YENEPOYA

(DEEMED TO BE UNIVERSITY)
Recognized under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade

YENEPOYA (DEEMED TO BE UNIVERSITY)

Deralakatte, Mangaluru -575018

REGULATIONS AND CURRICULUM GOVERNING

UNDERGRADUATE PROGRAM

BACHELOR OF COMPUTER APPLICATION (BCA)

(ROBOTICS, MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE)

(CURRICULUM - EFFECTIVE FROM 2020-21)

ATTESTED

Dr.Gangadhara Somayaji K.S.
Registrar
Yenepoya(Deemed to be University)
University Road, Deralakatte
Mangalore-575 018, Karnataka

YENEPOYA
(DEEMED TO BE UNIVERSITY)
Recognized under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade

Office of the Registrar
University Road
Deralakatte
Mangalore - 575018
Ph: 0824-2204667/68/69/71
Fax: 0824-2203943

NOTIFICATION-39-ACM/04/2020 dtd. 09.09.2020

Sub: Starting of new programmes of BCA and B.Sc.

Ref: Resolution of the Academic Council at its 39th meeting held on 27.08.2020 vide agenda-14

******

The Academic Council at its 39th meeting held on 27.08.2020 and subsequently the Board of Management at its 50th meeting held on 28.08.2020 have resolved to approve the proposal for starting of the following 3 years BCA and B.Sc. programmes (Choice Based Credit System) under the Faculty of Science along with other running courses of B.Sc. and BCA.

1. BCA (Cyber Forensics, Data Analytics and Cyber Security) with an annual intake of 210
2. BCA (Robotics, Machine Learning and Artificial Intelligence) with an annual intake of 140
3. B.Sc. (Forensic Science, Data Analytics and Cyber Security) with an annual intake of 140

This notification issued for implementation with effect from the academic year 2020-21

REGISTRAR

Copy to:

1. The Principal, YIASC&M
2. Faculty of Science
3. Controller of Examinations
4. File copy

BCA (Robotics, Machine Learning and Artificial Intelligence)

This is a full time three-year degree course, on the new area of technologycourse in Computer Science with specialization in Robotics offered to meet the demands of designing intelligent and automated systems for societal and business needs. The initial level courses provide students with a core foundation in programming, mathematical reasoning, physics and circuit design. The latter part blends fundamentals in computer science including Introduction to Robotics, Embedded Robotic programming, Robo kinematics and Dynamics, Artificial Intelligence, Natural Language processing, Representation Reasoning, Design and Analysis of Algorithms, Object Oriented Programming, Digital Logic Design, Operating System, Software Engineering, Database Management Systems and Computer Networks, sensors and control systems, Signal Acquisition and conditioning. Apart from the core areas, electives allow students to specialize in advanced fields. Hence, the program focuses on the practical and theoretical dimensions of Robotics across a range of fundamental areas, such as Machine Design Robotics, Industrial Automation, Plant Layout and Material handling, modelling and simulation.

Need of Intelligent and automated systems in the private, public sectors and government organizations is rapidly increasing. The design of these system involves technology of robots, inter-domain skills, and extensive knowledge of computing and robotic design. The students have career opportunities in private manufacturing and design companies, public organizations, Military & Defence, Health Care industry, Education, Agriculture, and Government institutions.

The jobs in Robotics include Robotics Engineer, Robotics analysts and designer, Robotics Sales Engineers, Robotics Accounts Manager, Robotics Scientists, AI specialists, Research scientists, AI and ML Engineer, Machine Learning and Artificial Intelligence Scientist, AI Software Engineer, and so on.

Programme Outcomes

Yenepoya University proposes to conduct BCA (Robotics, Artificial Intelligence andMachine Learning). The programme will help the students to gain the following:

- Knowledge of Robotic Process Automation, its working and various factors and parameters affecting the technology
- Knowledge of Process Management (Process design, Management and Automation), Basic Electronics, Sensor Technologies, IoT as well as Robotic Automation
- Understand and master the concepts and principles of Machine Learning, Artificial Intelligence and Robotics
- Learn about major applications of Artificial Intelligence across various use cases invarious industry verticals
- Learn about fast-changing world of InformationTechnology needs.

- The graduates will become effective collaborators and through innovativemethodologies, they will be able to address the social, technical and businesschallenges.
- The graduates will be able to communicate efficiently and effectively.
- The graduates will be able to function in multiple disciplinary teams.

Programme Specific Outcomes

Upon successful completion of the programme, candidates will be familiar with cyber security landscapes and able to:

1. Problem analysis: Identify, formulate, review research literature, and analyze complexproblems reaching substantiated conclusions using first principles of Robotics, Machine Learning & Artificial Intelligence.
2. Design/development of solutions: Design solutions for complex problems anddesign system components or processes that meet the specified needs with appropriateconsideration using the concepts studied.
3. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesisto solve real world problems.
4. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

1. Duration of the Course:

The duration of the course shall be three years. Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year, the third and fourth semesters, and the third academic year as the fifth and sixth semesters.

2. Eligibility:

A candidate who has passed the two years (any stream) of Pre-University Examination conducted by the Pre-University Education Board in the State of Karnataka or any other examination considered as equivalent thereto by University is eligible for admission to these programmes.

3. Selection Process:

Application forms will be available in the official website of Yenepoya University (www.yenepoya.edu.in) and the college office for the applicants. A merit list will be prepared of selected candidates based on the 12^{th} class marks /PUC marks. Reservation of seats will be followed as per the university Bye Laws.

4. Total Intake of Students: 140 students will be registered per year for the course.

5. Medium of Instruction: The medium of instruction and examination shall be English.

6. Attendance and Change of Subjects:

- A candidate shall be considered to have satisfied the requirement of attendance for a semester if he/she attends not less than 75% of the number of classes held in all subjects, including EC & CC.
- A candidate who does not satisfy the requirement of attendance in more than two subjects in a semester shall not be permitted to take the whole (all papers/subjects) University examination of that semester and he/she shall seek re-admission to that semester in a subsequent year and fulfil the attendance requirements of all subjects.
- A student having an attendance shortage in any two subjects (whatever may be the credits or type e.g. Theory /practical) will not be allowed to write the examination of those two subjects, during that semester.
- The student will enrol by paying a casual term fee of Rs. 7000/- per subject and will undertake remedial classes held during the semester vacation (either summer or winter) and fulfil the attendance requirement and take the examination when offered according to odd or even semester.
- A student seeking readmission due to shortage of attendance in 3 subjects and more per semester will not be permitted to carry forward the tuition fee. The student will pay the entire tuition fee of the semester.
- A student having the required attendance % in all subjects and fails to pass the subject in a semester is permitted to carry over all subjects and will attempt the exam as offered during the odd or even semester as a resit candidate
- Whenever a change in a subject is permitted the attendance in the changed subject shall be calculated by taking into consideration the attendance in the previous subject studied by the candidate.
- If a candidate represents his/her Institution/University/ Karnataka State/ Nation in Sports/ NSS/ Cultural or any officially sponsored activities he/she may be permitted to claim attendance for actual number of days participated, based on the recommendation of the Head of the Institution concerned. If a candidate is selected to participate in national level events such as Republic Day Parade etc., he/she may be permitted to claim attendance for actual number of days' participation based on the recommendation of the head of the Institution concerned.

7. Teaching Learning Methodology

The instructors will choose the pedagogy according to the course content and its applications from the methods provided below.

Lectures, Class discussions, reading assignments, Discussion groups. Lecture-demonstration, Student Presentation, Panel discussion by student panels from the class. Student reports by individuals, Student-group reports. Debate (informal) on current issues by students Forums Bulletin boards, Small groups such as task oriented, discussion, Textbook assignment. Reading assignments in journals, monographs, Assignment to outline portions of the textbook, Assignment to outline certain supplementary readings, Debates (formal). Crossword puzzles Maintaining Portfolios / Diaries. Reports on published research studies,Library research on topics or problems. Written book reports by students, Interviews, Audio-tutorial lessons, Open

textbook study,Committee projects--small groups, Individual projects, Quiz, Use of dramatization, skits, plays (street plays), Student construction of diagrams, charts, or graphs, making of posters by students, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching. Use of displays by instructor, Use of slides, Use of motion pictures, educational films, videotapes. Use of recordings (Ted Talks). Role playing, peer teaching. Coaching: special assistance provided for students having difficulty in the course. VIVA, filling out forms (income tax, checks). Visit an "ethnic" locations or commercial establishments or community. On the job training, specialize in other countries and in India Visit an employment agency. Campaigning, Volunteering, Prepare mock newspaper on specific topic or era, an entrepreneurial activity. Writing reports or project proposals.

The instructor would provide specific details of the methodology at the beginning of the course as applicable to each Unit, some teaching methods are -
Problem-based learning, learning tasks, discovery learning, computer simulation, Project work, direct instruction or lectures, models method, Programmed instructions, learning by teaching, Case study, learning at stations on PC and LAN network, Presentations through any applications.

Experiments, trials, Role play, Jigsaw and crosswords, concept mapping, Guidelines text methods, Web Quest, Reciprocal learning and portfolio methods.

8. Examination Structure for Written exam

Examination/Assessment	**Marks**
Internal Assessment	25
Final Examination	75
Total	100

9. Internal Assessment (IA)
Internal Assessment for each course, and details for each test are notified well in advance. IA consists of the following:

SN	**Internal Assessment for 25 marks**	**Weightage**
1	One Internal examination	15
2	Assignment/Seminars/Viva-voce/ Research Papers Presentation/ Class Participation /Attitude	10
	Total	25

10. The marks of the internal assessment shall be published on the notice board of the college for information of the students.

11. Registration for Examinations

A candidate shall register for all the papers of a semester when he/she appears for the examination of that semester for the first time.

12. Conduct of Examinations

There shall be examinations at the end of each semester, ordinarily during November/December for odd semesters and during April/May for even semesters, as prescribed in the Scheme of Examinations.

13. Examination Scheme / Assessment Question Pattern for the internal exam will be as below

Section A	Objective Questions	25 questions x 1 mark each	25 Marks
Section B	Short Answers or case	5 Questions x 5 marks each	25 Marks
Total			**50 Marks**

14. A) Examination Scheme / Assessment Question Pattern for the end semester exam will be as below

Section A	Objective Questions	25 questions x 1 mark each	25 Marks
Section B	Analytical Questions/Illustrations/ case studies/essay type questions	5 Questions x 10 marks each	50 Marks
Total			**75 Marks**

B) Examination Scheme for

1	Constitution of India	Objective Questions
2	Human Rights, Gender Equity and Environmental Studies	Objective Questions
3	Intellectual Property Rights	Objective Questions
4	Environmental Studies	Objective Questions

C) Marks for N.S.S., Sports and Games**,** Other Co-Curricular, Extra-Curricular activities and students who have received meritorious awards will be considered a s per UGC regulations.

D)Continuous Internal Assessment (CIA): Individual faculty will design the assessment for CIA. There will be no internal or final exam and the marks will be out of 100.

E)

Question paper pattern

Duration: 3 Hours **Max. Marks:75**

Section A

Answer the following Questions **(1*25=25)**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.

Section B

Answer any FIVE of the Questions **(10 *5=50)**

26.
27.
28.
29.
30.
31.
32.
33.

15. Minimum for a Pass

No candidate shall be declared to have passed the Semester Examination (except in Co-curricular and extracurricular activities) unless he/she obtains not less than 40% marks in the aggregate of written examination and internal assessment put together in each of the subjects. There is no minimum mark in Internal Assessment, but Candidate should get minimum 40% in external examination.If a candidate fails in any subjects, he/she shall appear for that subject only at any subsequent regular examination, within the maximum 6 years from date of registration prescribed for completing the programme.

16. Evaluation/Challenge Evaluation

All theory examination papers will be evaluated by one examiner. There will a scope for revaluation of the papers, where the students can apply by submitting an application along with the necessary fee.

17. With Holding of Results

Results will be withheld when a student has not paid his/her dues or there is a case of disciplinary action pending against him/her.

18. Carry Over

A candidate who fails in a lower semester examination may go to the higher semester and take the examination.

19. Rejection of Results

A candidate may be permitted to reject the result of the whole examination of any semester. Rejection of result paper-wise/subject-wise shall not be permitted. A candidate who has rejected the result shall appear for the immediately following regular examination.The rejection shall be exercised only once in each semester and the rejection once exercised cannot be revoked.Application for rejection along with the payment of the prescribed fee shall be submitted together to the controller of examination of university through the College with the original statement of marks within 30 days from the date of publication of the result.A candidate who rejects the result is eligible for only class and not for ranking.

20. Transfer of Admission

Transfer of admissions to other university is permissible only on mutual agreement with the other university. A candidate migrating from any other university may be permitted to join III/V Semester of the degree programme provided he/she has passed all the subjects of previous semesters/years as the case may be. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of Yenepoya University. Conditions for transfer of admission of students of other universities. He/she shall fulfil the attendance requirements as per the Yenepoya University Regulations.His / Her transfer of admission shall be within the intake permitted to the college.The candidate who is migrating from other universities is eligible for overall class and not for ranking. He / She shall complete the programme as per the regulation governing the maximum duration of completing the programme.

