion of this unit, student will be able to

- Learn different ways of storing Bitcoin keys, security measures. (L2)
- Understand various types of services that allow you to trade and transact with bitcoins. (L3)
- Learn how Bitcoin relies on mining. (L1)
- Who are the miners? (L1)
- How the miners are going to operate. (L1)

Course Outcomes:

Upon completion of this course student will be able to

- Understand the theoretical foundations of Distributed systems(L2)
- Learn individual components of the Bitcoin protocol make the whole system tick. (L2)
- Learn the design challenges of simple cryptocurrency system in blockchain. (L2)
- Analyze the incentive structure in a blockchain based system and critically assess its functions,benefits and vulnerabilities. (L4)
- Learn the methods of security from a combination of technical methods and clever incentive engineering. (L2)

Text Books:

1. Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained by Imran Bashir, Second Edition, Packt Publishing, 2018.
2. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction by ArvindNarayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Princeton Press, 2016.

Reference Books:

1.MasteringBitcoin: Programming the Open Blockchain by Andreas M. Antonopoulos Shroff, O'Reilly, 2nd Edition, 2017.

SOL1A103: Legal Aspects of Intellectual Property Rights

Hours per week: 3 L	**End Examination: 60 Marks**
Credits: 2	**Continuous Assessment: 40 Marks**

Preamble:

This course is designed to give an overview of the evolution of IPR. The aim is discussing the jurisprudence of IP and shall be a detailed study of the concept of property and its relation with intellectual property.

Course Objectives:

• To understand the jurisprudential and theoretical ideology behind the concepts of IPRs
• To understand the origin and development of IPRs
• To acquaint with various international conventions relating to IPR

UNIT - I

Overview of Indian Laws: Intellectual Property Rights – National & International Character; Characteristics & functions of Trademarks – Dimensions of Trademark Protection; Law relating to Copyright; Functions and Protection of Copyright; Patents – Transfer of Rights & Infringement of Patents; Geographical Indications; Plant Variety Protection & Farmers' Rights Act; Industrial Designs. Learning Outcomes:

Upon completion of the unit, the student is able to

● Understand the meaning of Intellectual Property rights. (L3)
● Get an overview of copy right and its protection. (L2)
● Know about the patents and the transfer rights. (L2)

UNIT - II

Role of International Institutions: International Instruments concerning Intellectual Property Rights; The Berne Convention; Universal Copyright Convention; The Paris Convention; Patent Co-operation Treaty; TRIPS; The World Intellectual Property Organization (WIPO) & the UNESCO; National Regime in India – Pre & Post WTO.

Learning Outcomes:

Upon completion of the unit, the student is able to

● To understand the World Intellectual Property Organization. (L3)
● To know about International Instruments concerning Intellectual Property Rights. (L2)

UNIT- III

Copyright Law: Scope of Copyright & rights of the Copyright owners; Procedure for Copyright Registration; How to License & Monetize Copyright Laws; Copyright Infringement & Practical Remedies.

Learning Outcomes:

Upon completion of the unit, the student is able to

● To know the Scope of Copyright & rights of the Copyright owners.(L2)
● To understand the procedure for Copyright Registration.(L2)

UNIT-IV

Trademark Law: Selection of Trademark & Strategy; Procedure for Trademark Registration; Licensing & Monetization Techniques for the Trademark; Trademark Opposition & Litigation; Infringement of Trademarks & Right of Goodwill.

Learning Outcomes:

Upon completion of the unit, the student is able to

- To get on overview on Trade Marks. (L2)
- To learn the right of Goodwill. (L2)

UNIT - V

Patent Law: Understanding the Criteria for Patentability; Patent Application & Registration Process; Patent Licensing& Assignment; Patent Litigation; Infringement of Patent – a) Modes of Infringement; b) National / International Infringement.

Learning Outcomes:

Upon completion of the unit, the student is able to

- To understand the procedure for filing patent application. (L2)
- To learn the patent licensing process. (L3)

Course Outcomes:

On successful completion of this course, students will be able to

- Learn the general principles in introduction of IPRs Presentation. (L2)
- Explain origin and development of IPRs Presentation. (L3)
- Understand the theoretical and ideological approaches to IP jurisprudence Presentation. (L3)
- Understand the economic importance of IPRs Presentation. (L3)
- Learn the international conventions and other documents pertaining to IPRs Presentation. (L2)

Reference Books:

1. Intellectual Property Rights: Infringement and Remedies by Ananth Padmanabhan, LexisNexis, Nagpur, 2012.
2. Principles of Intellectual Property by N.S. Gopalakrishnan, EBC, Lucknow, 2014.
3. Intellectual Property Lawby Bently and Sherman, Oxford University Press, U.K.
4. Intellectual Property LawbyPaul Torremans, Holyoak&Torremans, Oxford University Press, 2010.

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2231 Programming with JAVA

Hours per week: 3 L   **End Examination: 60 Marks**

Credits: 3   **Continuous Assessment: 40 Marks**

Preamble: The aim of the course is to make the students learn the object-oriented concepts. This course covers preliminaries and makes the students learn how to program in java using basic Concepts, Inheritance, Interfaces, Packages, Threads, I/Os, Applets, Swings and allow the students to implement them effectively.

Course Objectives:
- To identify Java language components and how they work together in applications.
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java.
- To understand how to use Java APIs for program development.

UNIT-I

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods, constructors, parameter passing, recursion, string handling.

Inheritance: Base class object, subclass, subtype, Forms of inheritance, combination, benefits of inheritance, Member access rules, super keyword ,using final with inheritance, polymorphism- method overriding, abstract classes.   (10)

Learning Outcomes:
Upon completion of the unit, the student will be able to
- Understand the basics of Java.(L2)
- Get an Overview on the Control structures.(L3)
- Understands the concepts of Classes and Instances. (L2)
- Practice the concepts of Inheritance

UNIT-II

Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.   (8)

Learning Outcomes:
Upon completion of the unit, the student will be able to
- Create, Access and Import Packages.(L3)
- Able to distinguish class and Interface.(L3)
- Implement the interface.(L4)

UNIT - III

Exception handling and multithreading: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Difference between multi-threading and multitasking, thread lifecycle, creating threads, synchronizing threads.   (8)

Learning Outcomes:
Upon completion of the unit, the student will be able to
- Learn the concepts of Exception handling and Exception types. (L1)
- Understand the concepts of throw, throws and built- in exceptions(L2).
- Differentiate multi-threading and multitasking. (L4)

- Summarize thread life cycle, synchronizing threads. (L2)

UNIT - IV

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components-labels,button,canvas,scrollbars,text components, checkbox, checkbox groups,choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types –boarder, grid, flow, card and grid bag.   (10)

Learning Outcomes:

Upon completion of the unit, the student will be able to
- Understand AWS Class Hierarchy. (L3)
- Implement user Interface Components. (L4)

UNIT -V

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swing –Introduction, limitations of AWT, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Checkboxes, Radiobuttons, Comboboxes, Tabbed Panes, ScrollPanes, Trees and Tables.   (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to
- Learn the concepts of Applets. (L1)
- Differentiate between applets and applications. (L2)
- Illustrate Applet and Swing Controls (L2)

Course Outcomes:

Upon completion of the course, the student will be able to
- Describe the concept of Java Programming Constructs and inheritance (L2).
- Realize the basic concepts of Java such as interfaces and packages (L3).
- Apply the concept of exception handling and multi-threading (L3).
- Design the applications of Java & Java applet (L4).
- Analyze& design the concept of Event Handling and Abstract Window Toolkit (L3).

Text books:
1. Java; the complete reference, Herbert Schildt, 7th edition, TMH.
2. Understanding OOP with Java, updated edition, T.Budd, Pearson education.

Reference books:
1. An Introduction to programming and OO design using Java by J.Nino and F.A.Hosch, John Wiley& sons.
2. An Introduction to OOP by T.Budd, Second edition, Pearson education.
3. Introduction to Java programming by Y. Daniel Liang, 6thedition, Pearson education.
4. An introduction to Java programming and object oriented application development by R.A.Johnson-Thomson.

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2251 IT Infrastructure Management

Hours per week: 3 L   **End Examination: 60 Marks**

Credits:3   **Continuous Assessment: 40 Marks**

Preamble:

Course Objectives:

- Learn the installation and configuration process for Windows 10 and System Center Operations Manager standard and Data Center features.
- ·Acquire knowledge on monitor services, devices, and operations for many computers in a single console by showing state, health, and performance information.
- Generate alerts for availability, performance, configuration and security situations.

UNIT-I

Windows 10 Client OS: Introducing Windows 10, Overview of Deploying Windows 10, ConfigureDevices and Drivers, Perform Post installation Configuration Tasks, Managing Apps in Windows.

(8 hours)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Deploy Windows 10 Operating System. (L5)
- Configuring Devices and Drivers. (L4)
- Perform Post Installation. (L3)

UNIT-II

Introduction to SCCM: System Center Configuration Manager Overview, SCCM Features and Capabilities, SCCM Setup & Installation, Configuration Manager Basics, Deploying SCCM Client, User and Device Collections in SCCM. (8 Hours)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Understanding System Centre Configuration Manager.(L3)
- Learning how to install & configure SCCM.(L5)
- Know the deployment & device management in SCCM.(L4)

UNIT-III

Managing Systems with SCCM: Application Management using SCCM, Operating System Deployment using SCCM, Endpoint Protection using SCCM, Troubleshooting SCCM Server, Troubleshooting SCCM Clients, and Creating Reports using SCCM Reports. (10 Hours)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Understanding application and OS deployment using SCCM. (L3)
- Learning how to troubleshoot SCCM client and server. (L3)
- Designing reports using SCCM. (L4)

Introduction to SCOM: System Center Operations Manager Overview, SCOM Features and Capabilities, SCOM Setup& Installation, Operations Manager Basics, Deploying SCOM Clients, Management Packs in SCOM   (10 Hours)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Understanding System Centre Operations Manager. (L3)
- Know about the installation, configuration & deployment of SCOM.(L4)
- Know about the Pre-installed management packs.(L4)

Monitoring Systems with SCOM : Managing & Administering SCOM Environment, Managing Alerts using SCOM, Creating Custom Management Packs and Alerts, Troubleshooting SCOM Server, Troubleshooting SCOM Clients, Creating Reports using SCOM Reporting.   (8 Hours)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Understand the administration environment to manage SCOM.(L4)
- Learn how to create custom management packs &alerts.(L5)
- Create and view of customized reports.(L5)

Course Outcomes

Upon completion of the course, the students is able to

- Install a new Windows 10 and System Center. (L5)
- Design and provision custom views to relevant support teams.(L5)
- Understand how to deploy agents.(L3)
- Work with management packs.(L3)
- Create dashboards and custom visualizations. (L3)

Recommend Books:

1. Windows 10 All-in-One For Dummies By Woody Leonhard, CiprianRusen (2021)
2. System Center Configuration Manager Current Branch Unleashed By Kerrie Meyler, Gerry Hampson, Saud Al-Mishari, Greg Ramsey, Kenneth van Surksum, Michael Gottlieb Wiles (2018).
3. Getting Started with Microsoft System Center Operations Manager By Kevin Greene(2016)

References:

1. https://www.youtube.com/watch?v=z2r-p7xc7c4

2. https://docs.microsoft.com/en-us/mem/configmgr/core/understand/introduction

3. https://docs.microsoft.com/en-us/system-center/scom/deploy-overview?view=sc-om-2019

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2271 Process Management

Hours per week: 3 L	**End Examination: 60 Marks**
Credits:3	**Continuous Assessment: 40 Marks**

Preamble:

Process Management is important because specific software is needed in almost every industry, in every business, and for every function. It becomes more important as time goes on – if something breaks within the application portfolio, a quick, efficient, and effective fix needs to happen as soon as possible.

Course Objectives:

- To provide students with a theoretical understanding of software development practices and process models.
- To understand Agile development and testing in Scrum.
- To acquire knowledge about Devops principles.
- To learn to use Lean UX, Sprint.
- To understand Design thinking principles.

UNIT - I

Software and software engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering- Software Process, Software Engineering Practice, Software Myths. Software Process Model: A Generic Process Mode, Process Assessment and Improvement, Perspective Process Models, Specialized Process Model, The Unified Process.   (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Understand the nature of Software. (L3)
- Distinguish between process models. (L4)

UNIT - II

Agile- Agile Methodology, Manifesto, Principles of Agile, Agile Methodologies, Challenges with Agile. Scrum: Overview of Scrum, Scrum Roles-Scrum Ceremonies, Scrum Artifacts, Extreme programming vs Scrum.   (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Explain Agile methodology.(L2)
- Outline Scrum. (L2)
- Differentiate Extreme Programming vs Scrum.(L4)

UNIT - III

DEVOPS: Introduction to Devops, Principles-Automation, Performance Measurement through KPIS and Metrics-Agile and Devops, Agile Infrastructure-Velocity-Lean Start-up UPS.   (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Infer Devops.(L2)
- Make use of performance Measures.(L3)

UNIT - IV

Lean UX and AGILE Anti-patterns Sprint: Staggered sprints, Sprint zero and design sprints, Dual-track Agile, Listening to Scrum's rhythms, Participation, Design is a team sport, coordinating multiple Lean UX teams, Managing up and out, Agile anti-patterns.   (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Construct new features. (L3)
- Organize and Coordinate User teams. (L4)
- Infer the most common anti patterns that agile team run into. (L3)

UNIT - V

Design thinking - Introduction to Design Thinking, Lean thinking, Actionable Strategy, The Problem with Complexity, Vision and Strategy, Defining Actionable Strategy Act to Learn, Leading Teams to Win.