21. Grade Points - Choice Based Credit System (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses are evaluated

following the grading system, which is considered to be better than the conventional marks system. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations is followed as per the UGC formulated guidelines. The CBCS syllabus is framed with not more than 20 % deviation. at the maximum

The papers are marked in a conventional way for 100 marks. The marks obtained are converted to a 10-point scale (if it is 50 marks paper 5point scale).

Grade Point = Actual Marks scored out of 100/10.

Range of Marks:

Absent	Below 4	4 - 4.49	4.5 - 4.99	5 - 5.99	6 - 6.99	7 - 7.99	8 - 8.99	9 - 10
0	0	4	5	6	7	8	9	10

Grade Point Weightage (GPW): Grade points of each paper multiplied by credits assigned to the subject.

GPW= Grade point X Credits

The Semester Grade Point Average (SGPA) - is the sum of the product of the credits with the grade points scored in all subjects divided by the total credits in the semester.

SGPA = Σ Credits x Grade Points / Total Credits

Minimum SGPA for a pass is 4.

If a student has not passed in a subject or is absent then the SGPA is not assigned.

The Cumulative Grade Point Average (CGPA) - is the weighted average of all the subjects undergone by a student over all the six semesters of a course.

CGPA = Σ Total credits in the semester x SGPA / Total credits of the course. SGPA and CGPA will be rounded off to two decimal places. Interpretation of SGPA/ CGPA/ Classification of final result for a UG course.

Grade Point and Class Description:

Letter Grade	Grade Point	Range of mark
O (Outstanding)	10	9.00-10
A+ (Excellent)	9	8.00 - 8.99
A (Very Good)	8	7.00 -7.99
B+ (Good)	7	6.00 - 6.99
B (Above Average)	6	5.00 - 5.99
C (Average)	5	4.50 - 4.99
P (Pass)	4	4.00 - 4.49
F (Fail)	0	Below 4
Ab (Absent)	0	0

22. Details of Course Structure and Assessment:

BCA (Robotics, Machine Learning and Artificial Intelligence)

Semester – I								
Course Code	**Course Name**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Cr ed its**
		L	**T**	**P**	**Internal**	**External**		
DC01RM-1C1	Fundamentals of Information Technology-Theory	4	-	-	25	75	100	4
DC01RM-1P1	Fundamentals of Information Technology- Practical	-	-	4	CIA		100*	2
DC01RM-1C2	Computer System Architecture- Theory	4	-	-	25	75	100	4
DC01RM-1P2	Computer System Architecture- Practical	-	-	4	CIA		100*	2
DC01RM-1C3	Soft Skills & Business Communication	4	-	-	25	75	100	4
DC01RM-1C4	Basic Mathematics & Statistics	4	-	-	25	75	100	4
DC01RM-1C5	Social Responsibility and Community Engagement	2	-	-	CIA		100*	2
	Total	**18**	**-**	**8**			**700**	**22**
Semester – II								
DC01RM-2C1	Programming Fundamentals using C++-Theory	4	-		25	75	100	4
DC01RM-2P1	Programming Fundamentals using C++ -Practical	-	-	4	CIA		100*	2
DC01RM-2C2	Database Management System-Theory	4	-	-	25	75	100	4
DC01RM-2P2	Database Management System- Practical	-	-	4	CIA		100*	2
DC01RM-2C3	Environmental Studies	2	-	-	25	75	100	2
DC01RM-2C4	Statistical Techniques with R	4	-	-	25	75	100	4
	Total	**14**	**-**	**8**			**600**	**18**
Semester – III								
DC01RM-3C1	Introduction to Robotics	2	-		25	75	100	2
DC01RM-3C2	Data Structures	4	-	-	25	75	100	4

DC01RM-3C3	Operating Systems-Theory	4	-		25	75	100	4
DC01RM-3P1	Operating Systems-Practical	-	-	4	CIA		100*	2
DC01RM-3C4	Research Methodology	2	-	-	25	75	100	2
DC01RM-3C5	Web Application and Development-Theory	4	-	-	25	75	100	4
DC01RM-3P2	Web Applications and Development- Practical	-	-	4	CIA		100*	2
DC01RM-3C6	Open Elective - I	-	2	-	CIA		100*	2
	Total	**16**	**2**	**8**			**800**	**22**
Semester – IV								
DC01RM-4C1	Software Engineering	4	-	-	25	75	100	4

DC01RM-4C2	Introduction to Artificial Intelligence-Theory	4	-	-	25	75	100	4
DC01RM-4P1	Artificial Intelligence - Practical	-	-	4	CIA		100*	2
DC01RM-4C3	Programming in Java-Theory	4	-	-	25	75	100	4
DC01RM-4P2	Programming in Java-Piratical	-	-	4	CIA		100*	2
DC01RM-4C4	Computer Networks	2	-	-	25	75	100	2
DC01RM-4C5	Entrepreneurship	2	-	-	25	75	100	2
DC01RM-4C6	Open Elective - II	-	2	-	CIA		100*	2
	Total	**16**	**2**	**8**			**800**	**22**
Semester - V								
DC01RM-5C1	Fundamentals of robotic system and robot programming-Theory	4	-	-	25	75	100	4
DC01RM-5P1	Fundamentals of robotic system and robot programming- Practical	-	-	4	CIA		100*	2
DC01RM-5C2	Machine Learning –I	4	-	-	25	75	100	4
DC01RM-5C3	Artificial Neural Network-Theory	4	-	-	25	75	100	4
DC01RM-5P2	Artificial Neural Network-Practical	-	-	4	CIA		100*	2
DC01RM-5C4	Data Analytics-Theory	4	-	-	25	75	100	4
DC01RM-5P3	Data Analytics- Practical	-	-	4	CIA		100*	2
	Total	**16**	**-**	**12**			**700**	**22**
Semester – VI								
DC01RM-6C1	Machine Learning –II	4	-	4	25	75	100	6
DC01RM-6C2	Kinematics and Dynamics of Robots	4	-	4	25	75	100	6
DC01RM-6C3	Fundamentals of Artificial Intelligence for Robots	4	-	-	25	75	100	4
DC01RM-6C4	Project	2	2	4	CIA		100*	6
DC01RM-6C5	Ethics in Information Technology and Computer Communication	2	-	-	25	75	100	2
	Total	**16**	**2**	**12**			**700**	**24**
Grand total credits of (I,II,III,IV,V and VI Semester)							**4300**	**130**

*Continuous Internal Assessment (CIA).

Open Elective I: (DC01RM-3O1, DC01RM-3O2, DC01RM-3O3) Or DC01RM-3O4

DC01RM-3O1 Cryptography

DC01RM-3O2 Computer Security

DC01RM-3O3 Cloud Computing

DC01RM-3O4 Swayam Course (SWAYAM course related to the above mentioned electives)

Open Elective II: (DC01RM-4O1, DC01RM-4O2, DC01RM-4O3) Or DC01RM-4O4

DC01RM-4O1 Computer Forensics

DC01RM-4O2 Mobile & Wireless Security
DC01RM-4O3 Internet of Things
DC01RM-4O4 Swayam Courses (SWAYAM course related to the above mentioned electives)

23. **SWAYAM Course Guidelines (**For Students) Minimum 8 credits and a maximum of 20 credits of MOOC credits is permitted.)

Guidelines for opting MOOC subjects as elective or open elective (Any of the 4 credit or 2 credit subjects) Core 6 credit courses are not electives.

1. At the time of selecting any Elective or Open Elective, student can opt for a MOOC subject of same credit or one credit less.
2. Process for opting MOOC subject by the student:

Student identifies a MOOC subject on SWAYAM portal (https://swayam.gov.in).
Student informs Departmental SWAYAM Coordinator (DSC) about it.
DSC gives the code of the subject to the student.
Students will apply online through SMS or mobile app.
After the process the student enrolls/registers in the subject on SWAYAM portal (https://swayam.gov.in).
Student will inform DSC after registering and enrolling on SWAYAM portal.

3. After the completion of the subject, a copy of the certificate of completion with the marks obtained is to be submitted to the DSC.
4. Credit Conversion: If credit for MOOC subject taken by the student matches with the credit of Departmental elective or Open elective then no conversion is needed and same breakup for CA (online assignments) and ESE (Proctored exam) will be taken.

End Semester Exam (ESE) 50 Marks	**Continuous Assessment (CA) 50 Marks**			
	Proctored Exam (as per MOOC mark sheet scaled to 50)	Online Assignments (as per MOOC mark sheet)	Presentation 1 (to be conducted by departmental committee)	Presentation 2 (to be conducted by departmental committee)
Marks distribution	50	25	10	15
Marks required to Pass	ESE(out of 50) + Online assignment (out of 25)=30 marks		P1+P2=11 marks	

DC01RM-1C1- Fundamentals of Information Technology

(Total Hours 60)

Goal: To impart the knowledge about the evolution of computers, classification, various peripherals of computers, types of software's etc.

Objectives: By the end of this course, a student will

- Identify various devices and their working principles.
- Define various computer applications.
- Develop programming languages.

Teaching Learning Methodology:
Lectures, Class discussions, reading assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching. Use of displays by instructor, Use of slides, Quiz, Jigsaw and crosswords.

Unit 1 Computer Basics and Architecture
Computer Basics: Introduction, Characteristics computers, Evolution computers, Generation of computers, Classification of computers, the computer system, Application of computers.
Computer Architecture: Introduction, Central processing Unit- ALU, Registers, Control Unit, system bus, main memory Unit, cache memory, communication between various Units of a computer system.Components inside a computer system– System case, Power supply, Mother board, BIOS, Ports and Interfaces, Expansion card, Ribbon cable, Memory chips, Processors.

Unit 2 Computer memory and storage
Computer memory and storage: Introduction, memory representation, memory hierarchy, Random access memory, Types of RAM, Read-only memory, Types of ROM, RAM, ROM and CPU interaction.Secondary Storage: Types of secondary storage device - Magnetic tape, magnetic disk, Floppy disk, Hard disk, Advantages and disadvantages of magnetic disk, Optical disk, Types- CD, DVD, Blu ray disk, Advantages and disadvantages of optical disk, Magneto-optical disk, Memory stick, Universal serial bus, Mass storage devices.

Unit 3 Input devices and Output devices
Input devices: Introduction, Types of input devices, Keyboard, Mouse, Introduction to Track ball, Joystick light pen, Touch screen and track pad. Speech recognition, digital camera, webcam, flatbed scanner, Optical character recognition, Optical Mark Recognition, Magnetic ink character recognition, Bar code reader.
Output devices: Types of output, Classification of output devices, Printers- Dot
matrix, drum printer, Ink jet, Laser, Hydra, Plotter, Monitor- CRT, displaying graphics on CRT, Colour display on CRT, LCD, Differences between LCD and CRT, Other types of monitors, Voice response, Projector, Electronic white board.

Unit 4 Computer programming languages
Introduction to Computer programming languages, developing a program, Program development cycle, Types of programming languages, generation of programming languages, Features of a

good programming language. Computer software: Introduction, software definition, relationship between software and hardware, software categories, Installing and uninstalling software, software piracy, software terminologies. Word processing software, Spreadsheet software: Excel environment, copying cells using Fill handle, dragging cells, Formulas and functions, Inserting Charts, sorting.
Presentation software: Introduction, PowerPoint environment, creating a new presentation, working with different views, using masters, adding animation, adding transition, running slides. Microsoft Access: Access environment, Database objects.

Unit 5 Overview of Electronic Commerce
Main Activities, definition, Goal, Components, Advantages and disadvantages, Technical architecture, E-Com applications, E-Com and Electronic business. Network infrastructure: Evolution of the Internet, Business use, LAN, MAN, WANs. OSI Model: Introduction to OSI Model, Seven Layers, Overview of TCP/IP reference model.

Suggested Reading:

- Sharma, A. K. (2018). Computer fundamentals and programming in C.
- Norton, P. (2005). Peter Norton's Introduction to Computers. Mcgraw-Hill Education.
- Goel, A., & Mittal, A. (2015). "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
- ESL, I. (2012). Introduction to Information Technology. Pearson Education India.

Practical: Based on MS Office (Total Hours 60)

1. Prepare a word document for inserting picture, bulleting, numbering, formatting, border shading.
2. Prepare document for word art, drop cap, columns, text box, symbols, equation of any mathematical series.
3. To create a resume.
4. Prepare a Power point presentation on a technical topic.
5. Create a student table with the following details: name, address, class attendance,
6. Create a EMPLOYEE data base having D.A.H.R A, income tax, Net Pay
    a. D.A = 10% of basic pay
    b. H.R.A – if basic pay is less than 25,000 H.R.A 10% of basic else H.R.A 25% of basic.
    c. Gross= D.A+H.R.A+Basic Pay
    d. Provident fund = 12% of basic pay.

DC01RM-1C2 – Computer System Architecture

(Total Hours 60)

Goal: This course will enable the students to conceptualize the basics of organizational and architectural issues of a digital computer. To analyze performance issues in processor and memory design of a digital computer. To understand various data transfer techniques in digital computer. To analyze processor performance improvement using instruction level parallelism

Objectives: By the end of this course, a student will

- Understand basic structure of computer.
- Perform computer arithmetic operations.
- Control Unit operations.
- Design memory organization that uses banks for different word size operations.
- Explain the concept of cache mapping techniques.
- Describe the concept of I/O organization.
- Conceptualize instruction level parallelism.

Teaching Learning Methodology:
Lectures, Demonstration using IC trainer kits, Class discussions, assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching. Use of displays by instructor, Use of slides.

Unit 1 Introduction
Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory Units.

Unit 2 Data Representation and Basic Computer Arithmetic
Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers

Unit 3 Basic Computer Organization and Design
Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

Unit 4 Central Processing Unit
Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

Unit 5 Memory Organization:
Cache memory - Associative memory - mapping.

Unit 6 Input-Output Organization
Input / Output: External Devices, I/O Units, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Suggested Reading

- Mano, M. M. (2003). Computer system architecture. Prentice-Hall of India.
- Mano, M. M., &Ciletti, M. D. (2007). Digital design. Upper Saddle River, NJ: Pearson Prentice Hall.
- Hamacher, V. C., Vranesic, Z. G., Zaky, S. G., Vransic, Z., &Zakay, S. (1984). Computer organization. New York: McGraw-Hill.
- Dos, A. J. (2004). Assembly language and computer architecture using C++ and Java. Brooks/Cole.
- Stallings, W. (2019). Computer organization and architecture: designing for performance. Pearson.

PRACTICAL: (Total Hours 60)

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

1. General study of Basic & Universal gates
   - AND
   - OR
   - NOT
   - NOR
   - NAND
   - XOR
   - XNOR
2. Simple Boolean Expression using Basic gates and Universal gates: A.(B+A) + B.A
3. Design Half-Adder, Full-Adder, Half-Subtractor, Full-Subtractor Circuit.
4. Parallel Adder (2-bit, 3-bit) Circuit.
5. Implement logic functions in SOP form using Multiplexer.
6. Implement De-multiplexer.
7. Implement 7- Segment Display with Decoder.
8. Implement Parity Generator (Odd & Even)
9. Implement Magnitude Comparator (1-bit, 2-bit, 3-bit)
10. Circuit Design and implementation of Flip-Flops (SR, JK, D) using ICs
11. Circuit design and implementation of Decoder (2x4) and Encoder (4x2) using ICs

DC01RM-1C3 –Soft Skills &Business Communication

(Total Hours 60)

Goal: This course will enable the students to sharpen the Analytical, Written, non-verbal, Spoken Communication and interpersonal Skills essential in organizations involving Decision making and implementation, to demonstrate good team work and negotiation skills.

Objectives: By the end of this course, a student will

- Hone the communication skills of the student to meet the changing and challenging demands of modern professional environment
- Reinforce presentation skills and professionalism
- Build a strong base for good interpersonal relationship and communication skills
- Create awareness about all areas of multiple intelligences

Teaching Learning Methodology:
Lectures, Class discussions, reading assignments, Discussion groups, Student Presentation, Textbook assignment, Use of flip chart board by instructor as aid in teaching, Use of slides, Quiz, Jigsaw and crosswords.

Unit 1: Communication in Business
Importance of Communication, Forms of Communication, Communication Network of the Organization; Process of Communication: Different Stages, Difference between Oral and Written Communication.

Oral Communication Skills
Fundamentals, Barriers and Gateways, Public Speaking, Effective Power point presentation, body language, non-verbal, facial expressions, voice modulation, eye contact, audience research, questions from the audience, communication and emotional intelligence, creativity in oral communication, Communication through Telephonic, video and Skype, Group Discussion.

Unit 2: Non Verbal and Inter Cultural Communication

Importance of non-verbal communication, personal appearance, facial expressions, movement, posture, gestures, eye contact –voice, beliefs and customs, worldview and attitude.

Written Communication Skills: Writing an Effective Report: Stages of Writing, Style and Tone; Five W's and one H of Report Writing, Divisions, Numbering and use of Visual Aids, creativity in written communication, use of picture, diagram in written communication, Writing Commercial Letters, E- Mail Messages, maintaining a Diary, Job applications & resume writing.

Unit 3: Listening Skills: Importance and need, types, active and empathic listening, listening and judgment, developing skills, listening and understanding, Anatomy of poor Listening, Features of a good Listener

Communication in Business: Systems approach, forms, functions and principles of communication, management and communication, communication patterns, barriers to communication, interpersonal perception – SWOT analysis, Johari Window, Transactional Analysis.

Unit 4: Interpersonal Communication skills

Advantages and disadvantages of utilizing the team work; characteristic features of successful teams; stages of the development of a team; team roles; challenges in team working, forms of non-team behaviour. Conditions of negotiating; strategies of negotiating (win-win, win-loss); participative negotiations; negotiating tactics; cognition and emotions in negotiating; negotiating and ethics, Types and sources of conflicts; the influence of various cultures on the solving of conflicts.

Unit 5:

Prose:

A Snake in the Grass R K Narayan

Poetry:

On his Blindness John Milton

Suggested Reading:

1. Monippally, M. M. (2001). Business communication strategies. Tata McGraw-Hill Pub. New Delhi.
2. Bovée, C. L., Thill, J. V., & Raina, R. L. (2016). Business communication today. Pearson India Education Services Pvt. Ltd.
3. Ober, S. (2009). Contemporary Business Communication. Houghton Mifflin.
4. Thill, J. V., &Bovée, C. L. (2019). Excellence in business communication. Pearson.
5. Lesikar, R. V., &Flatley, M. E. (2005). Basic business communication: skills for empowering the internet generation. Boston, Mass. McGraw-Hill/Irwin C.
6. Ludlow, R., & Fergus Panton. (1995). The essence of effective communication. Prentice-Hall of India.
7. Chaturvedi, P. D. (2013). Business Communication: concepts, skills, cases and applications.
8. Murphy, H. A., Hildebrandt, H. W., & Thomas, J. P. (1997). Effective business communications. New York: McGraw-Hill.

DC01RM-1C4 - Basic Mathematics & Statistics

(Total Hours 60)

Goal: To impart the basic knowledge about the Mathematics and Statistics.

Objectives: By the end of this course, a student will

- To develop the skills of students in applying basic concepts in chosen topics of mathematics that are imperative for effective understanding of application oriented topics.
- To understand the basic concepts of matrices and know the importance of rank of matrix in data science.
- To know the importance of equation in data science models and its transformation.
- To understand the importance of differential calculus in estimation of linear models and to find the optimal values in minima and maxima.
- To know the basic concepts of integral calculus in statistical distribution functions.
- Laying the foundation for learning concepts of Trigonometry and inverse functions

Teaching Learning Methodology:
Lectures, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1: Set Theory
Sets and their representations; The empty set; finite and infinite sets; equal and equivalent sets; subsets; power set; universal set; Venn diagrams; complement of a set operations on sets; applications of sets.

Unit 2: Matrices and Determinants
Definition of a matrix; Operations on matrices; Square Matrix and its inverse; determinants; properties of determinants; the inverse of a matrix; solution of equations using matrices and determinants; solving equations using determinants.

Unit 3: Trigonometry
Radian or circular Measure; Trigonometric Functions; Trigonometrical ratios of angle θ when θ is acute; trigonometrical ratios of certain standard angles; allied angles; compound angles; multiple and sub- multiple angle. Limits and Continuity. The real number system; The concept of limit; concept of continuity.

Unit 4: Differentiation
Differentiation of powers of x; Differentiation of ex and log x; differentiation of trigonometric functions; Rules for finding derivatives; Different types of differentiation; logarithmic differentiation; differentiation by substitution; differentiation of implicit functions; differentiation from parametric equation. Differentiation from first principles.

Unit 5: Integrations

Integration of standard Functions; rules of Integration; More formulas in integration; Definite integrals.

Probability

Concept of probability; sample space and events; three approaches of probability; kolmogorov's axiomatic approach to probability; conditional probability and independence of events; bay's theorem. Basics Statistics, Measures of central Tendency; Standard Deviation; Discrete series. Methods; Deviation taken from assumed mean; continuous series; combined standard deviation; coefficient of variation; variance.

Suggested Reading:

- Narayan, S., & Mittal, P. K. (2005). Integral calculus. Chand.
- George, F. (1960). Higher mathematics for students of engineering and science. Macmillan; New York.
- Kandasami. (2012). Allied mathematics. S Chand & Co Ltd.
- Cochran, W. L. (2018). Single Variable Calculus.
- Tom Mike Apostol. (2003). Calculus. John Wiley & Sons.
- William Snow Burnside. (1960). The Theory of equations / 2. Dover.
- Snow, W., & Arthur William Panton. (2005). The theory of equations: with an introduction to the theory of binary algebraic forms. Dover Publications.
- Beecher, J. A., Penna, J. A., &Bittinger, M. L. (2016). Algebra and trigonometry. Pearson.

DC01RM-1C5 Social Responsibility and Community Engagement

(Total Hours:30)

Goal: This paper will help the students

- To develop an appreciation of rural culture, life-style and wisdom amongst students
- To learn about the status of various agricultural and rural development programmes
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning

Learning Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and social realities
- Develop a sense of empathy and bonds of mutuality with local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic Improvements

Course Content:

Unit 1: Appreciation of Rural Society (08 hours)

Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.

Assignment: Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.

Teaching/ Learning Methodology

1. Interactive Lectures (03 hours)
2. Self directed learning (03 hours)
3. Field activities (02 hours)

Unit 2: Understanding rural economy & livelihood (08 hours)

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.

Assignment: Describe your analysis of rural household economy, its challenges and possible pathways to address them.

Teaching/ Learning Methodology

1. Interactive Lectures (02 hours)
2. Self-directed learning (02 hours)
3. Field activities (04 hours)

Unit 3: Rural Institutions **(07 hours)**

Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration

Assignment: How effectively are Panchayat raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual)

Teaching/ Learning Methodology

1. Interactive Lectures (02 hours)
2. Field activities (05 hours)

Unit 4: Rural Development Programmes **(07 hours)**

History of rural development in India, current national programmes: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swatch Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.

Assignment: Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving implementation of the programme for the rural poor.

Teaching/ Learning Methodology

1. Interactive Lectures (01 hour)
2. Field activities (04 hours)
3. Assignment (02 hours)

Assessment: - Feedback, MCQs, Submission & presentation of project work/Survey findings

Continuous Internal Assessment (CIA)

Internal Assessment is continuous and details are notified well in advance. CIA consists of the following

SN	Assessment for 100 marks	Marks
1	Objective type questions	20
2	Presentation / Survey Findings	50
3	Assignment/Seminars/Viva-voce/ Class Interaction/Attitude	20
4	Log Book	10

Recommended field-based practical activities:

- Interaction with SHG women members and study of their functions and challenges; planning for their skill building and livelihood activities
- Visit MGNREGS project sites interact with beneficiaries and interview functionaries at the work site
- Field visit to Swatch Bharat project sites conduct analysis and initiate problem solving measures
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan(GPDP)
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource embolization
- Visit Rural Schools/mid-day meal centres study Academic and infrastructural

resources and gaps

- Participation Gram Sabha meetings and study community participation
- Associate with Social audit exercise at the Gram Panchayat level, and interact with programme beneficiaries
- Attend Parent Teacher Association meetings and interview school drop outs
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NGOs civil society organizations and interact with their staff and beneficiaries,
- Organize awareness programmes health camps Disability camps and cleanliness camps
- Conducts oil health test drinking water analysis energy use and fuel efficiency surveys
- Raise understanding of people's impacts of climate change building up community's Disaster preparedness
- Organize orientation programmes for farmers regarding organic cultivation rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
- Formation of committees for common property resource management village pond Maintenance and fishing

Credit: 2 credit, 30 hours, at least 50% in field, compulsory for all students

Contents: Divided into four Units, field immersion is part of each Unit

Course Structure: 2Credits Course (1Credit for Class room and Tutorials and 1Credit for Field Engagement)

Suggested Readings

Books:

- Katar Singh, & Anil Shishodia. (2016). Rural development. 4e : principles, policies and management. Sage Publications.
- A Hand book on Village Panchayat Administration Rajiv Gandhi Chair for Panchayat Raj Studies,2002.
- United Nations, Sustainable Development Goals, 2015un.org/sdgs/
- M.P. Boraian,Best Practices in Rural Development,ShanlaxPublishers,2016.

Journals:

1. Journals of Rural development, (published by NIRD &PR Hyderabad)
2. Indian Journal of Social Work, (by TISS,Bombay)
3. Indian Journal of Extension Education(byIndianSocietyofExtensionEducation)
4. Journal of Extension Education (by Extension EducationSociety)
5. Kurukshetra (Ministry of Rural Development,GoI)
6. Yojana(Ministry of Information and Broadcasting,GoI

DC01RM-2C1Programming Fundamentals using C++

(Total Hours 60)

Goals: This course is aimed at enabling students to perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs. Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance. Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.

Objectives: By the end of this course, a student will**,**

- Understand concepts of objects and their significance in real world
- Investigate software problem in terms of objects and entities
- Learn to co-relate relationship among different entities involved in a system
- Find dependency and roles in an environment
- Develop software in terms of objects, associations, and integrity constraints
- Generalize and aggregate business entities and transform behavior into functions
- Identify, understand and analyze various sample development models

Teaching Learning Methodology:
Lectures, Demonstration by program execution using various software tools, Class discussions, reading assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies by programming assignments. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Principles of OOP
Software Crisis – Software Evolution – Programming Paradigms. Object Oriented Technology-Basic concepts and benefits of OOP – Application of OOP, OOP Languages.