                                                                                    (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to

- Spell design thinking. (L1)
- Infer different strategies. (L2)

Course Outcomes:

Upon completion of the course, the student is able to

- Understand software development practices and process models. (L3)
- Understand Agile development and testing in Scrum. (L3)
- Differentiate Devops and Agile principles. (L3)
- Use Lean UX, Sprint, Scrum
- Design thinking principles for software development. (L4)

Text Books:

1. Software Engineering: A Practioners Approach by Roger S Pressman, 7th Edition 2010.
2. Introduction to Devops by Kallori Vikraman, 1st Edition, 2016.
3. Essential of Scrum by Stephen Haunts, Addison-Wesley Professional, 1st Edition, 2012.
4. Lean UX by Jeff Gothelf, Josh Seiden, 2nd Edition, 2016.
5. Understanding Design Thinking, Lean, and Agile by Jonny Schneider, O'Reilly Media 2017.
6. Lean vs. Agile vs. Design Thinking by Jeff Gothelf, Sense and Respond Press,2017.

Websites

1. https://www.tutorialspoint.com/sdlc/sdlc_overview.htm
2. https://existek.com/blog/sdlc-models/
3. https://www.agilealliance.org/agile101/
4. https://devops.com/
5. http://theleanstartup.com/principle

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
Department Specific Elective
CSCI2281 Introduction to Cryptography

Hours per week: 3 L	**End Examination: 60 Marks**
Credits: 3	**Continuous Assessment: 40 Marks**

Preamble:
This course will emphasize on principles and practice of cryptography and network security: classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers), linear and differential cryptanalysis, perfect secrecy, public-key cryptography algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes, email and web security, viruses, firewalls, digital right management, andother topics.

Course objectives:
- To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- To familiarize Digital Signature Standard and provide solutions for their issues.
- To familiarize with cryptographic techniques for secure (confidential) communication of two parties.

UNIT – I

Introduction: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. Classical encryption techniques: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography. (8) **Learning Outcomes:**
Upon completion of the unit, the student will be able to
- Understand OSI Security Architecture.(L1)
- Interpret Classical encryption techniques.(L3)
- Define Steganography. (L1)

UNIT - II

Block cipher and data encryption standards: Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles. Advanced encryption standards: Evaluation Criteria for AES, the AES Cipher. More on symmetric ciphers: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4. Introduction to number theory: Prime Numbers, Fermat's and Euler's Theorem, Testing for primality, The Chinese Remainder Theorem, Discrete logarithms. (10)
Learning Outcomes:
Upon completion of the unit, the student will be able to
- Interpret Data Encryption Standards.(L2)
- Explain Symmetric Ciphers.(L2)
- Enumerate number theory.(L2)

UNIT - III

Public key cryptography and RSA: Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography. Message authentication and hash functions: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Functionand MACs.
HASH and MAC algorithm: Secure Hash Algorithm, Whirlpool, HMAC, CMAC. Digital Signature: Digital Signature, Authentication Protocol, Digital Signature Standard. (12)
Learning Outcomes:
Upon completion of the unit, the student will be able to

- Outline Public key crypto Systems.(L2)
- Explain Message Authentication.(L4)
- Explore Digital Signature Standard.(L4)

UNIT - IV

Authentication application: Kerberos, X.509 Authentication Service, Public Key Infrastructure. Email security: Pretty Good Privacy (PGP) and S/MIME. IP security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. (8)

Learning Outcomes:

Upon completion of the unit, the student will be able to
- Discover Authentication.(L4)
- Understand IP Security.(L3)

UNIT – V

Web security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats. Firewall: Firewall Design principles, Trusted Systems. (7)

Learning Outcomes:

Upon completion of the unit, the student will be able to
- Explain socket layer security and Transport layer security.(L3)
- Differentiate viruses and threats.(L4)
- Understand firewall design principles.(L2)

Course Outcomes

Upon completion of the course, the students is able to
- Identify basic security attacks and services. (L2)
- Use symmetric and asymmetric key algorithms for cryptography. (L3)
- Build a security solution for a given application.(L3)
- Analyze Key Management techniques and importance of number Theory.(L4)
- Understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works. (L2)
- To examine the issues and structure of Authentication Service and Electronic Mail Security. (L3)

Text books:

1. Cryptography and Network Security: Principles and Practice by William Stallings (2006), 4th edition, Pearson Education, India.
2. Network Security Essentials (Applications and Standards) by William Stallings (2000), Pearson Education, India.

Reference books:

1. Network Security: Private Communication in a Public World byCharlie Kaufman, 2nd edition, Prentice Hall of India, 2008.
2. Cryptography and Network Security by AtulKahate,2nd edition, Tata McGrawhill, 2008.
3. Network Security: The complete reference by Robert Bragg and Mark Rhodes, Tata McGrawhill, 2004.

B.Sc Computer Science with Cognitive Systems
IV SEMESTER
Department Specific Elective
CSCI2291 Mobile Computing

Hours per week: 3 L   End Examination: 60 Marks
Credits:3   Continuous Assessment: 40 Marks

Preamble:
This course enables the students to associate with an overview of the key features of the 5th Generation (5G) mobile networks, discussing the motivation for 5G and the main challenges indeveloping this new technology. This course provides a hawk's eye view over a whole host of intertwined subjects that will predominantly influence the 5G landscape, including the future Internet, cloud computing, small cells and self-organizing networks (SONs), cooperative communications, dynamic spectrum management, and cognitive radio, Broadcast-Broadband convergence, 5G security challenge, and green RF.

Course Objective:
- To understand the history of the wireless communication and core working principal of the 5G mobile networks.
- To get familiar with the concept of cooperative network architecture for 5G mobile networks and implementation of Mobile cloud.
- To understand the concept of cognitive radio technology and become familiar with the Spectrum usage and Spectrum Optimisation.
- To understand the functionalities and role of TV White Space Technology in 5G mobile network and become familiar with Broadcast-Broadband Architecture.
- To get familiar with the Security with 5G Communications, self-organizing networks (SONs) and Green Flexible RF

UNIT-I
Drivers for 5G: The 'Pervasive Connected World': Introduction, Historical Trend of Wireless Communications, Evolution of LTE Technology to Beyond , 5G Roadmap, 10 Pillars of 5G, 5G in Europe, 5G in North America, 5G in Asia, 5G Architecture.

The 5G Internet: Introduction, Internet of Things and Context-Awareness, Networking Reconfiguration and Virtualization, Mobility, Quality of Service Control, Emerging Approach for Resource Over-Provisioning

Small Cells for 5G Mobile: Introduction, What are Small Cells?, Capacity Limits and Achievable Gains with Densification, Mobile Data Demand, Demand vs Capacity, Small-Cell Challenges, Conclusions and Future Directions. Case Study on Indian Scenario.   (10)

Learning Outcomes:
After completion of this unit, student will be able to
- Understand the history of the wireless communication and implementation of 5G mobile network Architecture. (L2)
- Understand the 5G internet and its implementation with the help IOT and context-awareness. (L2)
- Understand the approach for Resource Over-Provisioning. (L2)
- Understand the construction of small cells and address the challenges with small cells. (L2)

UNIT – II
Cooperation for Next Generation Wireless Networks: Introduction, Cooperative Diversity and Relaying Strategies, PHY Layer Impact on MAC Protocol Analysis, Case Study: NCCARQ, Performance Evaluation.

Mobile Clouds: Technology and Services for Future Communication Platforms: Introduction, the Mobile Cloud, Mobile Cloud Enablers, Network Coding.   (8)

Learning Outcomes:
After completion of this unit, student will be able to
- Understand the Cooperative and Relaying Strategies for implementation of 5G network. (L2)
- Evaluate the performance of MAC protocols under realistic PHY layer conditions. (L4)
- Understand the implementation of Mobile Cloud and the concepts of network coding (L2)

Cognitive Radio for 5G Wireless Networks: Introduction, Overview of Cognitive Radio Technology in 5G Wireless, Spectrum Optimisation using Cognitive Radio, Relevant Spectrum Optimisation Literature in 5G, Cognitive Radio and Carrier Aggregation, Energy-Efficient Cognitive Radio Technology, Key Requirements and Challenges for 5G Cognitive Terminals. (8)

Learning Outcomes:

After completion of this unit, student will be able to
- Understand the implementation of cognitive radio technology. (L2)
- Get familiar with the Spectrum usage and Spectrum Optimisation. (L1)
- Understand the Requirements and Challenges for 5G Cognitive Terminals. (L2)

UNIT – IV

The Wireless Spectrum Crunch: White Spaces for 5G? : Introduction, Background, TV White Space Technology, White Space Spectrum Opportunities and Challenges, TV White Space Applications, International Efforts, Role of WS in 5G.

Towards a Unified 5G Broadcast-Broadband Architecture: Introduction, Background, Challenges to Be Addressed, Candidate Network Architectures for a BC-BB Convergent Solution, and the BC-BB Study: What Needs to Be Done. (9)

Learning Outcomes:

After completion of this unit, student will be able to
- Understand the concepts of TV White Space Technology and the role of White Space in 5G mobile network. (L2)
- Understand the opportunities and challenges with White Space Spectrum. (L2)
- Understand the Broadcast-Broadband Architecture of 5G Mobile network. (L2)

UNIT – V

Security for 5G Communications: Introduction, Overview of a Potential 5G Communications System Architecture, Security Issues and Challenges in 5G Communications Systems

SON Evolution for 5G Mobile Networks: Introduction, SON in UMTS and LTE, The Need for SON in 5G, Evolution towards Small-Cell Dominant HetNets, Towards a New SON Architecture for 5G.

Green Flexible RF for 5G: Introduction, Radio System Design, Nonlinear Crosstalk in MIMO Systems. (10)

Learning Outcomes:

After completion of this unit, student will be able to
- Understands the Challenges and Security Issues available with 5G Communications Systems. (L2)
- Understand the implementation and evolution of self-organizing networks (SON) in 5G mobile network. (L2)

Course Outcomes:

Upon completion of this course, student will be able to:
- Understand the history of the wireless communication and core working principal of the 5G mobile networks.
- Learn the key RF, PHY, MAC and air interface changes required to support 5G and implementation of Mobile cloud.
- Understand the concept of cognitive radio technology and become familiar with the Spectrum usage and Spectrum Optimization.
- Implementation of functionalities and role of TV White Space Technology in 5G mobile network and understand the concepts of Broadcast-Broadband Architecture.
- Understand the Security concerns related with 5G Communications, self-organizing networks (SONs) and Green Flexible RF.

Text Book:
1. Fundamentals of 5G Mobile Networks by Jonathan Rodriguez, Wiley,1st Edition, 2015

Reference Books:
1. 5G Mobile and Wireless Communications Technology by AfifOsseiran, Jose F. Monserrat, Patrick Marsch, Cambridge University Press, 1st Edition, 2015
2. Essentials of LTE and LTE-A by AmitabhaGhosh and RapeepatRatasuk, Cambridge University Press.

Department Specific Elective
CSCI2301 Mean Stack Development

Hours per week: 3 L	End Examination: 60 Marks
Credits:3	Continuous Assessment: 40 Marks

Preamble:

MEAN is a combination of user-friendly JavaScript frameworks that are ideal for building dynamicapplicationsandwebsiteswhicharesomeofthemostexcitingandinnovativetechnologiesemerging in the world of Web Development asset of tools. It is an open-source stack and free, designed to offer developers an organized and quick method of making quick prototypes Mean -based web apps. The main benefit of mean-stack is that one language -JavaScript, is used/runs at every level of the app, making it a modern and efficient approach to web development.

Course Objectives:

- Learn and understand the fundamental basics what is MEAN stack.
- Learn Mongo DB-a schema-less(document-oriented) No SQL database.
- KnowExpress.js: aserver-sideJavaScriptframeworkrunningontopofNode.js.
- What is Angular: a browser-independent MVC Java Script UI framework.
- Write Node.js: a server-side Java Script run-time.

UNIT - I

Introducing the Node.js-to-Angular Stack: Understand basic Web Development Framework, Understand Node.js-to-Angular Stack Components.

JavaScript Primer: Define variables, Understand JavaScript Data Types, Using Operators, Implementing Looping, Creating Functions, Understanding Variable Scope, Using JavaScript Objects, Manipulating Strings, Working with Arrays, Adding Error Handling. (10)

Learning outcomes:

By the end of the unit, the student will be able to:

- Understand the Basic Web Development Framework. (L2)
- Identify the Node.js-to-Angular Stack Components. (L1)
- List Java script Data types and demonstrate the use of operators in Java Script.(L1)
- Illustrate the implementation of LOOPs. (L3)
- Brief understanding of working with Arrays, Strings, Functions, Error handling. (L2)

UNIT-II

Learning Node.js: Getting Started with Node.js, Understanding Node.js, Installing Node.js, Working with Node Packages, Creating a Node.js Application,

Using Events, Listeners, Timers, and Callbacks in Nodes.js: Understanding the Node.js Event Model, Adding Work to the Event Queue, Implementing Call backs. (10)

Learning outcomes:

By the end of the unit, the student will be able to:

- What is Node.js and houses. (L1)
- List the steps to Install Node.js. (L1)
- What are the Node Packaged modules. (L2)
- UnderstandtheNode.js Event Model.(L3)
- How to implement Event Emitters and Listeners.(L3)

UNIT-III

Handling Data I/OinNode.js: Working with JSON, Using the Buffer Module to Buffer Data, Using the Stream Module to Stream Data, Compressing and Decompressing Data with Zlib.

Understanding HTTP Services in Node.js: Processing URLs, Processing Query Strings and Form Parameters, Understanding Request, Response, and Server Objects. Implement HTTP Clients and Servers in Node.Js.