Introduction to C++: History of C++, Structure of C++, Application of C++, tokens, keywords, identifiers, basic data types, derived data types, derived data types, symbolic constant, dynamic initialization, Suggested Reading variables, scope resolution operator, type modifiers, type casting operators and control statements, input and output statements in C++, Function prototyping and components, Passing parameters: Call by reference, Return by reference, Inline function, Default arguments, Over loaded function.

Unit 2 Classes and Objects- Class specification, Member function definition – nested member function, access qualifiers, static data members and, member functions. Instance creation – Array of objects - Dynamic objects - Static Objects – Objects as arguments -Returning objects

Unit 3Constructors and Destructors: Constructors- Parameterized constructors, Overloaded Constructors, Constructors with default arguments, copy constructors, Destructors.
Operator Overloading: Operator function-overloading unary and binary operators, overloading the operator using Friend function, Stream operator overloading, Data conversion.

Unit 4 Inheritance: Defining derived classes. Single Inheritance - Protected data with private inheritance - Multiple Inheritances - Multi Level Inheritance - Hierarchical Inheritance. Hybrid Inheritance - Constructors in derived and base Class -Abstract classes - Virtual function and Dynamic polymorphism -Virtual destructor - Nested Classes.

Unit 5 Functions in C++
Virtual functions- need for Virtual function, Pure Virtual functions, Generic Programming with Templates. Introduction, function templates, overloaded function templates, user defined templates arguments, class templates, Inheritance of class templates.

Suggested Reading

- Sourav Sahay. (2012). Object oriented programming with C++. Oxford University Press, OupIndia ; New Delhi.
- Schildt, Herb. (2002). The Complete Suggested ReadingC++. Tata McGraw-Hill, Fourth Edition.
- Lafore, R. (2002). Object-oriented programming in C. Indianapolis, IN: Sams. Ashok N Kamathane. (2003). Object Oriented Programming with ANSI & Turbo C++, Pearson.
- Stroustrup, B. (2000). The C++ programming language. Pearson Education India.
- Venugopal, K. R. (2013). Mastering C++. Tata McGraw-Hill Education.
- Balagurusamy. E., (2013). Object oriented programming with C++. Tata Mcgraw-Hill.
- Dewhurst, S. C. (2009). C++ common knowledge: essential intermediate programming. Addison-Wesley.
- Malik, D. S. (2018). C++ programming: from problem analysis to program design. Cengage Learning.
- Schildt, H., & Eloy Pineda Rojas. (2009). C++ Programming, Mcgraw-Hill.
- Savitch, W. (2018). Problem solving with C++. New York, Pearson.
- Savitch, W. J. (2003). Visual C++ 6.0: companion to Problem solving with C++: the object of programming. Addison-Wesley.

Practical: (Total Hours 60)

Object Oriented Programming Using C++ LAB

1. Write a C++ program to find the sum of individual digits of a positive integer.
2. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C++ program to generate the first n terms of the sequence.
3. Write a C++program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C++program to find the factorial of a given integer 5. Write a C++program to find the GCD of two given integers
5. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.
6. Write a C++program to implement call by value and call by Suggested Reading parameters passing
7. Write a C++ program to implement function templates
8. Write a program to implement Overloading and Overriding
9. Write a C++ program to implement the matrix ADT using a class. The operations supported by this ADT are:
    a. Reading a matrix.
    b. Printing a matrix
    c. Addition of matrices
    d. Subtraction of matrices
    e. Multiplication of matrices
10. Write C++programs that illustrate how the Single inheritance, Multiple inheritance Multi level inheritance and Hierarchical inheritance forms of inheritance are supported.
11. Write a C++program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class
12. Write a C++ program that illustrates how run time polymorphism is achieved usingvirtual functions

DC01RM-2C2 Data Base Management System

(Total Hours 60)

Goal: This course will enable the students to understand and use a relational database system, to introduce the students to Databases, Conceptual design using ERD, Functional dependencies andNormalization, Relational Algebra is covered in detail. To learn how to design and create agood database and use various SQL operations.

Objectives: By the end of this course, a student will

- Master the basic concepts and understand the applications of database systems.
- Construct an Entity-Relationship (E-R) model from specifications and to transform to relational model.
- Construct unary/binary/set/aggregate queries in Relational Algebra.
- Understand and apply database normalization principles.
- Cconstruct SQL queries to perform CRUD operations on database. (Create, Retrieve, Update, Delete)
- Understand principles of database transaction management, database recovery, security.

Teaching Learning Methodology:
Lectures, Class discussions, Demonstration using program execution, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Database Systems
Introducing the database and DBMS, Files and File Systems, Problems with file System and advantages of Database Management systems.
Data Models: The importance of Data models, Data Model Basic Building Blocks, Business Rules, The evaluation of Data Models, Degree of Data Abstraction.

Unit 2 The Relational Database Model
A logical view of Data, Keys, Integrity Rules, Relational Set Operators, The Data Dictionary and the system catalog, Relationships within the Relational Database, Data Redundancy revisited, Indexes, Codd's relational database rules.
Entity Relationship Model:The ER Model, Developing ER Diagram.

Unit 3 Normalization of database tables
Database Tables and Normalization, The need for Normalization, The Normal forms and High level Normal Forms, denormalization.

Unit 4 SQL

Introduction to SQL: Data Definition Commands, Data Manipulation Commands, Selectqueries, Advanced Data Definition Commands, Advanced Select queries, Virtual Tables, JoiningDatabase Tables.

Advanced SQL:Relational Set Operators, SQL Join Operators, Subqueries and correlatedqueries, SQL Functions, Oracle Sequences, and Procedural SQL.

Unit 5 Transaction Management and Concurrency Control

What is transaction, Concurrencycontrol, Concurrency control with locking Methods, Concurrency control with time stampingmethods, concurrency control with optimistic methods, database recovery management.

Suggested Reading

- Rob, P., & Coronel, C. (2003). Database systems: design, implementation, and management. Course Technology.
- RamezElmasri, & Sham Navathe. (1272). Fundamentals of database systems. Seiten [VerlagNichtErmittelbar.
- Elimasri / Navathe. (2007). Fundamentals of Database Systems, 5th Ed., Pearson Addison Wesley
- Raman A Mata – Toledo/Panline K Cushman. (2007). Database Management Systems, Schaum'sOutlibe Series, Tata McGraw Hill.
- Date, C. J. (2004). An introduction to database systems. Pearson Education India.
- Kahate, A. (2004). Introduction to database management systems. Pearson Education India.

Practical (Total Hours 60)

Database Management Systems Lab

1. **Order Tracking Database**

- The Order Tracking Database consists of the following defined six relation schemas.
- Employees(eno,ename,zip,hdate)
- Parts(pno,pname,qoh,price,level) (hint: qoh: quality on hand)
- Customers(cno,cname,street,zip,phone)
- Orders(ono,cno,eno,receiveddate,shipped date) Odetails(ono,pno,qty)
- Zipcodes(zip,city)

Solve the following:

1. Get all pairs of customer numbers for customers based on same zip code.
2. Get part numbers for parts that have been ordered by at least two different customers.

3. For each odetail row, get ono,pno,pname,qty and price values along with the total price for the item. (total price=price*qty)
4. Get customer name and employee pairs such that the customer with name has placed an order through the employee
5. Get customer names living in fort dodge or liberal.
6. Get cname values of customers who have ordered a product with pno 10506.
7. Get pname values of parts with the lowest price. 8. Get cname values of customers who have placed at least one order through the employee with number 1000.
8. Get the cities in which customers or employees are located.
9. Get the total sales in dollars on all orders.
10. Get part name values that cost more than the average cost of all parts.
11. Get part names of parts ordered by at least two different Customers.
12. Get for each part get pno, pname and total sales
13. For each part, get pno,pname, total sales, whose total sales exceeds 1000
14. Get pno, part names of parts ordered by at least two different customers.
15. Get cname values of customers who have ordered parts from any one employee based in wichita or liberal.

2. Shipment database

An enterprise wishes to maintain the details about his suppliers and other corresponding details.

For that it uses the following tables:

- Table s(sid,sname,address)
- primary key:sid
- Table p(pid,pname,color)
- primary key:pid
- Table cat(sid,pid,cost)
- primary key:sid+pid
- Suggested Reading key:sidSuggestedReadings.sid
- pidSuggestedReadingp.pid

Solve the following:

1. Find the pnames of parts for which there is some supplier
2. Find the snames of suppliers who supply every part.
3. Find the snames of suppliers who suppy every red part.
4. Find the pnames of parts supllied by london supplier and by no one else
5. Find the sids of suppliers who charge more for some part other than the average cost of that part
6. Using group by with having clause get the part numbers for all the parts supplied by more than one supplier.
7. Get the names of the suppliers, who do not supply part p2.

8. Find the sids of suppliers who supply a red and a green part 9. Find the sids of suppliers who supply a red or a green part
9. Find the total amount has to pay for that supplier by part located from london Employee Database: An enterprise wishes to maintain a database to automate its operations. Enterprise divided into certain departments and each department consists of employees.

The following two tables:

- describes the automation schemas
- Dept (deptno, deptname, loc)

3. Emp (empno,ename,job,mgr,hiredate,sal,comm,deptno)

1. Create a view, which contain employee names and their manager names working in sales department.
2. Determine the names of employee, who earn more than their managers.
3. Determine the names of employees, who take highest salary in their departments.
4. Determine the employees, who located at the same place.
5. Determine the employees, whose total salary is like the minimum salary of any department.
6. Update the employee salary by 25%, whose experience is greater than 10 years.
7. Delete the employees, who completed 32 years of service.
8. Determine the minimum salary of an employee and his details, who join on the same date.
9. Determine the count of employees, who are taking commission and not taking Commission.
10. Determine the department does not contain any employees.
11. Find out the details of top 5 earner of company.
12. Display those managers name whose salary is more than average salary of his employees.
13. Display those employees who joined the company before 15th of the month?
14. Display the manager who is having maximum number of employees working under him?
15. Print a list of employees displaying ‘less salary’ if less than 1500 if exactly 1500 display as ‘exact salary’ and if greater than 1500 display ‘more salary’?
16. Display those employees whose first 2 characters from hire date-last 2 characters of salary?
17. Display those employees whose 10% of salary is equal to the year of joining?
18. In which year did most people join the company? Display the year and number of employees.
19. Display the half of the enames in upper case and remaining lower case
20. Display ename, dname even if there no employees working in a particular department(useouter join).

4. Pl/sql programs

- Write a pl/sql program to check the given number is strong or not.
- Write a pl/sql program to check the given string is palindrome or not.

- Write a pl/sql program to swap two numbers without using third variable.
- Write a pl/sql program to generate multiplication tables for 2,4,6
- Write a pl/sql program to display sum of even numbers and sum of odd numbers in the given range.
- Write a pl/sql program to check the given number is pollinndrome or not.
- write a pl/sql procedure to prepare an electricity bill by using

following table
table used: elect
name null? Type
mno not null number(3)
cname varchar2(20)
cur_readnumber(5)
prev_readnumber(5)
no_Unitsnumber(5)
amount number(8,2)
ser_taxnumber(8,2)
net_amtnumber(9,2)

- Write a procedure to update the salary of employee, who belongs to certain department with a certain percentage of raise.

DC01RM-2C3 Environmental Studies

(Total Hours 30)

Goal: This course will enable the students to understand and define terminology commonly used in environmental science; Briefly summarize and describe global, regional, and landscape scale environmental processes and systems; list common and adverse human impacts on biotic communities, soil, water, and air quality and suggest sustainable strategies to mitigate these impacts.

Objectives: By the end of this course, a student will

- Possess the intellectual flexibility necessary to view environmental questions from multiple perspectives, prepared to alter their understanding as they learn new ways of understanding.
- Solve problems systematically, creatively, and reflexively, ready to assemble knowledge and formulate strategy.
- Read, critically evaluate presented information and data using scientific principles and concepts, synthesize popular media reports/articles discussing environmental issues, and verbally discuss and defend their Introduction to Environmental Science
- Apply learned information to postulated environmental scenarios to predict potential outcomes.

Teaching Learning Methodology:
Lectures, Class discussions, field visits, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2 Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3 Natural Resources: Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4 Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5 Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6 Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8 Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems -pond, river, Delhi Ridge, etc.

Suggested Reading

- Gleick, P. H. (1993). Water in crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p, 9.
- Odum, E. P., & Barrett, G. W. (1971). Fundamentals of ecology (Vol. 3, p. 5). Philadelphia: Saunders.
- Environmental and Pollution Science (Third Edition). (2020). Academic Press.
- Gupta, S. R. (2014). Ecology environmental science and conservation. S Chand.
- Sodhi, N. S. (2013). Conservation biology: voices from the tropics. Wiley Blackwell.
- Ronald Ernest Bartlett. (1971). Waste water treatment. Applied Science Publishers.
- Raven, P. H., & Berg, L. R. (2003). Environment. Study guide. Wiley.
- Shyam Divan, & Armin Rosencranz. (2002). Environmental law and policy in India. Oxford University Press.
- RamprasadSengupta. (2004). Ecology and economics: an approach to sustainable development. Oxford University Press.
- Rosencranz, A., Divan, S., & Noble, M. L. (2001). Environmental law and policy in India. Tripathi.
- Sengupta, R. (2003). Ecology and economics: An approach to sustainable development. OUP.
- Singh, J.S., Singh, S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
- Sodhi, N.S., Gibson, L. & Raven, P.H. (2013). Conservation Biology: Voices from the Tropics. John Wiley & Sons.