Understanding Socket Services in Node.js: Understanding Network Sockets, Implementing TCP Socket Server and Socket Objects. Implementing TCP socket Servers and Clients. (10)

Learning outcomes:

By the end of the unit, the student will be able to:
- Learn to work with JSON.(L2)
- Demonstrate the use of Buffer module to Buffer Data.(L2)
- ImplementHTTPservicesinNode.js.(L3)
- Understand Network Sockets.(L2)
- Implement TCP socket servers and Socket Objects.(L3)

UNIT-IV

Understanding NoSQL and MongoDB: Why NoSQL?, Understanding Mongo DB, MongoDB Data Types, Planning Your Data Model.

Getting Started with MongoDB: Building the MongoDB Environment, Administering User Accounts, Configuring Access Control, Administering Databases, Managing Collections. **Getting Started with MongoDB and Node.js:** Adding MongoDB Driver to Node.js , Connecting to MongoDB from Node.js, Understanding the Objects Used in the MongoDB Node.js Driver, Accessing and Manipulating Databases, Accessing and Manipulating Collections.(10)

Learning outcomes:

By the end of the unit, the student will be able to:
- Understand why No SQL.(L1)
- Explain MongoDB –collections and documents.(L3)
- List the data types used.(L1)
- Learn steps to Install MongoDB and build the environment.(L2)
- Connect to MongoDB from Node.js.(L3)
- Familiarize accessing and manipulating databases.(L3)

UNIT-V

Using Express: Implementing Expression Node.js.

Learning Angular: Jumping into Type Script, Getting Started with Angular, Angular Components, Expressions, Data Binding, Built-in Directives.(8)

Learning outcomes:

By the end of the unit, the student will be able to:
- Get started with Express. (L2)
- Brief understanding of implementing Express in Node.js. (L2)
- Learn what is Angular. (L1)
- Identity the benefits Angular provides. (L2)
- What are the Angular components, expressions. (L2)
- Understand Data Binding.(L2)

Course Outcome:

By the end of the course, the student will be able to:
- Implement Node.js as a server-side Java Script run-time. (L3)
- Create a simple Node.Js application. (L3)
- Develop Http and services in Node.js. (L3)
- Develop MongoDB-a schema-less(document-oriented) NoSQL database. (L3)
- ImplementExpress.js as aserver-sideJavaScriptframeworkrunningontopofNode.js. (L3)
- Explain about the Angular as a browser-independent MVC JavaScript UI framework. (L3)

Text Book:

1.Node.js,MongoDBandAngularWebDevelopment by BradDayley, BrendanDayley, CalebDayley, Pearson EducationInc., 2ⁿᵈEdition, 2018.

Reference Books:

1. Write Modern Web Apps with the MEANStack: Mongo, Express, Angular JS andNode.js by JeffDickey, Peachpit Press, 2015.
2. Web Development with Node & Express by Ethan Brown, O'reilyMedia,2014.

CSCI2261 IT Infrastructure Management Lab

Hours per week: 2 P   **Credits:1**
                                                               Continuous Assessment: 100 Marks

Course Objectives:
- Learn the installation and configuration process for Microsoft Windows 10 and System Center Operations Manager standard and System Center features.
- Acquire knowledge on monitor services, devices, and operations for many computers in a single console by showing state, health, and performance information, as well as alerts generated for availability, performance, configuration and security situations.

List of programs:

1. Windows 10

   a. Explain the Deployment Overview of Windows 10

2. System Center Configuration Manager (SCCM)
   a. Installation of SCCM Server
   b. Deployment of SCCM Agents
   c. Explain the OS and Software Deployment using SCCM
   d. Generate Reports for SCCM

3. System Center Operations Manager (SCOM)
   a. Installation of SCOM Server
   b. Deployment of SCOM Agents
   c. Explain the Deployment and Customization of Management Packs in SCOM
   d. Create Alerts and Notifications using SCOM
   e. Generate Reports for SCOM

Course Outcomes:

On successful completion of the course the students should be able to
1.   Install a new Microsoft Windows 10, System Center and Operations Manager ManagementGroup.
2.   Design and provision custom views to relevant support teams.
3.   Understand how to deploy agents.
4.   Work with management packs.
5.   Create dashboards and custom visualizations.
6.   Tune, optimize, maintain and troubleshoot System Center Operations Manager.

Recommended Books:
1. Windows 10 All-in-One For Dummies By Woody Leonhard, CiprianRusen (2021) [PDF]
2. System Center Configuration Manager Current Branch Unleashed By Kerrie Meyler, Gerry Hampson, Saud Al-Mishari, Greg Ramsey, Kenneth van Surksum, Michael Gottlieb Wiles (2018)
3. Getting Started with Microsoft System Center Operations Manager By Kevin Greene(2016).

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2211 Artificial Intelligence Lab

Hours per week: 2 P

Credits:1   **Continuous Assessment: 100 Marks**

Course Objectives:
- To understand and write program in PROLOG.
- To design and implement various list and set operation using PROLOG.
- To design and implement the algorithms.

List of Programs:

Write the following programs using PROLOG

1. Program to read address of a person using compound variable.
2. Program of fun to show concept of cut operator.
3. Program to count number of elements in a list.
4. Program to find member of a set.
5. Program to concatenate two sets.
6. Program to find permutation of a set.
7. Program to demonstrate family relationship.
8. Write a program to solve N-queens problem
9. Solve any problem using depth first search.
10. Solve any problem using best first search.
11. Solve traveling salesman problem.

Course Outcomes:

Upon completion of the course, the student is able to:

1. Familiarize with PROLOG environment.

2. Build PROLOG program using facts, predicates and clauses

3. Develop searching techniques.

Suggested Readings:

1. Artificial Intelligence (SIE) by Kevin Night and Elaine Rich, Nair B.,McGraw Hill- 2017.

2. Introduction to AI and ES by Dan W. Patterson, Pearson Education, 2007.

3. PROLOG: Programming for Artificial Intelligence by Ivan Brako, 3rd edition Pearson, 2011.

4. Introduction to Expert Systems by Peter Jackson, 3rd Edition, Pearson Education, 2007.

5. AI – A Modern Appro by Stuart Russel and Peter Norvig, 2nd Edition, Pearson Education 2007.

6. Artificial Intelligence by Deepak Khemani, Tata McGraw Hill Education 2013.

Web Sites https://nptel.ac.in/courses/106/105/106105077/

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
CSCI2241 Programming with Java Lab

Hours per week: 2 P

Credits:1   **Continuous Assessment: 100 Marks**

Course Objectives:
- Practice programming in the Java.
- Gain knowledge of object-oriented paradigm in the Java programming language.
- Learn use of Java in a variety of technologies and on different platforms.

Course Outcomes:
- Able to user and implement programming constructs of Java.
- Create and work with files using file streams.
- Create and run Applets on standalone machines.
- Develop standalone applications using Multithreading concepts of Java

Week 1:

a) Write Java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a,b,c and use the quadratic formula. If the discriminant $b^2- 4ac$ is negative, display a message stating that there are no real solutions. The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value in the Fibonacci sequence.

Week2:

a) Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer.

Write a Java program to multiply two given matrices.

Week3:

a)   Write Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.

b)   Write Java program that for sorting a given list of names in ascending order.

c)   Write Java program that to make frequency count of words in a given text.

Week4:

a)   Write a Java program that reads a filename from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable,
the type of file and the length of the file in bytes.

b)   Write a Java program that reads a file and displays the file on the screen, with a line number before each line.

c)   Write a Java program that displays the number of characters, lines and words in a text file.

Week5:

a) Develop an applet that displays a simple message.

b) Develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.

Week6:

Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the+,-,*,% operations. Add a text field to display the result.

Week7:

Write a Java program for handling mouse events.

Week8:

a) Write a Java program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

b) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

Week9:

Write a java program that creates a user interface toper form integer divisions. he user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

Week10:

a) Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.

b) Write a java program that allows the user to draw lines, rectangles and ovals.

Week11:

a) Write a java program that create an abstract class named Shape that contains an empty method named number of Sides(). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides() that shows the number of sides in the given geometrical figures.

b) Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using J table component.

Textbooks:

1.   Java How to Program by H.M.Dieteland P.J.Dietel, Sixth   Edition, Pearson Education/PHI.

2.   Introduction to Java programming by Y.DanielLiang, Sixth edition, Pearson Education

3.   Big Java by CayHorstmann,2nd edition, Wiley Student Edition, Wiley India Private Limited.

B. Sc Computer Science with Cognitive Systems
IV SEMESTER
FPEA2131 Introduction to Indian Philosophy

Hours per week: 3 L
Credits:2   **Continuous Assessment: 100 Marks**

Preamble: The course will focus on understanding and explaining about the different philosophical systems of India. Starting with understanding the history of Indian Philosophy and it being an integral and internal part of Sanatana Dharma or the later Hindu religion will be discussed. The main part of Indian Philosophy of Vedanta and its different attributes will be taught. The different orthodox and heterodox philosophies along with a brief introduction of their progenitors will be taught in this course. Along with the Hindu Philosophies in the contemporary language, the Buddhist and the Jaina philosophies that originated on this land will also be taught and understood.

Course Objectives
- To introduce the nature of philosophical thinking.
- To infer the major issues, raised and discussed from the dawn of philosophical inquiry.

UNIT - 1

Introduction: Introduction and Definitions of Philosophy - Etymology; Definitions, Rise of Philosophical Schools in India - Origins and History; Orthodox Schools; Heterodox Schools

Learning outcomes:
By the end of the unit, the student will be able to:
1. Understand the meaning of philosophy in general. (L2)
2. Understand the history of Indian Philosophy. (L2)
3. Acquire knowledge about the different historical origins of the Indian Philosophical systems and their background information. (L1)

Reference Books:
1. S Radhakrishnan. (1923). Indian philosophy. London, G. Allen &Unwin, Ltd.; New York, The Macmillan Company.
2. Frauwallner, E., &Bedekar, V. M. (2008). History of Indian philosophy. MotilalBanarsidass Publishers.
3. Gotshalk, R. (1998). The beginnings of philosophy in India. University Press of America.

UNIT – II

Different Schools of Indian Philosophy- 6 Darshanas' of Indian Philosophy – Samkhya; Yoga; Nyaya; Vaisheshika; PurvaMimamsa; UttaraMimamsa - Nastika Schools of Indian Philosophy –Buddha; Jaina; Ajnana; Ajivika; Charvaka

Learning outcomes:
By the end of the unit, the student will be able to:
1. Gain insights into the understanding of Vedanta. (L2)
2. Acquire knowledge about the different orthodox schools of Indian Philosophical system(L1)
3. Talk about the importance of the Orthodox philosophical systems in the Indian Knowledge traditions. (L2)
4. Distinguish between Orthodox and Heterodox schools of Indian Philosophy (L4)

Reference Books:
1. V NithyananthaBhat, &Sukṛtīndra Oriental Research Institute. (2019). Vedānta and the modern world and other indological essays. Sukṛtīndra Oriental Research Institute.
2. Johnson, W. J. (2008). The Bhagavad Gita. Oxford University Press.
3. Harshananda, S. (2001). The Prasthānatraya : an introduction. Ramakrishna Math.

Indian Philosophies – I- Sri Shankaracharya's Advaita Philosophy – Etymology; History; Shankaracharya's Life; Metaphysical concepts; Nature and God; Concept of Liberation; Texts; Influence; Establishment of Mathas; Lineage - **Sri Ramanujacharya'sVisistadvaita Philosophy** – Etymology; History; Ramanujacharya's Life: Metaphysical Concepts; Social Conditions; Nature of God; Concept of Liberation; Texts; Influences; Temples; Lineage

Sri Madhvacharya'sDvaita Philosophy – Etymology; History; Madhvacharya's Life; Dvaita as a revolution; Metaphysical concepts; nature of God; Concept of Liberation; Texts. Udupi KrishnaTemple; Lineage

Learning outcomes:

By the end of the unit, the student will be able to::

1. Gain knowledge about Sri Shankaracharya's Advaita Philosophy and its core of understanding life. (L2)
2. Gain knowledge about Sri Ramanujacharya's Visistadvaita Philosophy along with its historical background. (L2)
3. Gain knowledge about Sri Madhvacharya's Dvaita Philosophy and the major difference that it has focused on and the societal conditions that are indirectly responsible. (L2)

Reference Books:

1. Ramakrishna Mission. Institute Of Culture. (2001). The Cultural heritage of India. The Ramakrishna Mission Institute Of Culture.
2. Burmester, E. N. (1955). The Advaita Vedanta philosophy of ShriShankaracharya. San Bernardino, Calif., Enbe.
3. R Balasubramanian, Project of History Of Indian Science, Philosophy, And Culture, & Civilizations, I. (2010). AdvaitaVedānta. Centre For Studies In Civilizations ; Delhi.
4. C R SrīnivāsaAyyangār. (1909). The life and teachings of Sri Ramanujacharya. R. Venkateshwar.
5. Sharma, B. N. K., & Philosophy, I. (1996). Dvaita philosophy as expounded by Śrī Madhvācārya. Radhakrishnan Institute For Advanced Study In Philosophy, University OfMadras.