DC01RM-2C4 Statistical Techniques with R

(Total Hours 60)

Goal: This course will enable the students toframe real life problems in appropriate statistical terms in order use data to make better decisions, to make sense of data along with the basics of regression analysis. Students will develop critical and integrative thinking in order to communicate the results of the analysis clearly in the context of the problem and unambiguously articulate the conclusions and limitations of the analysis with a clear separation between data and judgment.

Objectives: By the end of this course, a student will

- Select appropriate statistical techniques for summarizing and displaying data
- Analyze and draw inferences from data using appropriate statistical methods.
- Analyze the dispersion in the data and draw inference.
- Define the concept of a frequency distribution for sample data, and be able to summarize the distribution by diagrams and statistics.
- Examine correlation and regression, and be able to make predictions and understand their limitations.

Teaching Learning Methodology:
Lectures, Demonstrations using softwares, reading assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies by coding. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Classification, tabulation and graphical representation of data
Types of data, measurement of data, Classification of data, preparation of tables, stem and leaf display, presentation of data, frequency distribution, graphical representation.
Measure of central tendency: need, importance and Characteristics, Mean: Arithmetic mean, Geometric mean, Harmonic mean, weighted mean, Combined mean, Median, Mode of grouped and ungrouped data, quartiles, merits and demerits.

Unit 2 Measure of Dispersion
Need, importance and properties, range, interquartile deviation, quartile deviation, mean deviation, variance, standard deviation, coefficient of variation, combined variance of grouped and ungrouped data, merits and demerits.
Regression: scatter diagram, Simple linear regression, regression line x on y and y on x, regression coefficients, method of least squares to fit a regression line, properties of regression coefficient, multiple regression (2 independent variables), applications.

Unit 3 Correlation

Graphical representation, correlation coefficient, correlation of bi-variate data, relationship between correlation coefficient and regression coefficients, rank correlation, and problem of tied observations.

Unit 4 R Programming

Introducing R, The need for R, Installing R, RStudio; Basic Objects – Vector, Matrix, Array, Lists, Data frames, Functions. Managing Workspace: R's working directory, Inspecting the environment, Modifying global options Managing the library of packages; Basic Expressions: Assignment expressions, Conditional expressions, Loop expressions.

Working with Strings: Getting started with strings, Formatting date/time, using regular expressions.

Working with Data: Reading and writing data, Visualizing data, Analysing data

Unit 5 Inside R

Understanding lazy evaluation, the copy-on-modify mechanism, lexical scoping, how an environment works; Meta programming -functional programming; computing on language.

Data Manipulation: Using built-in functions to manipulate data frames, Using SQL to query data frames via the sqldf package, Using data. Table to manipulate data, Usingdplyr pipelines to manipulate data frames, Using rlist to work with nested data structures; Profiling code, Boosting code performance

Suggested Reading

- Ross, S. M. (2020). Introduction to probability and statistics for engineers and scientists.
- Montgomery, D. C. (2019). Applied statistics and probability for engineers. Wiley.
- Christian Albright, Winston, W. L., &Zappe, C. J. (2010). Data analysis and decision making with Microsoft Excel. South-Western; Andover.
- Black, K. (2013). Applied business statistics: making better business decisions. Wiley; Chichester.
- Boslaugh, S. (2013). Statistics in a nutshell. O'reilly.
- Gupta, S. C., & Kapoor, V. K. (2018). Fundamentals of mathematical statistics. Sultan Chand & Sons.
- Kurtz, T. E. (1963). Basic statistics. Prentice-Hall.
- Rice, J. A. (2007). Mathematical statistics and data analysis. Cengage Learning/Brooks/Cole, Reimp.

DC01RM-3C1 Introduction to Robotics

(Total Hours 60)

Goal: This course will familiarize the students with thesystematic approaches to Artificial Intelligence - I. The student shall be able to identify and resolve issues related to biometric securities such as fingerprint, retina, and DNA biometric

Objectives: by the end of the course the student will learn,

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Demonstration using various tools, Simulations, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

Introduction To Robotics: What is robot?, Classification of Robots, Advantages and Disadvantages ofRobots, Robot Components, Degree of Freedom, Joints, Robot Coordinates, Reference Frames,Programming Modes, Robot Characteristics, Robot Workspace, Robot Languages, Application of Robots.

Unit 2

Spatial Descriptions And Transformation: Robot as Mechanisms, Matrix Representation, Descriptionof Position and Orientation, Frames and Displacement mappings, Homogeneous transforms,Transformation of free vectors, examples.

Unit 3

Manipulator Forward Kinematics: Link description, link connection, Denavit – Hartenberg parameters,examplesManipulator Inverse Kinematics: Solvability, algebraic and geometric approaches, Degeneracy andDexterity, Examples.

Unit 4

Jacobians: Velocities, Static Forces and Manipulator Dynamics analysis: Velocity analysis, linearand rotational velocity of rigid bodies, velocity propagation, Jacobians, velocity transformation and inverse velocity, force transformation and inverse force, examplesRobot Controller Design: P, PI, PD, PID and AI control in Robotics

Suggested Reading:

- DavideBrugali. (2007). Software engineering for experimental robotics. Springer.
- Lewis, F. L., Fitzgerald, M., & Liu, K. (1996). Robotics. ACM Computing Surveys (CSUR), 28(1), 81-83.
- Craig, J. J. (2018). Introduction to robotics : mechanics and control. Pearson.
- Deb, S., & Deb, S. (2010). Robotics technology and flexible automation. Tata Mcgraw-Hill Education.
- YoramKoren. (1987). Robotics for engineers. Mcgraw-Hill.
- Fu, K. S., González, R. C., Lee, C. S. G., & Freeman, H. (1987). Robotics : Control, sensing, vision and intelligence. Mcgraw-Hill..

DC01RM-3C2 Data Structure

(Total Hours 60)

Goal: The Goal for this course are to gain a solid understanding of the topics such as Principles for good program design, especially the uses of data abstraction and modular program composition. The fundamental design, analysis, and implementation of basic data structures and algorithms. Basic concepts in the specification and analysis of programs.

Objectives: By the end of this course, a student will

- Differentiate primitive and non-primitive structures.
- Design and apply appropriate data structures for solving computing problems.
- Apply sorting and searching algorithms to the small and large data sets.

Teaching Learning Methodology:

Lectures, Demonstrations using software's, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies or Coding assignments. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Data Structures Basics

Structure and Problem Solving, Data structures, Data structure Operations, Algorithm: complexity, Time- space trade-off.

Unit 2 Linked List

Introduction, Linked lists, Representation of linked lists in Memory, Traversing a linked list, Searching a linked list, Memory allocation and Garbage collection, insertion into linked list, Deletion from a linked list, Types of linked list.

Unit 3 Stack and Queue

Introduction, Array Representation of Stack, Linked List Representation of stack, Application of stack, Queue, Array Representation of Queue, Linked List Representation of Queue.

Unit 4 Trees

Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Sequential and Other Representations of Trees, Tree Traversal.

Unit 5 Graphs

Matrix Representation of Graphs, List Structures, Other Representations of Graphs, Breadth First Search, Depth First Search, Spanning Trees.

Unit 6 Directed Graphs

Types of Directed Graphs; Binary Relation As a Digraph; Euler's Digraphs; Matrix Representation of Digraphs.

Unit 7Applications of Graphs

Topological Sorting, Shortest-Path Algorithms – Weighted Shortest Paths – Dijkstra's Algorithm, Minimum spanning tree- Prim's Algorithm, Introduction to NP-Completeness.

Unit 8 Searching and Sorting Techniques

Sorting Techniques: Bubble sort, Merge sort, Selection sort', Heap sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching, Search Trees.

Unit 9 Elementary Algorithms

Notation for Expressing Algorithms; Role and Notation for Comments; Example of an Algorithm; Problems and Instances; Characteristics of an Algorithm; Building Blocks of Algorithms; Procedure and Recursion – Procedure, Recursion; Outline of Algorithms; Specification Methods for Algorithms.

Unit 10 Mathematical Functions and Notations

Functions and Notations; Modular Arithmetic / Mod Function; Mathematical Expectation in Average Case Analysis; Efficiency of an Algorithm; Well Known Asymptotic Functions and Notations; Analysis of Algorithms – Simple Examples; Well Known Sorting Algorithms – Insertion sort, Bubble sort, Selection sort, Shell sort, Heap sort.

Unit 11 Divide and Conquer

Divide and Conquer Strategy; Binary Search; Max. And Min.; Merge sort; Quick sort.

Unit 12 Greedy Method

Greedy Method Strategy; Optimistic Storage on Tapes; Knapsack Problem; Job Sequencing with Deadlines; Optimal Merge Pattern; Single Source Shortlist Paths.

Unit 13 Dynamic Programming

Dynamic Programming Strategy; Multistage Graphs; All Pair Shortest Paths; Travelling Salesman Problems.

Unit 14 Backtracking Strategy

8-Queens Problem, Sum of Subsets, Knapsack Problem.

Suggested Reading

- Reddy. P. (1999). Systematic Approach to Data Structures Using C. Bangalore: Sri Nandi Publications
- Kamthane, A.(2003)Programming & Data Structures (For Anna University)Pearson Education India.
- Lipschutz. S. (2011). Data Structures with C. Delhi: Tata McGraw hill Reddy. P. (1999). Data Structures Using C. Bangalore: Sri Nandi Publications
- Samanta, D. (2003). Classic data structures. Prentice-Hall of India.
- Mark Allen Weiss. (2005). Data structures & algorithm analysis in C++. Addison-Wesley.
- Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C.(2009). Introduction to algorithms. MIT press.

http://msdn.microsoft.com/en-us/library/ms379574(v=vs.80).aspx

- http://cg.scs.carleton.ca/~luc/1997notes/topic11/

DC01RM-3C3 Operating System

(Total Hours 60)

Goal: This course will enable the students to understand how to operating systems works, including the processes, scheduling, deadlocks, memory management

Objectives: By the end of this course, a student will

- Understand the Basics of Computer and Operating Systems Structure
- Realize the concept of Process Management and Mutual Execution
- Understand the concepts of the Deadlock and different approaches to memory management
- Understand the issues in protection and security

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Introduction
Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems, Operating System Structures, Components & Services, System calls, System programs, Virtual machines. Process Management: Process Concept, Process Scheduling, Co – Operating process, Threads, Inter process communication, CPU Scheduling Criteria, Scheduling algorithm, Multiple Processor Scheduling, Real time Scheduling, Algorithm evolution.

Unit 2 Process Synchronization and deadlocks
The Critical Section Problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, monitors, Dead locks – system model, Characterization, Dead lock prevention, avoidance and detection, Recovery from dead lock, Combined approach to deadlock handling.

Unit 3Memory Management
Logical and Physical address space, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging in Mastics and Intel 386, Virtual Memory-Demand paging and its performance, Page replacement algorithms, Allocation of frames, thrashing, page size and other considerations. Demand Segmentation.

Unit 4 File management (Systems, Secondary Storage Structure
File Concepts, Access methods, Directory Structure, Protection and consistency, File system structure, Allocation methods, Free space management, Directory Implementation, Efficiency

and Performance, Recovery. Disk Management (Structure, Disk Scheduling Methods): Disk Structure & Scheduling methods, Disk management, Swap – Space management.

Unit 5 Protection and Security

Goal of protection, Domain Protection, Access matrix, Security Problem, Authentication, One-time password, program threats, System threads. Case Study of Windows and Linux Operating System.

Suggested Reading

- Deitel, H. M., Deitel, P. J., &Choffnes, D. R. (2007). Operating systems. Pearson/Prentice Hall.
- Stallings, W. (2018). Operating Systems: internals and design principles. Pearson Education Limited
- Stuart, R.C. (2008). Operating systems: Principles, Design and Implementation, 1st Ed. Cengage Learning India
- Silberschatz, A., Peter Baer Galvin, & Gagne, G. (2014). Operating system concepts. Wiley.
- Comer, D. (2004). Computer networks and internets: with internet applications. Pearson Education International.
- Stallings, W. (1988). Data and computer communication. London.

Practical: **(Total Hours 60)**

PART-A

DATA STRUCTURES

1.Write a program to demonstrate binary search.
2.Write a program to demonstrate selection sort.
3.Write a program to demonstrate insertion sort.
4.Write a program to demonstrate merge sort.
5.Write a program to implement stack using array.
6.Write a program to implement queue using arrays.

PART-B

OPERATING SYSTEM

1. Write a shell script to accept 'n' integers and count +ves, -ves and zeroes respectively. Also find the sum of +vesand -ves.
2. Write a shell script to accept many characters and count individual vowels, digits, spaces, special characters and consonants.
3. Write a shell script to accept student name and marks in 3 subjects through command line arguments. Find the total marks and grade (depending on the total marks).

4.Write a menu driven shell script for the following
a) Rename a file (check for the existence of the source file).
b) Display the current working directory.
c)List the users logged in.
5.Write a shell script to accept many filenames through command line. Do the following for each filename
a) If it is an ordinary file, display its content and also check whether it has executed permission.
b) If it is a directory, display the number of files in it.
c)If the file/directory does not exist, display a message.
6.Write a menu driven shell script for the following
a) Append the contents of a file to another file (Display the message if the file does not exist in the directory).
b) List all file names/ directory names in the present working directory which has the specified pattern.
c)Assign execute permission to a specified file for the owner and a group.