Indian Philosophies – II - Sri Nimbarka'sDviatadvaita Philosophy – Etymology; History; Nimbarka's Life; Metaphysical Concepts; Social Conditions; Nature of God; Concept of Liberation; Texts; Influences; Lineage. **Sri Vallabhacharya'sShuddhadvaita**Philosophy - Etymology; History; Vallabhacharya's Life; Metaphysical Concepts; Social Conditions; Nature of God; Concept of Liberation; Texts; Influences; Lineage. **Sri Chaitanya Mahaprabhu's AchintyaBhedaAbheda Philosophy** - Etymology; History; Chaitanya Mahaprabhu's Life; Metaphysical Concepts; Social Conditions; Nature of God; Concept of Liberation; Texts; Influences; Lineage

Learning outcomes:

By the end of the unit, the student will be able to::

1. Gain knowledge about Sri Nimbarka'sDviatadvaita Philosophy and gist of the preachings. (L2)
2. Gain knowledge about Sri Vallabhacharya'sShuddhadvaita Philosophy and make sense of the metaphysical concepts of it. (L2)
3. Gain knowledge about Sri ChaitanyaMahaprabhu'sAchintyaBhedaAbheda Philosophy and learn the Bhakti concept of this system. (L2)

Reference Books:

1. Srinivasachari, P. N. (1996). The Philosophy of Bhedābheda. Adyar Library.

2. Narain, K. (2004). The philosophy of the Vāllabha school of Vedānta. Indological Research Centre.
3. VinodaThakura, S. Bh. (n.d.). Sri ChaitanyaSiksamrta (The Nectarean Teachings of Lord Chaitanya) (2016th ed.) [Review of Sri ChaitanyaSiksamrta (The Nectarean Teachings of Lord Chaitanya)]. Nitai Gaur Chandra Deva Trust.

UNIT - V

Introduction to Buddhist and Jaina Philosophies - Introduction to Buddhist Philosophy – Origins; History; Early Buddhism; Texts; Different Buddhist Schools.**Introduction to Jaina Philosophy** – Origins; History; Metaphysical concept; Basic Constituents of Reality; Ethics; Texts.

Learning outcomes:

By the end of the unit, the student will be able to:

1. Understand about the Buddhist Philosophy from a bird's eye view. (L2)
2. Acquire knowledge about the Jaina Philosophy in brief. (L2)
3. Appreciate the different philosophical systems that the country has with many variations but one goal. (L4)

Reference Books:

1. SurendranathDasgupta. (2012). A history of Indian philosophy. 1, Philosophy of Buddhist, Jaina and Six Systems of Indian thought. Motilal Banarsidass.
2. Potter, K. H. (2002). Encyclopaedia of Indian philosophies / 8. Buddhist philosophy from 100 to 350 A.D. MotilalBanarsidass.
3. VirchandRaghavji Gandhi, & Desai, K. (2009). The Jaina philosophy. World Jain Confederation.

Course Outcomes:

Upon completion of the course, the student is able to

● Gain a brief understanding regarding Philosophy in general and Indian Philosophy in particular.
● Understand the history of Indian Philosophy.
● Acquire knowledge about the six schools of Indian Philosophy.
● Gain insights into the Vedantic Intellectual treasure from a bird's eye view.
● Gain a brief knowledge about the different philosophies that originated in India along with their Progenitors

B.Sc Computer Science with Cognitive Systems
V SEMESTER
GAP-706: COGNITIVE PSYCHOLOGY

Hours per week: 4L   **End Examination : 60 Marks**

Credits: 4   **Continuous assessment : 40 Marks**

INTRODUCTION: Cognitive Psychology has a lot of application value. In this paper, students are introduced to different brain related aspects of our behavior such as attention, perception, learning, memory and, decision making etc.. Students will be taught about each of these aspects of cognitive behavior and the theories related to these concepts. Along with this background, students will also learn how to improve cognitive behavior related to different areas such as learning, memory, attention and decision making etc. All these functions are directly related to effective functioning of an individual. Thus, during this course, students will develop great insight into application of psychological knowledge to human life.

COURSE OBJECTIVES:

- To introduce basic concepts and theoretical developments in the area of perception, memory, attention, language and reasoning.
- To make them understand how the study of failures in cognition for special populations can enhance the understanding of normal cognitive processes.
- Understand the brain and its cognitive functioning by exploring different paradigms in cognitive psychology
- Describe the basic processes and theories involved in attention and perception.
- Explore the processes of language acquisition & production and emotional expression

UNIT- I

FOUNDATION AND APPROACHES: What is Cognitive Psychology? Definition of Cognitive Psychology; brief history of cognitive Psychology; Research methods in Cognitive Psychology; Paradigms of Cognitive Psychology; Cognitive Neuro Psychology and Cognitive Neuroscience.

UNIT- II

VISUAL PERCEPTION AND ATTENTION: Basic processes in visual perception; Object recognition; Perception, motion and action; Attention and performance limitations

UNIT- III

CONCEPTS OF LEARNING AND MEMORY: Concept, theories and principles of Learning; Concepts of memory: Types of memory – forgetting - types of forgetting, memory enhancing techniques

UNIT- IV

LANGUAGE & EMOTIONS: Reading and speech perception; Language and comprehension; Language production, Theories of emotions.

UNIT -V

THINKING AND REASONING: Program solving and expertise; creativity; Reasoning: deductive and inductive reasoning; Judgment and decision making. Individual and gender differences in cognition.

METACOGNITION: From social cognition to metacognition; Illusions of knowing-knowledge and meta knowledge; The feeling of knowing as a judgment; Progress in metacognitive social psychology; Connectionism and metacognition.

COURSE OUTCOMES:

After this course, the students will be able to:

- Understand well established theories of cognitive domains such as attention memory, comprehension, problem-solving, reasoning and decision-making.
- Gain fundamental knowledge related to the brain's functioning and behavior in the areas of Perception, Memory, Learning and Thinking etc.
- Understand logical thinking and decision making.
- Apply this knowledge to problem solving in everyday life.
- learn how to enhance memory and apply cognitive psychology concepts for problem solving and metacognition

Text & Reference Books

1. Eysenck, M. W., & Keane, M.T., (2020). Cognitive psychology: A student's handbook, 8th Edition, Psychology Press, Hove [u.a.]
2. Goldstein, E. B. (2019) Cognitive Psychology: Connecting Mind, Research, and Everyday Experience, 5th edition. Boston, MA: Cengage.
3. Pandey, J (2000). Psychology in India revisited: Developments in the discipline by., Vol.1, Physiological foundation and human cognition, SAGE, New Delhi.
4. Robinson-Riegler, B. & Robinson-Riegler, L. (2008). Cognitive Psychology: Applying the Science of the mind. Pearson Ed.
5. Smith, E.E. & Kosslyn, S. (2007). Cognitive psychology: Mind and Brain, Pearson.
6. Srinivasan, N., Gupta, A. K., & Pandey, J., Volume 1., (2008). Advances in cognitive science., Sage Publications, New Delhi.
7. Solso (2009). Cognitive psychology, Pearson Publications, New Delhi.

V SEMESTER
CSCI3111: CLIENT RELATIONSHIP MANAGEMENT

Hours per week: 3L	**End Examination : 60 Marks**
Credits: 3	**Continuous Assessment : 40 Marks**

Preamble : This course enhances skills of server-side and Client side scripting and Debugging. It also provides clear idea about the concepts of AZAX User Interface Modules.

Course Objectives:
- To Acquire knowledge about the ServiceNow platform.
- To get comprehensive knowledge of UI Customization.
- To get acquainted with various Relationships in serviceNow.
- To use Workflows for process automation.
- To Understand Client-side and Server-side APIs.

UNIT - I

The Interface - Versions, Frames, Important application menus and modules, Content Frame, UI Settings and Personalization **Lists and Forms** – List V2 versus List V3, Lists and Tables, Forms. (9 hours)

Learning Outcomes:

After completion of this unit students will be able to:
- Understanding the importance of menus and modules.(L2)
- Know about the UI settings.(L1)
- Learn about Lists and forms.(L1)

UNIT –II

UI Customization - Branding your Instance, Custom Themes, UI-Impacting, System Properties, Configuring Service Portal UI, Creating a Custom Homepage, Styling Pages and Widgets, Setting up the War Room Page, Styling the CMS.   (9 hours)

Learning Outcomes:

After completion of this unit students will be able to:
- Know about Custom Themes.(L1)
- Understand the UI-Impacting System Properties.(L2)
- Understand the Styling Pages and Widgets.(L2)

UNIT – III

Understanding Data and Relationships - One to many relationships in Service Now, many to many relationships in ServiceNow, Enforcing one to one relationships, Defining Custom Relationships, Database table inheritance.   (10 hours)

Learning Outcomes:

After completion of this unit students will be able to:
- Identify different types of Relationships in serviceNow.(L4)
- Understand   Custom Relationships.(L2)
- Know Database table inheritance.(L1)

UNIT-IV

Tasks and Workflows – Important Task fields, Journals, and the activity formatter, Extending the task table, Workflows, SLAs, Approvals, Assignment, Creating Task fields.

UI and Data Policies – UI Policies, Reverse if false, Scripting in UI policies, UI Policy Order, Data Policies, Converting between data and UI Policies, Data Policies versus ACLs. (9 hours)

Learning Outcomes:

After completion of this unit students will be able to:

- Learn about Task fields and activity formatters.(L2)
- Outline and manage workflows.(L4)
- Understand the UI policies, UI Policy Order and Data Policies .(L2)

UNIT - V

User Administration and Security – Users, Groups and Roles, Emails and Notifications, User Preferences, ACLs – Security Rules.

Introduction to Scripting – Client-side versus Server-side APIs, Where scripting is supported, Integrated development environment.   (9 hours)

Learning Outcomes:

After completion of this unit students will be able to:
- Identify the Users, Groups and Roles.(L4)
- Learn ACLs – Security Rules.(L1)
- Understand the Client-side versus Server-side APIs .(L2)

Course Outcomes:

Upon completion of the course, the student is able to
- Understand about the ServiceNow platform.
- Know about UI settings ,lists and forms.
- Learn about Custom Themes, Styling Pages and Widgets.
- Understand Custom Relationships and Database table inheritance.
- Learn about UI policies, UI Policy Order and Data Policies .
- Identify the Users, Groups and Roles.

Suggested Readings:

1. Learning ServiceNow: Administration and development on the Now platform, for powerful automation by TimWoodruff, 2nd Edition, Packt Publishing Ltd.,2018.
2. ServiceNow CookBook by Ashish Rudra Srivastava, Packt PublishingLtd, 2017.
3. Mastering ServiceNow Scripting by Andrew Kindred, Packt Publishing, 2018.

Reference Links :

1. https://www.servicenow.com/products/it-service-management.html
2. https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doc-type/resource-center/data-sheet/ds-itsm.pdf
3. https://www.guru99.com/servicenow-tutorial.html

V SEMESTER
CSCI3121: DIGITAL TECHNOLOGY

Hours per week: 3 L   **End Examination: 60 Marks**
Credits: 3   **Continuous Assessment: 40 Marks**
Preamble: This course provides an overview of Robotic Process Automation and its tools. It helps students to explore various digital technologies like cloud, big data, AI, Digital marketing and social media. It will provide foundational knowledge of Automation Anywhere Enterprise components and its architecture and creation of bots. This course opens new dimensions to the students to make them explore in Process Automation and Bot creations that will be useful in day to day repeated activities in industries.

Course Objectives:

- To understand the fundamental concepts of digital technology.
- To introduce the concepts of cloud, big data, digital marketing.
- To introduce the principles of Artificial Intelligence, Blockchain technology.
- To recognize the use of Digital technology in various Industries.
- To understand the principles of Automatix, Automation Anywhere.
- To understand and create Bots.

UNIT –I
DIGITAL PRIMER : Why is Digital Different?- Digital Metaphors, On Cloud 9, A Small Introduction to Big Data, Social Media & Digital Marketing,Artificial Intelligence, Unchain the Blockchain, Internet of Everything, Immersive Technology. (9 hours)

Learning Outcomes:

After completion of this unit students will be able to
- Understand Digital Metaphors on Cloud.(L2)
- Know about features of Big Data.(L2)
- Understands BlockChain.(L2)

UNIT - II
DIGITAL FOR INDUSTRIES : Manufacturing and Hi-tech-Banking and Financial Services, Insurance and Healthcare, Retail-Travel & Hospitality,Communications, Media & Information Services – and Government. (10 hours)

Learning Outcomes:

After completion of this unit students will be able to understand the
- Importance of Digital technology in financial and banking services.(L2)
- Importance of Digital technology in Insurance and Healthcare.(L2)
- Importance of Digital technology in Travel and Hospitality.(L2)
- Importance of Digital technology in Communication and Media.(L2)
- Importance of Digital technology in Government.(L2)

UNIT - III
AUTOMATIX - Art of RPA: Introduction - Setting the Context, RPA Prelude, RPA Demystified, RPA vs BPM, RPA Implementations, RPA in Industries, RPA Tools, Automatix. (9 hours)

Learning Outcomes:

After completion of this unit students will be able to
- Outline the Robotic Process Automation.(L2)
- Learn the implementation of RPA.(L)2
- Know Business Process Management in Robotic Process Automation.(L2)
- Learn Robotic Process Automation tools.(L2)

UNIT –IV

AUTOMATION ANYWHERE: Getting Started with an AA Enterprise,   Exploring AA Enterprise, AA Enterprise – Architecture.   (10 hours)
Learning Outcomes:
After completion of this unit students will be able to
- Learn and analyze the meaning of Automation Anywhere.(L4)
- Present the architecture of AA.(L2)

UNIT – V

Knowing the Bots : More About Task Bots, assess your learning, AA Enterprise, All About Recorders , Designers , Medabots, Cognitive RPA.   (9 hours)
Learning Outcomes:
After completion of this unit students will be able to
- Present the Task bots.(L1)
- Understand recorders.(L1)
- Understand Designers.(L1)
- Explain Cognitive Robotic Process Automation.(L2)

Course Outcomes:

On successful completion of the course, the student will be able to

- Understand the fundamental concepts of digital technology.
- Comprehend the concepts of cloud, big-data.
- Familiarize the principles of Artificial Intelligence, Blockchain technology.
- Recognize the use of Digital technology in various Industries.
- Understand the principles of Automatix, Automation Anywhere.
- Create bots and understand its various types.