PART-C

DATA STRUCTURES

Write a program to evaluate postfix expression.
Write a program to implement circular queue using array.
Write a program to perform all operations on a singly linked list.
Write a program to implement stack using linked list.
Write a program to implement queue using linked list.
Write a program to perform inorder,preorder and post order traversal of a binary tree.

DC01RM-3C4 Research Methodology

(Total Hours 30)

Goal: This course will enable the students to accumulate knowledge which are essential for gathering, analyzing and interpretation of the problems confronted by humanity; to understand the concepts relating to research, basic statistics and business; to study the nature of Social and Business research, and provides the techniques of research, identification of problem, research design, data collection, sampling, hypothesis, processing, and interpretation of data and preparation of reports.

Objectives: By the end of this course, a student will

- Provide an overview of the research process
- Define the methods and techniques of research
- State clearly their research problem and associated research questions arising, including both descriptive and either explanatory or exploratory questions.
- Conduct a literature review of the concepts comprising the research questions
- Set out the main elements of a potential research instrument for testing the hypotheses,
- Distinguish between quantitative and qualitative approaches and methods
- Designing research report

Teaching Learning Methodology:
Lectures, Class discussions, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

Nature of Social and Business Research

Meaning and definition of research, Criteria of good research, social Research-Goal, assumptions, deductive and inductive methods, significance and difficulties of Social research. Business research- Research and business decisions.

Unit 2

Methods and Techniques of Research.

Classification of research -According to the intent- Pure Research, Applied Research, Exploratory Research, Descriptive Study, Diagnostic Study, Evaluation Studies, and Action Research. According to the method- Experimental Research, Analytical Study, and Historical Research. Inter Disciplinary Research and its essentials.

Unit 3

Research Problem and Research Design.

Research Problem: Steps involved for selection of a topic for research study, components of research problem, Definition of Problem, Evaluation of Problem, review of relevant literature, sources of literature Note Taking. Testing of Hypothesis, Errors in Hypothesis, Research Design:

- Meaning, definition, Classification of Research Designs. Importance of Research Plan, Contents of a Research Plan.

Unit 4

Sampling and Sample Design

Meaning of Sample, purpose of Sampling, Sampling Technique – Random Sampling and Non-random sampling, Errors in Sample Surveys – Sampling Errors and Non Sampling Errors.

Unit 5

Methods and Tools for Data collection.

Methods of Data Collection: Meaning and Importance of data, Sources of data – Primary Sources and Secondary Sources, Methods of collection of Primary and Secondary data. Tools or instruments of data collection: Observation schedule, Interview guide, Interview schedule, mailed questionnaire, Rating scale, Check list, Opinionated, Document Schedule. Types of Questions–open ended/close ended, Measurement scale–Meaning and types

Unit 6

Processing, Analysis and Interpretations of Data and Report writing.

Steps in data processing, editing, coding, classification, transcription, analysis of data, interpretation. Use of Excel in Data Entry & Analysis- Variable types- Frequency tables – Various Kinds of Charts and Diagrams Used and their Significance.

Report Writing: Introduction, types of report, planning of report-writing, format of research report. Documentation: Foot notes and Bibliography, briefing and evaluation of report-writing.

Suggested Reading

1. Krishnaswami, O.R (2012). Research Methodology. Mumbai: Himalaya publishing House.
2. Bhandarkar, P. L. (2010). Methodology and techniques of social research. Himalaya Publishing House.
3. Kothari, R. (2004). Research methodology: methods and techniques. New Age International.
4. Panneerselvam. R.., (2014). Research methodology. Phi Learning.
5. Trochim, M.K. (2009). ResearchMethods. New Delhi: Sultan Chand.

DC01RM-3C5 Web Application and Development

(Total Hours 60)

Goal: This course will enable the students to produce dynamic, animated, interactive and database driven web sites to prepare students for internet marketing and web site administration. Students will learn different languages like HTML5, CSS, JavaScript and PHP (Server Side Programming; Students will work with different technologies and software components like web browsers, web servers (Apache) and database connectivity's.

Objectives: By the end of this course, a student will

- Develop websites and web based projects.
- Be employed on entry-level jobs of PHP based web development in software industry.
- Develop interactive and dynamic website.

Teaching Learning Methodology:
Lectures, Demonstration using software's, Coding assignments, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1 HTML 5
Difference between HTML 4 & 5, Page Structure of HTML5. Section Tag & Article Tag; Adding figure and sidebar; Outlining in HTML5; using audio Element; Video Tag Attributes. HTML5 Forms Tags, search, tel, url and email; date/time input types, color number, range, min, max, and step attributes. Form Attributes, autocomplete, novalidate. Form Field Attributes, required, placeholder.
HTML5 Canvas; Drawing Lines; Multiple Sub-Paths; The Path Drawing Process. The fill () Method; Color and Transparency; Rectangles. Circles, Arcs and Curves.

Unit 2: CSS
Introduction to CSS, CSS Rules, Pseudo classes and pseudo elements, Selectors, Precedence of Selectors; Cascading; Creating an Embedded Style Sheet; Creating an External Style Sheet; Adding Inline Styles; Using CSS box model for spacing, borders, and backgrounds; Using CSS for page layout; Dealing with fonts, text, images and hyperlinks; Using Lists as Hierarchical Navigation. Styling Forms with CSS.
Drawback of CSS; Difference between SASS and LESS; Installation of LESS; Using LESS, Variables, Mixins, Cascading + Nesting, &combinatory, Operations, Comments, @import, String interpolation, Escaping, Pre-compile, Post-compile, LESS Elements.

Unit 3: jQuery UI

Overview of jQuery; UsingjQuery Selectors and Filters; Selecting Single and Multiple Elements. Operating on Wrapped Sets; Method Chaining; Accessing Attributes of an Element; Adding and Removing Elements; Setting up JQueryUI; JqueryUI Interactions, JqueryUI Widgets, JqueryUI Effects.

Unit 4: PHP Basics

Introduction to PHP; Embedding PHP code inside HTRML; Working with Types and operators; Integer division, Generating Random numbers; Comparing values with the Spaceship operator; Condition and Looping statements; Arrays, Numeric Associative and Multi-dimensional arrays; Strings and String functions; Regular Expressions; Date and Time function; Mathematical functions; User-Defined Functions; Return type declarations with compound Types; Scalar Type Hinting; Scalar Parameter and Return Type declarations; Working with web forms; PHP POST & GET form elements; Validating form data; Understanding magic quotes; Setting default values in forms; Handling Errors, Throwing and Catching Exceptions. Logging exceptions.

Unit 5: PHP Intermediate

Classes and Objects Constructors and Destructors Access Specifies, Static and final modifiers Inheritance and its types Polymorphism, Abstract and Final classes. Anonymous Classes, Generator Return expressions, Generator Delegation. Using MySQL; Database Basics, Configuring PHP for Database Support, Managing Database Connections, PHP's Database & SQL APIs, Performing Queries, Processing Result Sets, PDO. PHP cookie handling; PHP session handling; Reading& writing; files with PHP; Processing uploaded files; Retrieving uploaded files; Mail functions

Suggested Reading

- Lubbers, P., Albers, B., Salim, F., &Pye, T. (2011). Pro HTML5 programming (pp. 107-133). New York, NY, USA::Apress..
- Clark, R., Studholme, O., Murphy, C., &Manian, D. (2012). Beginning HTML5 and CSS3. Apress.
- Curioso, A., Bradford, R., & Galbraith, P. (2010). Expert PHP and MySQL. John Wiley & Sons.
- Sarris, S. (2013). HTML5 unleashed. SamsPublishing..
- Sikora, P. (2016). Professional Css3. Packt Publishing Ltd.
- Sarrion, E. (2012). jQuery UI: Learn How to use Dialogs, Autocomplete, and More. O'Reilly Media, Inc.
- Murach, J., & Harris, R. (2010). Murach's PHP and MySQL. Mike Murach& Associates, Inc.
- Freeman, A. (2012). Pro jQuery. Apress.

- Prettyman, S. (2016). Learn PHP 7: Object Oriented Modular Programming using HTML5. CSS3, JavaScript, XML, JSON, and MySQL, 308.
- Porebski, B., Przystalski, K., & Nowak, L. (2011). Building PHP Applications with Symfony, CakePHP, and Zend Framework. John Wiley and Sons.
- Curioso, A., Bradford, R., & Galbraith, P. (2010). Expert PHP and MySQL. John Wiley & Sons.

Practicals **(Total Hours 60)**

HTML

1. Create a table in HTML with Person's Details
2. Create a registration form using HTML form input elements viz. textbox, text area, radio button and drop down menu, check box, submit, file and reset button. Field should contain name, address, birth-date, qualification, email, phone number, gender, comments, attach photo etc. Use HTML Form elements wherever required. Align all elements using table.
3. Create a HTML programs using frames. Three frames displaying three different HTML files. i. Frame 01 – contain examples of ordered as well as unordered list
    a. ii. Frame 02 – contain examples of text formatting tags i.e. <b>, <i>, <u>, <h1>--<h6>, <p>, <sup> and <sub>
    b. iii. Frame 03 – contain example of 3 by 4 table with data.
    c. Iv.Create a hyperlink in Frame 01 that opens in Frame 03

B. CSS

- Create a horizontal navigation bar in DIV using external CSS which contain home, about, gallery, enquiry, contacts menus. Also create the same bar in vertical alignment in another DIV in same page.
- Create a following layout using CSS and display it in html file with proper border, background color, margin, border and padding.

C. PHP

- Create a PHP program in which two values submitted using form and calculate its addition, subtraction, multiplication, modulation, average and division on the same page. Find the greatest number between them and square of each of them using PHP function.
- Write following program in PHP:
    i. Validating given email address
    ii. Change background color based on hour of a day.
    iii. Print Fibonacci Series.

D. JavaScript

- Write a Java script program to create a simple calculator.

- Write following Java script program:

i. Create form validation program that checks the empty values from that form and alertback using alert function. Use at least 5 components.

ii. Display a live clock in Java script.

E. PHP MYSQL Admin

- Create feedback form in PHP which contains first name, last name, address, email, comment and mobile number and store that information in database. Also create a page which displays submitted feedbacks in tabular form.
- Create a login form using session handling in PHP. After successful login display name, address and other details in tabular format of logged user. Create 5 users. Also create a 'Logout' option. Store the data of user, login and password in the database.
- Create a simple address book in PHP using MySQL database which contains Adding new person with address (name, phone number, email, permanent address and temporary address etc..), updating their address, deleting him from record and view all records in table.

F. Java Servlets

Create two textboxes on the HTML page named login and password. After clicking on

i. the 'login' button the servlet will be displayed. It will show 'login successful' upon correct password else 'authentication failure' will be displayed. Make the use of HTTP Servlet or Generic Servlet.

ii. Write a program to demonstrate the use of servlet request and response as well as doGet( ) and doPost( ) methods. (The subject teacher should provide the appropriate problem statement for this).

DC01RM-3O1 -Cryptography

(Total Hours 30)

Goal: This course will provide students with a practical and theoretical knowledge of cryptography and network security. Students will understand the fundamental principles of access control models and techniques, authentication and secure system design. Students will have a strong understanding of different cryptographic protocols and techniques and be able to use them.

Objectives: By the end of this course, a student will

- Apply methods for authentication, access control, intrusion detection and prevention.
- Identify and mitigate software security vulnerabilities in existing systems.

Teaching Learning Methodology:
Lectures, Class discussions, Demonstration, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Introduction
Security Goal, Cryptographic Attacks, Services and Mechanism, Techniques. Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence.

Unit 2 Transformations
Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transpositional Ciphers, Stream and Block Ciphers. Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Security of DES, Multiple DES, Examples of Block Ciphers influenced by DES. Advanced Encryption Standard: Introduction, Transformations, Key Expansion, The AES Ciphers, Examples, Analysis of AES.

Unit 3 Cryptography
Encipherment using Modern Symmetric-Key Ciphers: Use of Modern Block Ciphers, Use of Stream Ciphers, Other Issues. Mathematics of Asymmetric-Key Cryptography: Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm. Asymmetric Key Cryptography: Introduction, RSA Cryptosystem, Rabin Cryptosystem, Elgamal Cryptosystem, Elliptic Curve Cryptosystems.

Unit 4 Functions
Cryptography Hash Functions: Introduction, Description of MD Hash Family, Whirlpool, SHA-512. Digital Signature: Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Schemes, Variations and Applications. Key Management: Symmetric-Key Distribution, Kerberos, Symmetric-Key Agreement, Public-Key Distribution, Hijacking.

Suggested Reading

- Whitman, M. E., &Mattord, H. J. (2018). Principles of information security. Cengage Learning.
- Forouzan, B. A. (2007). Cryptography & network security. McGraw-Hill, Inc.
- Nemati, H. R. (Ed.). (2010). Applied Cryptography for Cyber Security and Defense: Information Encryption and Cyphering: Information Encryption and Cyphering. IGI Global.
- Kartalopoulos, S. V. (2006). A primer on cryptography in communications. IEEE Communications Magazine, 44(4), 146-151.
- Daras, N. J., &Rassias, M. T. (Eds.). (2015). Computation, cryptography, and network security (pp. 253-287). Springer.

DC01RM-3O2 –Computer Security

(Total Hours 30)

Goal: This course will familiarize the students to learn, analyze and understand Confidentiality, Integrity, and Availability of the organizations systems, network and data.

Objectives: By the end of this course, a student will

- To identify different types of authentication techniques.
- To understand and analyze different types of Compute viruses such as Trojan horse.
- To analyze different types of security attacks.
- To understand, analyze and implement different security techniques related to operating system and networks.

Teaching Learning Methodology:

Lectures, Class discussions, Coding assignments, Simulations, Demonstration using various software tools, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

What Is Computer Security- Values of Assets, The Vulnerability–Threat–Control Paradigm. Threats- Confidentiality, Integrity, Availability, Types of Threats, Types of Attackers. Harm- Risk and Common Sense, Method–Opportunity–Motive. Vulnerabilities, Controls. Authentication-Identification Versus Authentication, Authentication Based on Phrases and Facts: Something You Know, Authentication Based on Biometrics: Something You Are, Authentication Based on Tokens: Something You Have, Access Control- Access Policies, Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control.

Unit 2

Malicious Code, Malware—Viruses, Trojan Horses, and Worms, Technical Details: Malicious Code. Countermeasures for Users.

Unit 3

Browser Attacks- Browser Attack Types. Web Attacks Targeting Users- False or Misleading Content, Malicious Web Content. Email Attacks-Fake Email, Fake Email Messages as Spam, Fake (Inaccurate) Email Header Data, Phishing, Protecting Against Email Attacks.

Unit 4

Security in Operating Systems- Operating System Structure, Security Features of Ordinary Operating Systems, Protected Objects. Security in the Design of Operating Systems-Simplicity of Design, Layered Design, Kernelized Design, Reference Monitor

Unit 5

Network Concepts- Network Transmission Media, Protocol Layers, Addressing and Routing. Threats to Network Communications, Interception, Modification, Fabrication, Interruption, Port Scanning.

Suggested Readings

- Pfleeger, C. P. (2009). Security in computing. Pearson Education India.
- Biskup, J. (2008). Security in Computing Systems: Challenges, Approaches and Solutions. Springer Science & Business Media.
- Gollmann, D. (2010). Computer security. Wiley Interdisciplinary Reviews: Computational Statistics, 2(5), 544-554.
- Stallings, W., Brown, L., Bauer, M. D., &Bhattacharjee, A. K. (2012). Computer security: principles and practice (pp. 978-0). Upper Saddle River, NJ, USA: Pearson Education.
- Bishop, M. (2005). Introduction to computer security.

DC01RM-3O3 Cloud Computing

(Total Hours 30 hours)

Goal: This course will familiarize the students to learn, analyze and understand basic concepts of cloud computing and its implementation in network.

Objective: By the end of this course, a student will

- To understand cloud services and solutions
- To know about cloud virtualization technologies and cloud management
- To understand the relevance of Cloud, SOA and benchmarks

Teaching Learning Methodology:
Lectures, Class discussions, Demonstration using program execution, Simulation, Discussion groups, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

Introduction: Introduction, Essentials, Benefits, Business and IT Perspective, Cloud andVirtualization, Cloud Services Requirements, Cloud and Dynamic Infrastructure, CloudComputing Characteristics, Cloud Adoption.Cloud Models: Cloud Characteristics, Measured Service, Cloud Models, Security in a PublicCloud, Public versus Private Clouds, Cloud Infrastructure Self Service.

Unit 2

Cloud Services and Solutions: Gamut of Cloud Solutions, Principal Technologies, CloudStrategy, Cloud Design and Implementation using SOA, Conceptual Cloud Model, CloudService Defined.Cloud Solutions: Introduction, Cloud Ecosystem, Cloud Business Process Management,Cloud Service Management, Cloud Stack, Computing on Demand (CoD), Cloud sourcing.

Unit 3

Cloud Offerings and Cloud Management: Cloud Offerings, Information Storage,Retrieval, Archive and Protection, Cloud Analytics, Testing under Cloud, InformationSecurity, Virtual Desktop Infrastructure, Storage Cloud.Cloud Management: Resiliency, Provisioning, Asset Management, Cloud Governance, HighAvailability and Disaster Recovery, Charging Models, Usage Reporting, Billing and Metering

Unit 4

Cloud Virtualization Technology: Virtualization Defined, Virtualization Benefits, ServerVirtualization, Virtualization for x86 Architecture, Hypervisor Management Software,Logical Partitioning (LPAR), VIO Server, Virtual Infrastructure Requirements, Storagevirtualization, Storage Area Networks, Network-Attached storage, Cloud ServerVirtualization, Virtualized Data Center.

Unit 5

Cloud Computing Web Services: Google Web service, Surveying the Google applicationportfolio, Google toolkit, Amazon web services, Components and services, EC2-Storagesystems, Database services, Microsoft cloud services, Windows azure platform, Windowslive.Cloud Infrastructure: Managing the cloud, Administrating the cloud, Management products,communicating with the cloud, Instant messaging, Collaboration technologies, Socialnetworks, Media and streaming.

Suggested Reading

- Sosinsky, B. (2010). Cloud computing bible (Vol. 762). John Wiley & Sons.
- Rothon, J. (2009). Cloud Computing Explained: Implementation Handbook for Enterprises (2 Kindle ed.).
- Saurabh, K. (2011). Cloud Computing: Insights into new-era infrastructure. Winsome Book India.
- Buyya, R., Vecchiola, C., &Selvi, S. T. (2013). Mastering cloud computing: foundations and applications programming. Newnes.
- Sosinsky, B. (2010). Cloud computing bible (Vol. 762). John Wiley & Sons.
- Negus, C. (2015). Linux bible. John Wiley & Sons Inc.
- Velte, A. T., TojVelte, &Elsenpeter, R. C. (2010). Cloud computing: a practical approach. Mcgraw-Hill.

DC01RM-4C1 Software Engineering

(Total Hours 60)

Goal: This course will familiarize the students with thesystematic approaches to software development and maintenance. Software engineering meets this requirement. The student shall be able to take up a software projects and plan, develop and estimate its cost.

Objectives: By the end of this course, a student will

- Plan and deliver an effective software engineering process, based on development lifecycle models.
- Translate a requirements specification into an implementable design, a structured and organised process.
- Make effective use of UML, along with design strategies such as defining a software architecture, separation of concerns and design patterns.
- Formulate a testing strategy for a software system, employing techniques such as Unit testing, test driven development and functional testing.
- Evaluate the quality of the requirements, analysis and design work done during the Unit.

Teaching Learning Methodology:
Lectures, Class discussions, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1 Introduction

Software, Software Engineering: Definition; Phases in Software Engineering, Key Challenges in Software Engineering.

Software Process Life Cycle

Software Process, Project and Product; Process Assessment; Software Life cycle models; Selection criteria of Software Process Models; Organization Process.

Unit 2Software Requirements

Software Requirement, Feasibility Study, Requirements Elicitation; Requirement Analysis; Analysis Patterns; Requirements Specification; Requirements Validation; Requirements Management; Requirements Engineering Tools;

Software Design: Basics of Software Design; Data Design; Architectural Design; Component-Level design; User Interface Design; Pattern-Based Software Design; Developing a Collaborative Design; Software Design Notation; Software Design Reviews, Software Design Documentation; Case Studies

Unit 3 Software Coding

Features of a Software code; Coding Guidelines, Coding Methodology; Programming Practices, Code Verification Techniques, Coding Tools, Code Documentation

Software Testing: Software Testing Basics, Test Plan, Test Case Design, Software Testing Strategies, V Model of Software Testing, Levels of Software Testing; Testing Techniques; Object-oriented Testing; Software Testing Tools; Debugging; Software Test Report(STR), Case Studies

Unit4: Software Maintenance

Software Maintenance; Types of Software Maintenance; Software Maintenance Life Cycle; Software Maintenance Models; Techniques for Maintenance; Tools for Software Maintenance; Technology Change Management (TCM); Software Maintenance Documentation.

Software Quality: Quality Concepts; Software Quality Assurance Group; SQA Activities; Software Reviews; Evaluation Quality; CMM; TQM; Software Reliability.

Unit 5 Software Metrics

Software Measurement; Software Metrics; Designing Software Metrics; Classification of Software Metrics; Process Metrics; Product Metrics; Project Metrics; Measuring Software Quality; Object-Oriented Metrics

Software Planning & Scheduling: Project Planning; Project Scheduling; Project staffing; People Capability Maturity Model; Risk Management.

Suggested Reading.

- Aggarwal, K. K., Singh, Y., Kaur, A. (2007). Software Engineering, New Age International
- Sommerville, I. (2011). Software engineering. Pearson.
- Thayer, R. H., & Christensen, M. J. (2005). Software engineering. Ieee Computer Society Press.
- James Peter, W Pedrycz, “Software Engineering”, 4th Edition, 2011, Wiley India
- Fairley, R. E. (1988). Software engineering concepts. Jdigielcom Publishers and Traders.
- Schach, S. R. (2011). Object-oriented and classical software engineering. Mcgraw-Hill.
- Kurana, R. (2011). Software Engineering Principles and Practices. Vikas Publishers
- Pressman, R. S., & Maxim, B. R. (2020). Software engineering: a practitioner’s approach. Mcgraw-Hill Education

DC01RM-4C2 Introduction to Artificial Intelligence

(Total Hours 60)

Goal: The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is. Due to limited time, we will try to eliminate theoretic proofs and formal notations as far as possible, so that the students can get the full picture of AI easily. Students who become interested in AI may go on to the graduate school for further study.

Objectives: By the end of this course, a student will

- to develop semantic-based and context-aware systems to acquire, organize process,share and use the knowledge embedded in multimedia content.
- Research will aim to maximizeautomation of the complete knowledge lifecycle and achieve semantic interoperability betweenWeb resources and services.
- The field of Robotics is a multi-disciplinary as robots are amazinglycomplex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

Teaching Learning Methodology:

Lectures, Class discussions, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching.

Unit 1:

Problem solving and Scope of AI Introduction to Artificial Intelligence. Applications-Games,theorem proving, natural language processing, vision and speech processing, robotics, expertsystems. AI techniques- search knowledge, abstraction.Problem Solving State space search; Production systems, search space control: depth-first, breadth-first search. Heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction,Constraint Satisfaction End, Means-End Analysis. LA* Algorithm, L(AO*) Algorithm.

Unit 2:

Knowledge Representation Knowledge Representation issues, first order predicate calculus,Horn Clauses, Resolution, Semantic Nets, Frames, Partitioned Nets, Procedural Vs Declarativeknowledge, Forward Vs Backward Reasoning.

Unit 3:

Understanding Natural Languages Introduction to NLP, Basics of Syntactic Processing, Basicsof Semantic Analysis, Basics of Parsing techniques, context free and transformational grammars,transition nets, augmented transition nets, Shanks Conceptual Dependency, Scripts, Basics ofgrammar free analyzers, Basics of sentence generation, and Basics of translation.

Unit 4

Expert System: Need and justification for expert systems, knowledge acquisition, Casestudies: MYCIN, R1 Learning: Concept of learning, learning automation, genetic algorithm, learningby inductions, neural nets. Programming Language: Introduction to programming Language, LISP andPROLOG. Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, use of certaintyfactors, Fuzzy logic

Unit 5:

Introduction to Robotics Fundamentals of Robotics, Robot Kinematics: Position Analysis,Dynamic Analysis and Forces, Robot Programming languages & systems: Introduction, the threelevels of robot programming, requirements of a robot programming language, problems peculiar torobot programming languages.

Suggested Readings

- E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
- Nilsson, N. J. (1986). Principles of artificial intelligence. Morgan Kaufmann.
- Craig, J. J. (2009). Introduction to robotics: mechanics and control, 3/E. Pearson Education India.
- Klafter, R. D., Chmielewski, T. A., &Negin, M. (1989). Robotic engineering : an integrated approach. Prentice-Hall.
- Yoshikawa, T. (1990). Foundations of robotics: analysis and control. MIT press.
- Luger, G. F., & Stubblefield, W. A. (1989). Introduction to AI and Expert systems.
- Schalkoff, R. J. (1990). Artificial intelligence: an engineering approach (pp. 529-533). New York: McGraw-Hill.
  Buchanan, B. G., &Duda, R. O. (1983). Principles of rule-based expert systems. In Advances in computers (Vol. 22, pp. 163-216). Elsevier.

Artificial Intelligence Lab

Course Contents:

Assignments will be provided for the following:

- Programming in Prolog
- Programming for Robotics

DC01RM-4C3 Programming in Java

(Total Hours 60)

Goal: This course will enable the students to familiarize with hands-on course, students will gain extensive experience with Java and its object-oriented features. Students will learn to create robust console and GUI applications and store and retrieve data from relational databases.

Objectives: By the end of this course, a student will

- Write, compile and execute Java programs
- Build robust applications using Java's object-oriented features
- Create robust applications using Java class libraries
- Develop platform-independent GUIs
- Read and write data using Java streams
- Retrieve data from a relational database with JDBC.

Teaching Learning Methodology:

Lectures, Class discussions, Coding assignments, Demonstration using various software tools, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1 Introduction to Java

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods)

Unit 2 Arrays, Strings and I/O

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings to& From Methods, String Buffer Classes. Simple I/O using System. Out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit 3 Object-Oriented Programming Overview

Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Unit 4 Inheritance, Interfaces, Packages, Enumerations, Auto boxing and Metadata

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.