Suggested Readings
1. Getting started with RPA using Automation Anywhere: Automate your day-to-day Business Processes using Automation Anywhere (English Edition) by Vaibhav Srivastava
2. Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere by Arun Kumar Asokan and Nandan Mullakara
3. The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization by Kelly Wibbenmeyer.

Reference Links:
1. https://en.wikipedia.org/wiki/Robotic_process_automation
2. https://en.wikipedia.org/wiki/Automatix_(software)
3. https://www.automationanywhereuniversity.com/
4. https://www.automationanywhere.com/in/products/iq-bot

B.Sc Computer Science with Cognitive Systems
V SEMESTER
CSCI3141 SOFTWARE TESTING

Hours per week: 3 L   **End Examination: 60 Marks**
Credits: 3   **Continuous Assessment: 40 Marks**
Preamble: This course is designed to help the students to gain an in-depth knowledge of concepts such as Selenium automation Testing Tool, Web Framework WebDriver, Java testing framework TestNG, Selenium Grid and Test Automation framework. This includes real-world examples to learn Selenium and WebDriver effectively. This course prepares the students to take up Software testing positions in the IT sector.

Course Objectives:
- To study fundamental concepts in software testing and foundations of Selenium.
- To explore various types of testing tools and study types of drivers.
- To work with various types of gestures and understand Browser Agnostic Features.
- To get exposure with the TestNG tool and understand testing framework components.
- To configure and set up the Selenium Grid.

UNIT -I

Software Testing, Automation Testing,Selenium Basics: Introduction to Selenium and its core components, Selenium IDE Features, Selenium Download and Installation, Selenium ecosystem, Creating Scripts using Firebug and Its Installation, Locator Types, Selenium Software testing fundamentals (Test Automation Using Selenium WebDriver with Java)   (10 Hours)

 Learning Outcomes:

 By the end of this Unit, the student will be able to
- Understand the need of software testing.(L1)
- Install the selenium and configure it in the local machine.(L3)
- Write different types of scripts using firebug.(L2)
- Explain the foundations of software testing(L2).

UNIT – II

Selenium WebDriver: Web Driver Fundamentals: Basic WebDriver Usage, Locating WebElements, Keyboard Actions, Mouse Actions, **Remote WebDriver:** Selenium WebDriver Architecture, Creation of RemoteWebDriver objects. (Hands on Selenium Web Driver with Java – O'Reilly)   (12 Hours)
Learning Outcomes:
By the end of this Unit, the student will be able to
- Explain the significance of web drivers in software testing.(L2)
- Apply various web elements and work around event handling during testing.(L3)
- Work with a remote web driver(L3).
- Understand WebDriver Architecture and creation of objects.(L1)

UNIT – III

User Gestures: RightClick and DoubleClick, Mouseover, drag and drop, click and hold, copy and

paste, Waiting Strategies – Implicit Wait, Explicit wait, Fluent Wait, **Browser Agnostic Features:** Executing JavaScript, Timeouts, Screenshots, Dropdown Lists, Dialog Boxes, Web Driver Exceptions. (Hands on Selenium Web Driver with Java –O'Reilly)   (12 Hours)

Learning Outcomes:

By the end of this Unit, the student will be able to
- Handle different types of end-user gestures.(L2)
- Write scripts to handle different strategies to manage the testing process.(L3)
- List out various types of browser agnostic features.(L2)
- Handle web driver exceptions.(L2)

UNIT – IV

Testing with TestNG:Introduction to TestNG, Overview of data driven testing, Testing Framework: parameterized Tests, Filtering Tests, Ordinary Tests, Retrying Tests, Parallel Test Execution, Disabled Tests. Test Automation Framework. (Hands on Selenium Web Driver with Java –O'Reilly) (10 Hours)

Learning Outcomes:

By the end of this Unit, the student will be able to
- Understand the role of TestNG in software testing.(L1)
- List different types of Tests in Testing Framework.(L2)
- Understand the overview of Data Driven Testing.(L1)
- Explain the flow of Test Automation Framework.(L2)

UNIT –V

Setting up Selenium Grid: Exploring Selenium Grid, Understanding the hub, understanding the node, Modifying the existing test script to use selenium Grid, Configuring Selenium Grid, Designing Selenium Grid, Selenium Grid Console(Learn Selenium, by UnmeshGundecha, Carl Cocchiaro, July 2019, Packt Publishing, OReilly)(12 Hours)

Learning Outcomes:

By the end of this Unit, the student will be able to
- Understand the role of Grid and hub in selenium Grid.(L1)
- Write and update the existing scripts to work with Grid.(L3)
- Configure and Setting up with Selenium grid.(L3)
- Explain the need for a selenium grid console.(L2)

Course Outcomes:

Upon completion of the course, the students are expected to:
- Explore the foundation concepts of software testing and be able to work with Selenium Tool.
- Understand Web Driver Architecture, web Elements and its corresponding actions
- Use different types of user interactive gestures and explore Browser Agnostic Features.
- Work with the TestNG tool and with the relevant components for testing the applications.
- Understand the significance of Selenium Grid and be able to configure the selenium grid

& work around the grid console.

TextBooks:
1. Hands-On Selenium WebDriver with Java, Boni Garcia, April 2022, O'Reilly Media, Inc.
2. Test Automation Using Selenium WebDriver with Java, Navneesh Garg, AdactIn Group Pty Ltd. Copyright 2014
3. Learn Selenium, UnmeshGundecha, Carl Cocchiaro, July 2019, Packt Publishing

Reference Links:
1. https://www.guru99.com/installing-selenium-webdriver.html
2. https://www.edureka.co/blog/selenium-grid-tutorial
3. https://knolx.knoldus.com/session/content/608ba4bbe0f1f67952f4ae40
4. https://www.guru99.com/introduction-to-selenium-grid.html
5. https://www.lambdatest.com/blog/selenium-grid-setup-tutorial/
6. https://www.slideshare.net/knoldus/introduction-to-selenium-grid

B.Sc Computer Science with Cognitive Systems
V SEMESTER
Department Specific Elective - II
CSCI3161: CYBER SECURITY

Hours per week: 3 L   **End Examination: 60 Marks**

Credits: 3   **Continuous Assessment: 40 Marks**

Preamble: The course has been designed to provide students with a thorough overview of the topics, tools, and approaches that are essential for resolving challenges in the many cyber security areas. Students will learn about computer security, cryptography, digital currency, secure protocols, detection, and other security strategies in this course. The course will assist students in evaluating their comprehension of key methods for safeguarding information systems, IT infrastructure, identifying and tracking potential risks and assaults, creating security architecture, and putting security measures into exercise. The students will also have a broader understanding of information security from a legal and technological standpoint related to national security.

Course Objectives:

- Learn about the policies and procedures to manage enterprise security risks.
- Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.
- Interpret and forensically investigate security incidents.

UNIT – I

Introduction to Cybercrime : Cyber crime: Definition and Origins of the Word, Cyber crime and Information Security, Cyber criminal, Classifications of Cyber crimes, Cyber crime: The Legal Perspectives, An Indian Perspective, Cyber crime and the Indian ITA 2000, A Global Perspective on Cyber crimes, Cyber crime Era: Survival Mantra for the Netizens.

Cyber offenses: How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cyber crimes, Botnets: The Fuel for Cyber crime, Attack Vector, Cloud Computing.   (9 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Understand the Cyber crime and Information Security.(L2)
- Have an overview on the Information Technology Act 2000.(L1)
- Learn about Cyber Offenses.(L1)

UNIT – II

Cyber Crime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile devices, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.   (8 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- List Credit card Frauds. (L2)
- Know about the attacks on Mobile devices.(L1)
- Understand the Organizational Security Policies.(L1)

UNIT – III

Tools and Methods Used in Cyber crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft : Introduction, Phishing, Identity Theft. Vulnerability management. (7 Hours)

Learning Outcomes:

After completion of this unit students will be able to
● Explain the Tools and Methods Used in Cyber crime.(L2)
● Learn Attacks on Wireless Networks.(L1)
● Know about Phishing and Identity theft.(L1)

UNIT – IV

Cyber Crimes and Cyber Security: The Legal Perspectives: Introduction, Cyber crime and the Legal Landscape around the World.
Why Do We Need Cyber laws: The Indian Context - The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cyber crime and Punishment, Cyber law, Technology and Students: Indian Scenario. (8 Hours)

Learning Outcomes:

After completion of this unit students will be able to
● Infer Legal Landscape of Cyber Crime.(L2)
● Identify the Indian IT Act.(L2)
● Understand Cyber crime and Punishment.(L2)

UNIT – V

Cyber security: Organizational Implications – Introduction, Cost of Cyber crimes and IPR Issues: Lessons for Organizations, Web Threats for Organizations: The Evils and Perils, Security and Privacy Implications from Cloud Computing, Social Media Marketing: Security Risks and Perils for Organizations, Social Computing and the Associated Challenges for Organizations, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling: An Essential Component of Cyber security, Forensics Best Practices for Organizations, Media and Asset Protection: Best Practices for Organizations, Importance of Endpoint Security in Organizations. (8 Hours)

Learning Outcomes:

After completion of this unit students will be able to
● Outline Organizational Implications with respect to Cyber Crimes.(L2)
● List the Privacy Implications from Cloud Computing.(L2)
● Discover the importance of Endpoint Security in Organizations.(L3)

Course Outcomes:
● Upon successful completion of the course, the students will be able to
● Understand the Cyber Crime and Information Act.
● Able to understand Mobile and Wireless Devices security needs of an organization.
● Name the Tools and Methods Used in Cyber Crime.
● Learn Cyber crime and Punishment.
● Interpret Organizational Implications on Cyber Security.

Suggested Readings:
1. Cyber Security by Nina Godbole & Sunit Belapure, Wiley India Pvt.Ltd,. New Delhi, 2013.

Reference Links :
1. https://www.wileyindia.com/cyber-security-understanding-cyber-crimes-computer-forensics-and-legal-perspectives.html
2. csrc.nist.gov/publications/nistpubs/800-12/handbook.pdf

Hours per week: 3 L   **End Examination: 60 Marks**

Credits: 3   **Continuous Assessment: 40 Marks**

Preamble: Data mining provides techniques for the discovery of valuable information from the accumulated data. The exploratory techniques help in finding novel patterns that can assist a business organization in understanding the business better.

Course Objectives:

- Understand the process of Data mining.
- Develop association rules.
- Learn different Supervised and Unsupervised learning algorithms.
- Study the concepts of Online Analytical Processing.

UNIT – I

Introduction: What is Data Mining, Why data mining, Data Mining process, Data mining Applications, Data Mining techniques, Future of Data mining, Guidelines for Successful Data mining, Data Mining Software.

Association Rule Mining: Basics, Naïve Algorithm, Apriori Algorithm, Improving Efficiency of Apriori algorithm, Apriori-Tid, Direct hashing and Pruning, FP growth, Performance evaluation of Algorithms.   (10 hours)

Learning Outcomes:

After completion of the unit, the student is able to

- Define data mining.(L1)
- Outline data mining applications.(L2)
- Develop Apriori algorithm.(L3)
- Inspect the Performance Measures. (L4)

UNIT – II

Classification : Introduction, Decision tree, Tree Induction Algorithm, Split algorithms, Over-fitting and Pruning, Decision tree rules, Naïve Bayes method, Accuracy of Classification methods, Improving accuracy, Evaluation of classification methods.

Cluster analysis: Introduction, Types of Data, Computing Distance, Types of Cluster Analysis methods, Partional methods, Hierarchical Methods, Density based methods, Dealing with large Data bases, Quality and validity of Cluster analysis methods.   (12 hours)

Learning Outcomes:

After completion of the unit, the student is able to

- Identify classification methods. (L3)
- Inspect accuracy of Classification methods. (L4)
- Explain types of cluster analysis methods. (L2)
- Examine the validity of Clustering Methods. (L4)

UNIT – III

WEB Data mining: Introduction, Web technology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web structure mining.

Search Engines : Introduction, Characteristics of Search Engine, Search Engine functionality, Search engine Architecture, Ranking of Web pages, Search engine industry, Enterprise search. (10 hours)

Learning Outcomes:

After completion of the unit, the student is able to
- Understand the WEB characteristics.(L1)
- Interpret Web content mining, usage mining, web structure mining. (L2)
- Show Search engine architecture. (L1)
- Appraise Enterprise Search. (L5)

UNIT – IV

Data Warehousing : Introduction, Operational Data Store, ETL, Data warehouse, Warehouse design, Guidelines for data warehouse Implementation, Data warehouse metadata.

OLAP: Introduction, OLAP , Characteristics of OLAP, Motivations for using OLAP, Multidimensional View and Data Cube, Data Cube implementation, Data Cube Operations, Guidelines for OLAP implementation.   (10 hours)

Learning Outcomes:

After completion of the unit, the student is able to
- Understand ETL.(L1)
- Build Data warehouse.(L2)
- Examine Data Cube Operations. (L4)

UNIT – V

Information Privacy and Data mining: Introduction, What is information privacy, Basic principles to protect Information Privacy, Information technology act, Uses and Misuses of Data mining, Primary aim of Data mining, Pitfalls of Data mining, Current privacy principles Ineffective for data mining, revised privacy principles, technological solutions, Case study. (10 hours)

Learning Outcomes:

After completion of the unit, the student is able to
- Define information privacy. (L1)
- Outline principles to protect Information Privacy. (L2)
- Summarize privacy principles.(L3)

Course Outcomes:

Upon completion of this course, the student will be able to :
- Explain the Data mining Process. (L2)
- Illustrate Classification and Clustering. (L2)
- Infer Data Cube Operations. (L3)
- Demonstrate the uses and misuses of Data Mining.

Suggested Readings:

1. Introduction to Data mining with Case Studies by G.K.Gupta, Prentice Hall India, Second Edition.

Other Readings:

1. Data mining Concepts and techniques by Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufman, Third Edition
2. Introduction to Data Mining by Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson Publications.

B.Sc Computer Science with Cognitive Systems
V SEMESTER
Department Specific Elective - II
CSCI 3181: DEVOPS

Hours per week: 3 L   **End Examination : 60 Marks**
Credits: 3   **Continuous Assessment : 40 Marks**

Preamble: The DevOps (a mashup of "development" and "operations") course enables the student to combine the best practices and available resources to help organizations produce apps and services more quickly than using conventional software development methods. Organizations are able to provide better customer service and engage in more profitable market competition thanks to this speed. The goal of DevOps is to break down the conventional divisions of labor between development and operations teams. A DevOps paradigm involves development and operations teams cooperating across the whole life cycle of a software programme, from development and testing to deployment and operations.

Course Objectives:

● To learn how to develop applications by integrating different tools.
● To understand Kubernetes which is a portable, extensible open-source. platform for managing containerized workloads and services.
● To Illustrate cluster administration.
● To experiment kubernetes onAWS.
● To experiment kubernetes on Google cloud.

UNIT -I

Introduction to Devops: Software delivery challenges, Waterfall and static delivery, Agile and digital delivery, Software delivery on the cloud, Continuous Integration, Continuous Delivery, Configuration management, Infrastructure as code, Orchestration. Trend of Microservices: Modular programming, Package management, The MVC design pattern, Monolithic application, Remote Procedure call, RESTful design, Microservices.   (7 Hours)

Learning Outcomes:
By the end of this Unit, the student will be able to
● Know software delivery challenges and different delivery models. (L1)
● Understand delivery on cloud and continuous integration. (L1)
● Illustrate microservices and packagemanagement. (L1)
● Explain MVC design pattern and Monolithic application. (L2)
● Apply Remote Procedure and RESTfuldesign. (L2)

UNIT - II

Automation and Tools: Continuous integration tools, Configuration management tools, Monitoring and logging tools, Communication tools, The Public cloud.
DevOps with Container: Understanding containers, Resource isolation, Linux containers, Containerized delivery.
Getting started with containers:Installing Docker for Ubuntu, Installing Docker for CentOS, Installing Docker for windows OS.   (8 Hours)

Learning Outcomes:

By the end of this Unit, the student will be able to
- Learn integration, continuous delivery, Monitoring & logging and communication tools. (L1)
- Know Public cloud with Devops. (L1)
- Understand container, resource isolation. (L2)
- Installing Docker for Windows OS. (L2)

UNIT - III

Container life cycle: Docker basics, Layer, Image, Container and Volumes, Distributing images, Connecting containers.

Working with a Docker file:Writing your first Docker file, Docker file syntax, Organizing a Docker file.

Multi-containers orchestration: Piling up containers, Docker compose overview,Composingcontainers.   (8 Hours)

Learning Outcomes:
- By the end of this Unit, the student will be able to. (L3)
- Understanding Docker Life Cycle. (L1)
- Experimenting Docker file syntax, organizing Dockerfile. (L3)
- Exploring Multi container orchestration. (L3)
- Know how to Compose containers and how to piling up. (L2)

UNIT - IV

Getting started with Kubernetes: Understanding Kubernetes, Kubernetes components, Master components, API server, Controller Manager, Scheduler, Node components, Kubelet, Proxy, Docker, Interaction between kubernets master and nodes. Preparing the environment, kubectl, Kubernetes resources, kubernetes objects, Namespace, Name, Label and selector, Annotation, Pods, ReplicaSet(RS), Deployments, Services, Volumes, Secrets, Config Map, Using ConfigMap via volume, Using ConfigMap via environment variables, Multi-containers orchestration.

(9 Hours)

Learning Outcomes:
By the end of this Unit, the student will be able to
- Understand Kubernetes, its components, API server and Scheduler. (L4)
- Learn Proxy and the interaction between kubernetes master and nodes. (L4)
- Develop environment kubectl, kuberetes resources and objects. (L4)
- Experiment on kubernetes objects, Namespace, Label and selector. (L3)
- Design ConfigMap and use it via Volumes and environment variables. (L2)

UNIT - V

Kubernets on AWS: Introduction to AWS, Public cloud, API and infrastructure as code, AWS components, VPC and subnet, Internet gateways and NAT-GW, Security group, EC2 and EBS, ELB.

Kubernetes on GCP (Google Cloud) : Introduction to GCP, GCP Components, VPC, Subnets, Firewall rules, VM instances, Load balancing, Health check, Backend service, Creating a LoadBalancer, Persistent Disk.

Kubernetes on Azure : Introduction to Azure, Resource groups, Azure virtual network, Network security groups, Application security groups, Subnets, Azure virtual machines, Storage account, Loadbalancers, Azure disks   (10 Hours)

Learning Outcomes:
By the end of this Unit, the student will be able to
- Learn introductory concepts of AWS. (L2)
- Understand Public cloud, API and AWScomponents. (L2)
- Experiment kubernetes onGoogle Cloud. (L4)
- Exploring the Load Balancing and Services. (L2)
- Experiment kubernetes onMicrosoft Azure. (L3)
- Understanding Azure network security and Storages. (L2)

Course Outcomes:
Upon successful completion of the Course, the student will be able to
- Understand Kubernetes which is a portable, extensible open-source platform for managing containerized workloads and services.
- Explain cluster administration.
- Handle Docker files and its organization.
- Create a job and apod.
- Experiment kubernetes on AWS, google and Aure.

Suggested Readings:

1. DevOps with Kubernetes: Accelerating software delivery with containers by Hideto Saito, Hui-Chuan Chloe Lee, Cheng-Yang Wu, O' Reilly publications, 2017.

Other Readings:

- Managing Kubernetes: Operating Kubernetes Clusters in the Real World by Brendan Burns, Craig Tracey, O'Reilly publications,2017.

B.Sc Computer Science with Cognitive Systems
V SEMESTER
CSCI3131: DIGITAL TECHNOLOGY LAB

Hours per week: 2 P   **Continuous Assessment : 100 Marks**
Credits: 01

Course Objectives:
- Understand Automatix (RPA) Tool and Automation Anywhere.
- Understand installation of Automatix and Patch Installations.
- Learn how to create Bots for file transfer operations.
- Learn how to create automatic file backup operations

Course Outcomes:
- Explain how to use Automatix (RPA) tool and Automation Anywhere tool.
- Install and configure Automatix and Patch in local machine.
- Create Bots that can transfer files across machines.
- Create Bots to perform file backup operations.

Programs on:
- Automatix (RPA)
- Automation Anywhere

1. Creating bots for automatix software installation.
2. Creating bots for automatix software patch installation.
3. Creating bots for file transfer.
4. Creating bots for automatic file backup.

Recommended Books:
- Getting started with RPA using Automation Anywhere: Automate your day-to-day Business Processes using Automation Anywhere (English Edition) by Vaibhav Srivastava
- Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere by Arun Kumar Asokan and Nandan Mullakara

Faculty & Student Resources:
- Automation Anywhere: Getting Started with Robotic Process Automation (RPA)
- Automation Anywhere: Citizen Developer Basics
- Automation Anywhere: Tips And Tricks (Beginner)
- YouTube: Automation Anywhere Full Course - Simplilearn
- Automation Anywhere Community Edition (Download Link)

B.Sc Computer Science with Cognitive Systems
V SEMESTER
CSCI3151: SOFTWARE TESTING LAB

Hours per week: 2 P   **Continuous Assessment : 100 Marks**
Credits: 01

Course Objectives:

- To test web application redirection properly or not.
- To write scripts that can open Google portal in chrome and internet explorer browsers.
- To write scripts that can perform search options using a list box.
- To write scripts that can access and manage list boxes and perform sorting.
- To work with selenium testing tools that handle locators to access web elements and dynamic wait.

Lab Exercises:

1. Write a script to open google.com and verify that title is Google and verify that it is redirected to google.co.in
2. Write a script to open google.co.in using chrome browser (ChromeDriver)
3. Write a script to open google.co.in using internet explorer (InternetExplorerDriver)
4. Write a script to create browser instance based on browser name
5. Write a script to search for specified option in the listbox
6. Write a script to print the content of the list in sorted order.
7. Write a script to print all the options. For duplicates add an entry only once. Use HashSet.
8. Write a script to close all the browsers without using quit() method.
9. Write a generic method in selenium to handle all locators and return web elements for any locator.
10. Write a generic method in selenium to handle all locators containing dynamic wait and return web elements for any locator.

Recommended Books:

- Test Automation using Selenium WebDriver with Java: Step by Step Guide by NavneeshGarg
- Absolute Beginner Java 4 Selenium Webdriver: Come Learn How to Program for Automation Testing by Rex Allen Jones II

Course Outcomes
Upon completion of the course, the student is able to
- Write scripts to test any web application – web page redirects.
- Write scripts that can open different web browsers instantly.
- Perform search options using list box through user defined scripts.
- Implement scripts to access and manage list boxes and perform sorting.
- Apply selenium testing tools to handle locators and dynamic wait.

B.Sc Computer Science with Cognitive Systems
V SEMESTER
Skill Enhancement - II
CSCI3191: IT INFRASTRUCTURE LIBRARY

Hours per week: 3 L   **Continuous Assessment: 100 Marks**

Credits: 02

Preamble: ITIL (Information Technology Infrastructure Library) is a framework designed to standardize the selection, planning, delivery, maintenance, and overall lifecycle of IT services within a business. The goal is to improve efficiency and achieve predictable service delivery. The ITIL framework enables IT administrators to be business service partners, rather than just back-end support. ITIL guidelines and best practices align IT department actions and expenses to business needs and change them as the business grows or shifts direction.

Course Objectives:
- To be able to design a knowledge-based system. (L1)
- To understand Service life cycle models. (L1)
- To know the Key Principles Models and Concepts of service management. (L2)
- To understand the process management and risk management. (L2)
- To know the Challenges in providing IT Infrastructure Services. (L3)
- To understand the event management concepts. (L4)

UNIT - I

Introduction to ITIL 4 :IT Service Management in the modern world, About ITIL v4, The structure and benefits of the ITIL v4 Framework, The ITIL SVS, The four dimensions model. (6 Hours)

Learning Outcomes:

After completion of this unit students will be able to
- Understand how the IT Infrastructure Library v4 uses in the modern world. (L1)
- Understand the structure of ITIL v4. (L1)
- Summarize concept of ITIL v4 model & framework. (L2)

UNIT - II

Key Concepts of Service Management : Value and value co-creation, Value co-creation, Organizations, service providers, service consumers, and other stakeholders, Service providers, Service consumers, Other stakeholders, Products and Services, Configuring resources for value creation, Service offerings, Service Relationships, The service relationship model, Value, Outcomes, Costs, and Risks, Utility and Warranty   (8 Hours)

Learning Outcomes:

After completion of this unit students will be able to
- Discover what service management is. (L1)
- Know the stakeholders, consumers and service providers. (L3)
- Interpret service relationships and values. (L2)

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The four Dimensions of Service Management :Organization & People, Information & Technology, Partners &Suppliers, Value Streams & Processes, Value streams for service management, Processes, External factors. (7 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Learn the ITILroles in organization & People. (L2)
- Inspect the Value streams & Processes. (L2)
- Know the ITIL external factors. (L3)

UNIT - IV

The ITIL Service Value System :Service Value System (SVS) Overview, Opportunity, demand, and Value, Guiding Principles. Focus on value, Start where you are, Progress iteratively with feedback, Collaborate and promote visibility, Think and work holistically, Keep it simple and practical, Governance, Governing bodies and governance, Governance in the SVS, Service Value Chain (SVC), Plan, Improve, Engage, Design and transition, Obtain/build, Deliver and support, Continual Improvement, Step of the continual improvement model, Continual improvement and the guiding principles. (10 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Explain Evolution of IT Infrastructure Services. (L1)
- Infer Challenges in providing IT Infrastructure Services. (L2)
- Learn Automation and Analytics. (L3)

UNIT - V

ITIL Management Practices :General Management Practices, Architecture management, Continual improvement, Information security management, Knowledge management, Measurement and reporting,Service management practices, Availability management, Business analysis, Capacity and performance management, Change control, Incident management, IT asset management, Monitoring and event management, Technical management practices, Deployment management, Infrastructure and platform management, Software development and management.

(10 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Build the Objectives of ITIL Management Practices. (L3)
- Discover ITIL General, Service and Technical Management Practices. (L3)

Course Outcomes:

Upon completion of the course, the student is able to

- Design a knowledge-based system.
- Understand service life cycle model.
- Know the key principles, models and concepts of service management.

- Understand the process management and risk management.
- Know the challenges in providing IT infrastructure services.
- Understand the event management concepts.

Suggested Readings:

1. ITIL Foundation 4th edition – Axelos Global Practices (2019), Published by TSO (TheStationeryOffice)

Other Readings:

1. ITIL For Beginners: The Complete Beginner's Guide to ITIL, 2nd Edition (ClydeBank Technology)
2. Service Support(CCTA): Part15(IT Infrastructure Library).
3. IT Infrastructure Risk & Vulnerability Library: A Consolidated Register of Operational & Technology Infrastructure Vulnerabilities for IT Assurance Professionals

Hours per week: 4 P   **Continuous Assessment: 100 Marks**
Credits: 02

Assessment Criteria:

(I) Report submission and Viva –Voce on Summer Internship done – 50 Marks

        Or

Identification, execution and presentation of report on a Case Study – 50 Marks

(II) 5 no. Presentation on the concepts studied in the curriculum – (5 * 10 marks each) = 50 marks

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
CSCI3211: FUNDAMENTALS OF NEURAL LEARNING

Hours per week: 3 L   **End Examination : 60 Marks**

Credits: 3   **Continuous Assessment : 40 Marks**

Preamble: Artificial Neural Networks to be more precise, represent a technology that has roots in many disciplines: mathematics, statistics, neurosciences, computer science. ANN is found in diverse fields such as modeling, time series analysis, pattern recognition.

Course Objectives:
- To understand the properties, compositions, benefits of neural networks and how they relate to artificial intelligence. (L2)
- To provide an overview on the various facets of the learning process and its statistical properties. (L3)
- To understand Rosenblatt's perceptron and the related concepts. (L2)
- To explore the concept of multilayer perceptron with the backpropagation algorithm. (L2)
- To understand a category of universal feedforward networks and information theoretic models. (L2)

UNIT – I
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Feedback, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.   (8 hours)

Learning Outcomes:
After completion of this unit, the student will be able to
- Acquire a basic understanding of the neural networks. (L2)
- Analyze the neural network problems. (L4)
- Understand various network architectures. (L2)

UNIT - II
Learning process: Introduction, Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive Learning, Boltzmann learning, Credit Assignment Problem, Learning with a Teacher, Learning without a Teacher, Statistical nature of the Learning Process.   (9 hours)

Learning Outcomes:
After completion of this unit, the student will be able to
- Understand basic learning rules. (L2)
- Explore Learning paradigms. (L3)
- Understand two fundamental learning paradigms. (L2)

UNIT - III
Single Layer Perceptron:Introduction, Adaptive Filtering Problem, Unconstrained Optimization Techniques, Linear Least Squares Filters, Least Mean-Squares Algorithm, Learning Curves, Learning Rate Annealing Schedules.   (10 hours)

Learning Outcomes:
After completion of this unit, the student will be able to
- Explore adaptive filtering problems. (L2)
- Understand three unconstrained optimization techniques. (L2)
- Experiment with binary classification models (L3)
- Explore the idea of learning curves. (L2)

UNIT - IV

Multilayer Perceptron: Introduction, Preliminaries, Back Propagation Algorithm, XOR Problem, Heuristics for making the Back Propagation Algorithm perform better, output representation and decision rule, Backpropagation and differentiation, hessian matrix, generalization, cross validation. (12 hours)

Learning Outcomes:

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

- Have the understanding of backpropagation (L2)
- Illustrate the use of backpropagation algorithms. (L2)
- Explore the concepts relating to the performance of a multilayer perceptron. (L2)
- Summarize the advantages and limitations of back propagation algorithms. (L2)

UNIT - V

Support Vector Machines: Introduction, optimal hyperplane for linearly separable pattern, optimal hyperplane for nonseparable patterns.

Information Theoretic Models: Introduction, Entropy, Maximum Entropy Principle, Mutual Information, Mutual Information as an objective Function to be optimized. (10 hours)

Learning Outcomes:

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

- Understand the basic ideas on support vector machines. (L2)
- Construct optimal hyperplanes for two cases. (L3)
- Analyze the concept of entropy, maximum entropy principle. (L3)
- Understand the concept of mutual information and its properties. (L2)

Course Outcomes:

By the end of the Course, the student is able to

- Acquire the knowledge on neural network issues and different architectures (L2)
- Explore Learning rules and Paradigms (L3)
- Apply the error calculation and optimization techniques. (L3)
- Learn Multilayer Perceptron and its related algorithms. (L2)
- Understand the concepts of Support Vector Machines and Information Theoretic Models. (L2)

Suggested Readings:

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.

Other Readings:

1. LaureneFausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.
3. B. Yegnanaryana "Artificial Neural Networks", PHI,2005.
4. S. Rajasekaran, G.A. VijayalakshmiPai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI, 2012.

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
CSCI3231 :INTRODUCTION TO MACHINE LEARNING

Hours per week: 3 L   **End Examination : 60 Marks**

Credits: 3   **Continuous Assessment : 40 Marks**

Preamble : Machine Learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves which is used in decision-making processes based on data inputs.

Course Objectives:
To understand the basic theory underlying machine learning and its applications.
- To learn the Steps involved in designing and interpreting Model Performance.
- To understand and apply different Learning models.
- To understand the concepts of Supervised Learning.
- To learn Different Supervised Learning Algorithms.

UNIT - I
Introduction: Human Learning definition, Types of Human Learning, Problems not to be solved using Machine Learning, Applications of Machine Learning, Tools in Machine Learning, Issues in Machine Learning.   (10 hours)
Learning Outcomes:
By the end of the unit, the student is able to
- Identify basic Types of Human learning. (L3)
- Identify Problems related to Machine learning. (L3)
- Learn about Applications of Machine Learning (L1)
- Learn about various Issues of Machine Learning (L1)

UNIT-II
Preparing to Model: Machine Learning Activities, Basis types of Data in Machine Learning, Exploring structured data, Data Quality and Remediation, Data Preprocessing.   (10 hours)

Learning Outcomes:
By the end of the unit, the student is able to
- Develop methods for exploring structured data. (L3)
- Relate data quality and remediation. (L1)

UNIT-III
Modelling& Evaluation: Introduction, Selecting a model, Training a model, Model Representation and Interpretability, Evaluating Model Performance, Improving model performance.   (10 hours)
Learning Outcomes:
By the end of the unit, the student is able to
- Learn about Model, Selecting and Training Models (L1)
- Learn about various Measures of evaluating Model Performance (L1)

UNIT-IV

Basics of Feature Engineering: Introduction, What is a feature, What is feature engineering, Feature Transformation, Feature construction, Feature extraction, Feature Subset Selection, Issues in high-dimensional data,Key drivers of feature selection – feature relevance and redundancy, Measures of feature relevance and redundancy, Overall feature selection process, Feature selection approaches.

(8 hours)

Learning Outcomes:

By the end of the unit, the student is able to

- Learn about Feature Engineering(L1)
- Learn about Feature Transformation(L1)
- Learn about Feature Subset Selection (L1)

UNIT-V
Introduction, **Importance of Bayes Theorem:** Bayes theorem and concept learning, Bayesian Belief Network.
Supervised Learning: KNN, Decision Tree, Random forest model, Support vector Machines, Regression.   (8 hours)
Learning Outcomes:
By the end of the unit, the student is able to
- Demonstrate the importance of Bayes Theorem. (L2)
- Make use of Bayesian Belief Networks(L3)
- Analyze KNN, Random Forest, Support Vector Machines, Regression(L4)

Course Outcomes:
By the end of the Course, the student is able to
- Understand the concept of human learning and its types, applications, tools in machine learning. (L2)
- Apply the statistical techniques for exploring data and its preprocessing techniques. (L3)
- Develop the ability to formulate models using machine learning techniques to respective problems. (L3)
- Explore the techniques for feature engineering. (L3)
- Apply Supervised machine learning algorithms to solve problems of moderate complexity. (L4)

Suggested Readings:
1. Machine Learning by Subramanian, Chandra Mouli, Amit Kumar Das , SaikantDutt, Pearson Publications, I edition, 2018.
2. Machine Learning by Tom Mitchell, McGraw Hill 2007

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
CSCI3241 :STATISTICAL COMPUTING WITH R

Hours per week: 3 L   **End Examination : 60 Marks**

Credits: 3   **Continuous Assessment : 40 Marks**

Preamble:This course, Statistical Computing with R, will expose students to the statistical programming language. There will be an assumption that students have completed prior Probability and statistics courses. By the end of the course students should be able to code statistical functions in R. They should be able to extend the functionality of R by using add-on packages and they should be able to use R to perform the work-horse statistical tasks such as Linear regression.

Course Objectives:
- To understand the basic concept of R programming and compute basic summary statistics.
- To learn the main R data structures – vector and data frame
- To do exploratory statistical data analysis using R.
- To understand about the Random variable, and probability distributions.
- To Perform appropriate statistical tests.
- To Implement/perform correlation and regression data analysis using real-world data.

UNIT - I
Introduction:-How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.
Learning Outcomes:
By the end of the unit, the student is able to
- Install R Studio package and run R Programming (L2)
- Use Function solve basic maths (L1)
- Understand the Advanced Data Structures(L2)
- Implement Data Frames, Lists, Matrices, Arrays, Classesin R (L3)

UNIT - II
R Programming Structures: Control Statements, Loops, - Looping Over NonvectorSets,- If-Else, Arithmetic and Boolean Operators and values.
Visualization of Multivariate Data: Panel Displays, Surface Plots and 3D Scatter Plots, Contour Plots, Other 2D Representations of Data, Other Approaches to Data Visualization.
Learning Outcomes:
By the end of the unit, the student is able to
- Understand R Programming Structures, Control Statements, Loops(L1)
- Solve the problem using Control Statements, Loops, If-Else,(L3)
- Do the data analysis using data visualization of Multivariate Data(L2)

UNIT – III
Basic Statistics: Measures of Central Tendency – (Grouped and Ungrouped data) Mean, Median and Mode. Measures of Dispersion- (Grouped and Ungrouped)-Range, Quartile-Deviation, Variance and Standard Deviation, Skewness and Kurtosis.
Learning Outcomes:
By the end of the unit, the student can
- Understand and solve the problems by applying mean, median and mode.
- Understand and apply to data using standard deviation, skewness, and kurtosis.

UNIT –IV

Random Variables and Probability distribution: Some Discrete Distributions: Binomial Distribution, Poisson Distributions, Some Continuous Distributions: Normal Distribution

Learning Outcomes:

By the end of the unit, the student can

- Understand the Random Variables and Probability distribution, (L1)
- Solve the problem-based binomial and Poisson distribution using R functions.L3)
- Perform analysis the normal distribution and visualization using R function (L3)

UNIT - V

Bivariate Distributions: Covariance, Correlation and Regression, Linear Models –Simple Linear Regression, Goodness of fit and Curve fitting.

Learning Outcomes:

By the end of the unit, the student can

- Understand theory of correlation and regression(L2)
- Implement code in R to analysis the real data for prediction using linear regression (L3)
- Implement code in R to analysis the real data by curve fitting(L3)

Course outcomes:

By the end of the course the student will be able to

- Apply the concepts of R and basic data structures (L2)
- Develop programs on the control structures of R and Visualization of Data. (L3)
- Explore the basic statistics and measures of dispersion. (L3)
- Demonstrate statistical distribution techniques (L2)
- Summarize the real data using regression and curve fitting. (L2)

Suggested Readings:

1. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics.,Sultan chand and sons
2. Maria L. Rizzo, Statistical Computing with R, Chapman & Hall/CRC
3. Shailaja R Deshmukh Sudha G Purohit, Sharad D Gore, Statistics Using R,2/e (PB), Narosa Publications

Other Readings:

1. Jones, O, Maillardet, R, and Robinson, Introduction to Scientific Programming and Simulation Using R, 2nd edition, 2014
2. Wickham. H, 2019, Advanced R, 2nd edition, Chapman and Hall/CRC.

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
Department Specific Elective - III
CSCI3261 : INTRODUCTION TO IOT

Hours per week: 3 L   **End Examination : 60 Marks**
Credits: 3   **Continuous Assessment : 40 Marks**

Preamble: The digital space has seen significant changes in recent years and, according to industry analysts will continue to do so. The Internet of Things is the most recent arrival into the digital realm (IoT). IoT can also be defined as the interaction of the software, telecommunications, and electronic hardware industries, and it promises to open up a slew of new prospects for a variety of industries.
Course Objectives:
Understand the definition and significance of the Internet of Things.
   ● Able to understand the application areas of IOT.
   ● Discuss the architecture, operation, and business benefits of an IoT solution.
   ● Examine the potential business opportunities that IoT can uncover.
   ● Identify how IoT differs from traditional data collection systems.
   ● Able to understand Ethics of the Internet of Things and characteristics..

UNIT – I
The Internet of Things: An Overview: The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?, Application of IoT – Smart Cities, Smart Cars, Smart Homes.   (10)
Learning Outcomes:
After completion of this unit the student will be able to
   ● Understand the Internet of Things through a lens of the history of technology to more clearly understand how and where it fits.(L1)
   ● Explain different types of electronic age, they have included telephones, radios, televisions, computers, smartphones, smart cities, and homes. (L2)
   ● Illustrate different programming using an Application Programming Interface (API), which allows other programs, rather than just users, to interact with and use the services.(L2)

UNIT-II
Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, climbing into the Cloud.
Prototyping Embedded Devices: Electronics, Sensors, Actuators, Embedded Computing Basics, Microcontrollers, System-on-Chips, Arduino, developing on the Arduino, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi. (10)
Learning Outcomes:
After completion of this unit the student will be able to
   ● Explain the building things in parallel: the physical Thing; the electronics to make the Thing smart; and the Internet service to connect.(L2)
   ● Explain prototype is optimized for ease and speed of development and also the ability to change and modify it.(L2)
   ● Describe about Many Internet of Things projects start with a prototyping microcontroller, connected by wires to components on a prototyping board.(L3)

Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, Nondigital Methods, Laser Cutting, Choosing a Laser Cutter, Software, 3D Printing, Types of 3D Printing, Software, CNC Milling.

Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, writing a New API, Clockodillo, Security, implementing the API, Real-Time Reactions, Polling, Comet   (9 Hours)

Learning Outcomes:

After completion of this unit the student will be able to

- Prepare for design work involves developing an interest in design and design ideas.(L3)
- Develop an interest in the world around you and start paying attention to the wealth of objects and experiences that you encounter.(L3)
- Describe aggregate information from disparate locations and types of sensors.(L2)

UNIT-IV

Business Models: A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business Model Canvas, Models, Make Thing, Sell Thing, Subscriptions, be a Key Resource, Provide Infrastructure: Sensor Networks, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital. (8)

Learning Outcomes:

After completion of this unit the student will be able to

- Describes how to Organize RAM: Stack versus Heap and Libraries.(L3)
- Explain various methods of Debugging software and hardware and Logging.(L2)
- Hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit.(L4)

UNIT-V

Ethics: Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition. (8)

Learning Outcomes:

After completion of this unit the student will be able to

- Explain Design Printed Circuit Boards and software choices(L2)
- Explains how to make up a PCB and its design process with the possible ways of Manufacturing PCB.(L2)
- Describes the uses of the internet of things as part of the solution.(L2)
- Summarize what the Internet of Things is? Explain the issues on Privacy.(L4)

Course Outcomes:

After completion of this course the student will be able to

- The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science.
- The graduates will provide sustainable solutions to ever changing interdisciplinary global problems through their Research, Innovation capabilities.
- The graduates will become employable, successful entrepreneurs as an outcome of Industry-Academia collaboration.
- The graduates will embrace professional code of ethics while providing solutions to multidisciplinary social problems in industrial, entrepreneurial and research environments to demonstrate leadership qualities.

Suggested Readings:

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, 1st Edition, John WILEY 2014.
2. Cuno Pfister, Getting Started with the Internet of Things, 6th Edition, O'Reilly, 2018.

Reference Book:

1. Matt Richardson and Shawn Wallace, Getting Started with Raspberry Pi, 3rd Edition, SPD 2016.

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
CSCI3271 : PYTHON FOR DATA ANALYSIS

Hours per week: 3 L	**End Examination : 60 Marks**
Credits: 3	**Continuous Assessment : 40 Marks**

Preamble:Data Analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data.This course is to learn manipulating, processing, cleaning, and crunching data in Python. It is also a practical, modern introduction to scientific computing in Python, tailored for data-intensive applications and about the parts of the Python language and libraries that need to effectively solve a broad set of data analysis problems.

Course Objectives:
- To understand Python Libraries
- To learn Pandas data structures
- To know and create data frames
- To apply matplotlib for data visualization
- To demonstrate Data Aggregation and Group Operation

UNIT – I
Preliminaries-Essential Python Libraries, Installation and setup; Introductory Examples; Numpy Basics- The Numpy ndarray, Universal Functions, Data processing Using Arrays, File Input and Output with Arrays, Linear Algebra, Random Number Generation. (10 hours)

Learning Outcomes:
After completion of this unit students will be able to
- Learn Pandas libraries. (L1)
- Know how to install and set up. (L2)
- Understand Numpy basics. (L2)

UNIT – II
Getting started with Pandas- Introduction to Pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing, Other Pandas Topics. (8 hours)

Learning Outcomes:
After completion of this unit students will be able to
- Understand introductory concepts of Pandas data structures(L2)
- Know how to handle missing data (L1)
- Apply statistics and indexing (L3)

UNIT – III
Data Loading, Storage, and File Format- Reading and Writing Data in Text Format, Binary Data Formats, Interacting with HTML and Web APIs, Interacting with Databases;
Data Wrangling- Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, Script manipulation. (10 hours)

Learning Outcomes:
After completion of this unit students will be able to
- Illustrate data loading and storage. (L1)
- Articulate Reading and Writing data in text format. (L3)
- Interact with HTML, Web API and databases. (L2)

UNIT – IV

Plotting and Visualizing- A Brief matplotlib API Primer, Plotting Functions in Pandas, Plotting maps, Python visualization Tool Ecosystem. (8 hours)

Learning Outcomes:

After completion of this unit students will be able to
- Illustrate Plotting and Visualization. (L1)
- Apply Plotting functions and maps. (L3)
- Understanding the Python Ecosystem. (L2)

UNIT – V

Data Aggregation and Group Operation- GroupBy Mechanics, Data Aggregation, Group-wise operations and Transformations, Pivot Tables and Cross-Tabulation (9 hours)

Learning Outcomes:

After completion of this unit students will be able to
- Categorize a pandas object into pieces using one or more keys. (L4)
- Infer group summary statistics. (L2)
- Develop quantile analysis. (L6)

Course Outcomes:

After completion of this course the student will be able to
- Understand Python Libraries (L2)
- Learn Pandas data structures (L1)
- Know and create data frames (L3)
- Apply matplotlib for data visualization (L3)
- Demonstrate Data Aggregation and Group Operation(L6)

Suggested Readings.

1. Python for Data Analysis: Agile tools for real world data, Wes Kenney, O'Reilly publication, 2nd edition, 2013.

Other Readings:

1. Introduction to Data Analysis Handbook, Migrant & Seasonal Head Start Technical Assistance Center Academy for Educational Development, © AED/TAC-12 Spring 2006
2. https://files.eric.ed.gov/fulltext/ED536788.pdf

B.Sc Computer Science with Cognitive Systems
VI SEMESTER
CSCI3281 : DATA CENTER MANAGEMENT

Hours per week: 3L   **End Examination : 60 Marks**
Credits: 3   **Continuous Assessment: 40 Marks**
Preamble:

The course is designed to provide an overview of data centers. It outlines the system architecture, Application architecture and data center design technologies. The course also focuses on the security issues in the data center.

Course Objectives:

- · To outline risks that were not previously evident. (L3)
- · To Outline the 4 tiers in security (L1)
- · To outline the taxonomy of applications.(L2)
- · To outline topologies.(L2)

UNIT – I

Overview of Data Centers: Data Center Definition, Goals, Facilities- Power capacity, cooling capacity, cabling, Temperature and humidity controls, Fire and Smoke system, Role of Data center in the Enterprise, Role of Data Centre in the Service Provider Environment.
Application Architecture Models: The Client/Server Model and its evaluation, the n-Tier model, Multi-tier Architecture Environment.

Data Centre Architecture: Aggregation Layer, Access Layer, Front-End segment, Application segment, Back-End Segment.   (8 Hours)

Learning Outcomes:
After completion of this unit students will be able to
- ● Outline the role of data centers in the enterprise. (L1)
- ● Explain the evolution of application environments. (L1)
- ● Present the blueprint of the data center architecture. (L2)

UNIT – II

Data center Services: IP infra-structure Services, Application Services, Security Services, Storage Services,

Server Architecture Overview: Network Attachment, Network Interface Cards, Server Multi homing, PCI and PCI – X Buses, Client and server Packet Processing, User Mode and Kernel mode, Server TCP/IP Processing, Sockets.   (7 Hours)

Learning Outcomes:
After completion of this unit students will be able to
- ● Describe the services provided by the data center network. (L2)
- ● Describe basics of network interface cards. (L2)
- ● Express the server processing of network traffic from the Ethernet driver to socket layer (L3)

UNIT – III

Application Architecture Overview: Taxonomy of Applications and Hosted Servers, Integration of Applications, Enterprise Application Integration.

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Multi-tier Applications: Markup Languages: HTML and XML, User Agents, Browsers, Helpers and Plugins, Client-side Programming, Web servers, Server-Side Programming, WEB Programming Technologies Overview. (7 Hours)

Learning Outcomes:
After completion of this unit students will be able to
- Identify the taxonomy of applications . (L1)
- Understands the integration of Applications. (L2)
- Explain the user agents namely web browsers. (L3)

UNIT – IV

Data Centre Design Overview: Types of Server Farms and Data Centers, Internet Server Farms, Intranet Server Farms, Extranet Server Farms, Internet Data center, Corporate Data Centre.

Data Centre Topologies: Generic Layer 3/Layer 2 Designs, The need for Layer 2 at the Access Layer, Alternate Layer 3/Layer2 Design. Multiple Tier Designs, Expanded Multi Tier Design, Collapsed Multitier Design. (8 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Explain different types of Servers and data centers. (L3)
- Outline the data center topologies. (L4)

UNIT – V

Data Centre Security Overview: The need for a secure Data Centre, Four Layers of data centre Physical Security, Physical security controls, Engineering plan and space design for a data centre, The four tiers of a data centres, Best practices.

Vulnerabilities and Common attacks, Threats, Vulnerabilities, Exploitation of Out-of-Date Software, Exploitation of Software Defaults, Common attacks, Scanning or Probing, DoS, Distributed Denial of service, Unauthorized Access, Eavesdropping, Viruses and Worms, Internet Infrastructure Attacks, Trust Exploitation, Session Hijacking, Buffer Overflow Attacks.

ACLs, Standard and Extended Access Lists, Router and VLAN ACLs, Dynamic ACLs, Reflexive ACLs, Firewalls, Packet-Filtering Firewalls, Proxy Firewalls, Stateful Firewalls, Hybrid Firewalls, Common Firewall Limitations. (11 Hours)

Learning Outcomes:

After completion of this unit students will be able to

- Explain the need for a secure Data Centre. (L1)
- Outline the 4 tiers in security (L1)
- Explain vulnerabilities and attacks. (L3)

Course outcomes:

After completion of this course the student will be able to

- To present architecture of Data centre.(L2)
- To demonstrate the server architecture..(L1)
- To elaborate user agents and integration of applications.(L2)

- To summarize the topologies in the data center. (L2)
- To discover the security issues. (L4)

Suggested Readings:

1. Data center Fundamentals by Mauricio Arregoces and Maurizio Portolani by CISCO press, First Edition.

B.Sc Computer Science with Cognitive Systems
V SEMESTER
CSCI3221: NEURAL LEARNING LAB

Hours per week: 2 P   **Continuous Assessment : 100 Marks**
Credits: 01
Preamble:

Neural networks are simplified models of the biological nervous system and therefore have drawn their motivation from the kind of computing performed by a human brain. Neural networks adopt various learning mechanisms which have been successfully applied to problems in the fields of pattern recognition, image processing, data compression, forecasting, and optimization

Course Objectives:

- To understand the basic principles and learn the computing frameworks of neural networks.
- To build computational skills for training neural networks
- To work with various algorithms for training neural networks and optimization of building neural networks.
- Implement basic neural networks using binary sigmoidal functions and display the results.
- Implement AND, NOT logic gate using McCulloch-Pitts neural model.
- Implementing logic gates using neural networks
- Implement various activation functions and visualize the results.
- Write a program to construct a Neural network with hidden layers
- Write a program to train the Neural Network on labeled training data
- Write a program to train a Neural Network with Back propagation method
- Write a program to understand Neural network architecture for Multiclass Models (such as 3 class, 4 class and so on..)
- Write a program to implement Gradient-Descent strategies to train Neural Networks (like Batch, Stochastic Gradient Descent, Mini-Batch Gradient Descent)

Lab Infrastructure:

- Python on Windows or Linux
- Python packages such as neural net, TensorFlow, PyTorch.

Course Outcomes:

By the end of the course students will be able

- To implement logic gates using neural networks and understand the linear separable concept. (L3)
- To implement Binary class neural networks with single layer and multiple layers. (L3)
- To implement activation functions like sigmoid, ReLU. (L3).
- To implement a neural network using backpropagation method (L3)
- To use the techniques for optimizing the neural networks. (L3)

B.Sc Computer Science with Cognitive Systems
V SEMESTER
CSCI3251: STATISTICAL COMPUTING WITH R LAB

Hours per week: 2 P   **Continuous Assessment : 100 Marks**
Credits: 01
Preamble:
Course Objectives:
Upon successful completion of this course, students will be able to:
- To acquire the computing tasks such as using conditional processing statements, loops, and writing one's own functions.
- To perform advanced graphing of data and statistical modelling of data.
- To use statistical distribution functions in R
- To read Structured Data into R from various sources
- To understand split-apply-combine (group-wise operations) in R
- To perform basic statistical modelling of data using R

List of Experiment:
1. Write a program to demonstrate functions and operators
2. Vectors: Grouping values into vectors, then doing arithmetic and graphs with them
3. Matrices: Creating and graphing two-dimensional data sets
4. Summary Statistics: Calculating and plotting some basic statistics: mean, median, and standard deviation
5. Factors: Creating and plotting(Scatter/Box plot/Histogram plot) for categorized/Numerical data
6. Data Frames: Organizing values into data frames, loading frames from files and merging them
7. Write a program to demonstrate Discrete Probability distributions.
8. Write a program to demonstrate continuous Probability distributions.
9. Write a program to demonstrate goodness of fit.
10. Write a program to demonstrate Importing and exporting data
11. Write a program to establish a Regression (Linear Regression)

Course Outcome:
1. Learn how to install and configure software necessary for a statistical programming environment. (L2)
2. Discuss generic programming language concepts as they are implemented in a high-level statistical language. (L3)
3. The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, and organizing and commenting R code. (L1)
4. Import external data into R for data processing and statistical analysis. (L3)
5. Learn the main R data structures – vector and data frame. (L2)
6. Design and develop R applications for data analytics. (L3)

Suggested Readings
1. Daniel Navarro, (2013). Learning Statistics with R. University of Adelaide Publications.
2. Garrett Grolemund and Hadley Wickham (2016). R for Data Science
3. Hadley Wickham, (2014). Advanced R Programming, (1 st ed.)
4. JeffreyStanton,(2013). Introduction to Data Science, with Introduction to R, Version3 ,
5. Roger.D.Peng, (2015).R Programming for Data Science

Reference Links :
1. https://www.r-project.org/
2. https://www.datamentor.io/r-programming/

3. https://www.datacamp.com/courses/free-introduction-to-r?utm_
4. https://www.coursera.org/learn/r-programming
5. https://172.16.25.76/Course/View.php?id = 2216
6. https://nptel.ac.in/courses/111104100/
7. https://nptel.ac.in/content/syllabus_pdf/111104100.pdf
8. https://www.edx.org/learn/r-programming

B.Sc Computer Science with
Cognitive
Systems VI
SEMESTER
CSCI3291: MAJOR PROJECT

Hours per week: 2 P   **Continuous Assessment :**
150 Marks

Credits: 12   **Semester End**

Assessment : 50 Marks Assessment Criteria:

Three internal reviews (each review evaluated for 50 marks) by a three member panel composed of Course Coordinator, Project Guide and HOD nominated faculty member.

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