Unit 5 Exception Handling, Threading, Networking and Database Connectivity

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

Unit 6 Applets and Event Handling

Java Applets: Introduction to Applets, Writing Java Applets, working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Suggested Reading

- Arnold, K., Gosling, J., Holmes, D., & Holmes, D. (2000). The Java programming language (Vol. 2). Reading: Addison-wesley.
- Gosling, J., Addison-Wesley, & Al, E. (2014). The Java language specification. Addison -Wesley, Cop.
- Bloch, J. (2016). Effective java. Pearson Education India.
- Horstmann, C. S., Cornell, G., & Microsystems, S. (2005). Core Java 2. Vol. 1, Fundamentals. Sun Microsystems Press
- Eckel, B. (2006). Thinking in Java. 2, Tecnicheavanzate. Pearson.
- E Balagurusamy. (2015). Programming with Java: a primer. Tata Mcgraw-Hill Education (India.
- Deitel, P. J., &Deitel, H. (2012). Java How to Program. Pearson.
- Sierra, K. (2006). Head first java. O'reilly Media.
- Daniel Liang. Y., (2016). Introduction to Java programming. Pearson.
- Hubbard, J. R., (2001). Programming with Java. Mcgraw-Hill.

Practical (Total Hours 60)

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

1. To find the sum of any number of integers entered as command line arguments
2. To find the factorial of a given number
3. To learn use of single dimensional array by defining the array dynamically.
4. To learn use of length in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
8. Write a program that show working of different functions of String and String Buffer class like set Char At (setLength(), append(), insert(), concat()and equals().

9. Write a program to create a ―distance‖ class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer.
10. Modify the ―distance‖ class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as Suggested Reading variable to another object Suggested Reading variable. Further create a third object which is a clone of the first object.
11. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions (from lower to higher data type)
12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by Suggested Reading and to learn use of final keyword
13. Write a program to show the use of static functions and to pass variable length arguments in a function.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate fibonacii series is given in a different file belonging to the same package.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program ―Divide By Zero that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throw able).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write a program to create URL object, create a URL Connection using the open Connection() method and then use it examine the different components of the URLand content.
24. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
25. Write a program to demonstrate different keyboard handling events.
26. Write a program to generate a window without an applet window using main() function.
27. Write a program to demonstrate the use of push buttons.

DC01RM-4C4 Computer Networks

(Total Hours 30)

Goal: This course is to familiarize the students withcomputer networks and concentrates on building a firm foundation for understanding Data Communications and Computer Networks.
To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).

Objectives: By the end of this course, a student will

- Define the architectural principles of computer networking and compare different approaches to organising networks.
- Explain key networking protocols and their hierarchical relationship in the context of a conceptual model such as the OSI and TCP/IP framework.
- Identify core networking and infrastructure components and the roles they serve.

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Demonstration using various software tools, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1 Network Architecture
Network architecture – layers – Physical links – Channel access on links – Hybrid multiple access techniques - Issues in the data link layer - Framing – Error correction and detection – Link-level Flow Control.

Unit 2 Connections
Medium access – CSMA – Ethernet – Token ring – FDDI - Wireless LAN – Bridges and witches.

Unit 3 Networks
Circuit switching vs. packet switching / Packet switched networks – IP – ARP – RARP –DHCP – ICMP – Queueing discipline – Routing algorithms – RIP – OSPF – Subnetting – CIDR – Interdomain routing – BGP – Ipv6 – Multicasting – Congestion avoidance in network layer.

Unit 4 Retransmission
UDP – TCP – Adaptive Flow Control – Adaptive Retransmission - Congestion control – Congestion avoidance – QoS.

Unit 5 HTTP
Email (SMTP, MIME, IMAP, POP3) – HTTP – DNS- SNMP – Telnet – FTP – Security – PGP – SSH.

Suggested Reading

- Tanenbaum, A. S. (2003). Computer networks, fourth edition: problem solutions. Prentice Hall Ptr..
- Trivedi, B. (2013). Computer networks. Oxford University Press.

- Kurose, J. F. (2005). Computer networking: A top-down approach featuring the internet, 3/E. Pearson Education India.

DC01RM-4C5Entrepreneurship

(Total Hours 30)

Goal: This course will enable the students to understand the basic concepts in the area of entrepreneurship and the role and importance of entrepreneurship for economic development, developing personal creativity and entrepreneurial initiative. Students will adopt the key steps in the elaboration of business idea and understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Objectives: By the end of this course, a student will

- Define basic terms
- Analyse the business environment in order to identify business opportunities
- Identify the elements of success of entrepreneurial ventures
- Consider the legal and financial conditions for starting a business venture
- Evaluate the effectiveness of different entrepreneurial strategies
- Specify the basic performance indicators of entrepreneurial activity
- Explain the importance of marketing and management in small businesses venture
- Interpret own business plan.

Teaching Learning Methodology:
Lectures, Class discussions, Discussion groups, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1 Introduction
Meaning, elements, determinants and importance of entrepreneurship and creative behaviour; Entrepreneurship and creative response to the society' problems and at work; Dimensions of entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, entrepreneurship, ecopreneurship and social entrepreneurship

Unit 2 Entrepreneurship and Micro, Small and Medium Enterprises:
Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy and behavioural orientations; Conflict in family business and its resolution

Unit 3 Public and private system of stimulation
Support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of industries/entrepreneur's associations and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund**.**

Unit 4 Sources of business ideas and tests of feasibility
Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment,

nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions.

Unit 5 Mobilising Resources

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems.

Suggested Reading

- Kuratko, D. F., & Rao, T. V. (2012). Entrepreneurship: A South-Asian Perspective. Cengage Learning.
- Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2019). Entrepreneurship. Mcgraw-Hill Education.
- Vasant Desai. (2013). Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House.
- Dollinger, M. J. (2003). Entrepreneurship: strategies and resources. Prentice Hall.
- Holt, D. H. (1992). Entrepreneurship: new venture creation. Prentice-Hall.
- Singh, N. P. (1985). Emerging Trends in Entrepreneurship Development: Theories and Practices, Predominantly on Indian Scene. Intercultural Foundation for Development Management.
- SangramKeshariMohanty. (2010). Fundamentals of entrepreneurship. Phi Learning Private Ltd

DC01RM-4O1 Computer Forensics

(Total Hours 30)

Goal: The aim of Machine Learning - II is to examine digital devices in a constructive way with the goal of identifying, preserving, recovering, analyzing, and presenting the evidence in a court of law.

Objectives: By the end of this course, a student will

- To understand the basics about digital forensics.
- To understand about handling of digital crime scene.
- To understand about digital investigation and evidence.
- To apply digital forensics to networks for providing security.

Teaching Learning Methodology:
Lectures, Class discussions, Student Presentation, Textbook assignment, Problem solving or case studies. Demonstration and Simulation.

Unit 1

Foundations of Digital Forensics, Digital Evidence, Increasing Awareness of Digital Evidence, Digital Forensics: Past, Present, and Future, Principles of Digital Forensics, Challenging Aspects of Digital Evidence, Following the Cyber trail. Language of Computer Crime Investigation, The Role of Computers in Crime.

Unit 2

Conducting Digital Investigations-Digital Investigation Process Models, scaffolding for Digital Investigations, Applying the Scientific Method in Digital Investigations, Investigative Scenario: Security Breach. Handling a Digital Crime Scene- Published Guidelines for Handling Digital Crime Scenes, Fundamental Principles, Authorization, preparing to Handle Digital Crime Scenes, Surveying the Digital Crime Scene, Preserving the Digital Crime Scene.

Unit 3

Investigative Reconstruction with Digital Evidence- Equivocal Forensic Analysis, Victimology, Crime Scene Characteristics, Threshold Assessments. Axes to Pathological Criminals and Other Unintended Consequences, Modus Operandi, Technology and Modus Operandi, Motive and Technology, Current Technologies.

Suggested Readings:

- Casey, E. (2011). Digital evidence and computer crime: forensic science, computers and the Internet. Academic Press.
- Vacca, J. R. (2010). Computer forensics: computer crime scene investigation. Jones and Bartlett Publishers.
- Kruse II, W. G., &Heiser, J. G. (2001). Computer forensics: incident response essentials. Pearson Education.
- Nelson, B., Phillips, A., &Steuart, C. (2014). Guide to computer forensics and investigations. Cengage Learning.

- Solomon, M. G., Rudolph, K., Tittel, E., Broom, N., & Barrett, D. (2011). Computer forensics jumpstart. John Wiley & Sons.

DC01RM-4O2 Mobile & Wireless Security

(Total Hours 30)

Goal: This course will familiarize the students to learn to analyze different types of mobile and wireless security and how to implement using various tools.

Objectives: By the end of this course, a student will

- The course will provide knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks.
- Knowledge and understanding of security mechanisms and protocols in wireless communication networks.
- Knowledge about some of the models, design principles, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.

Teaching Learning Methodology:
Lectures, Class discussions, Demonstrations using various tools, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1
Wireless Fundamentals: Wireless Hardware, Wireless Network Protocols, Wireless Programming WEP Security. Wireless Cellular Technologies, concepts, Wireless reality, Security essentials, Information classification standards, Wireless Threats: Cracking WEP, Hacking Techniques, Wireless Attacks, Airborne Viruses.

Unit 2
Standards and Policy Solutions, Network Solutions, Software Solutions, Physical Hardware Security, Wireless Security, Securing WLAN, Virtual Private Networks, Intrusion Detection System, Wireless Public Key infrastructure. Tools, Auditing tools, Pocket PC hacking, wireless hack walkthrough.

Unit 3
Security Principles, Authentication, Access control and Authorization, Non-repudiation, privacy and Confidentiality, Integrity and Auditing, Security analysis process. Privacy in Wireless World, Legislation and Policy, identify targets and roles analysis, Attacks and vulnerabilities, Analyze mitigations and protection.

Unit 4
WLAN Configuration, IEEE 802.11, Physical layer, media access frame format, systematic exploitation of 802.11b WLAN, WEP, WEP Decryption script, overview of WEP attack, Implementation, Analyses of WEP attacks.

Suggested Readings

- Russell Dean Vines. (2002). Wireless security essentials: defending mobile systems from data piracy. Wiley.
- Lin, Y. B., &Chlamtac, I. (2008). Wireless and mobile network architectures. John Wiley & Sons.
- Raj Pandya. (1999). Mobile and personal communication services and systems. Institute Of Electrical And Electronics Engineers.

- Swaminatha, T. M., & Elden, C. R. (2003). Wireless security and privacy : best practices and design techniques. Addison-Wesley.

DC01RM-4O3 - Internet of Things

(Total Hours 60)

Goal: The overall goal of this course is to enable you to build an IoT system from the ground up. Note, this is an IoT system; as you'll learn, there's extensive variety insofar as what an IoT system can be. That said, during this course, you'll learn the various kinds of IoT systems that you'll encounter and build one using representative technologies

Objectives: By the end of this course, a student will

- To introduce the concept of "Internet of Things" to the students.
- To understand the basic ecosystems and landscape in IoT.
- To understand the real time use cases in IoT
- To know the different domains, where IoT plays a crucial role.

Teaching Learning Methodology:
Lectures, Class discussions, Demonstrations using various tools, Practical and Simulation Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

Introduction to IoT: What is IoT, IoT architecture, Characteristics of IOT systems, PrevalentIoT architectures, IoT applications, Overview of different technologies involved for IoTrealization.

Unit 2

History of IoT: The transition from mainframes and personal computing, Planet lab and originsof distributed computing; Robotics, AI and Cyber Computing Infrastructure; M2Mcommunications; P2P networks; Universal identification and RFID; Autonomic computing,Pervasive computing, Ubiquitous computing; Wireless Sensor Networks; The emergence ofIoT.

Unit 3

IOT state of the art: The IoT ecosystem and landscape; IOT business models and its usage invarious domains; Technology Enablers for IOT – Mobility, Analytics, Cloud and Social Media;IOT platforms; Security; Test methodologies; Regulations and Risks.

Unit 4

IoT Characteristics and use cases: Consumer and enterprise use cases

Unit 5

IoT DOMAINS: Smart Home, Smart Buildings, smart cities, IoT in telecommunications, smartmanufacturing, IoT in environment monitoring, smart vehicles, IoT in healthcare, smartfarming, IoT in enterprises, smart transportation, smart energy, smart retail and logistics.

Suggested Reading:

- Bahga, A., &Madisetti, V. (2014). Internet of Things: A hands-on approach. Vpt.
- Vasseur, J. P., &Dunkels, A. (2010). Interconnecting smart objects with ip: The next internet. Morgan Kaufmann.
- Pfister, C. (2011). Getting started with the Internet of Things: connecting sensors and microcontrollers to the cloud. " O'Reilly Media, Inc.".

- Uckelmann, D., Harrison, M., &Michahelles, F. (Eds.). (2011). Architecting the internet of things. Springer Science & Business Media.

DC01RM-5C1 Fundamentals of Robotic System and Robot Programming

(Total Hours 60)

Goal: The complete framework has been proposed to make a programming robots easier and to develop intelligent mechanical devices.

Objective:By the end of this course, a student will

- to enlighten the students about the fundamentals of robotic systems.
- To understand the basics of robot, Robot Transformations and Sensors, Micro/Nano robotic systems and to program them for functioning.

Teaching Learning Methodology
Lectures, Class discussions, Demonstrations using various tools, Practical and Simulation Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1: Introduction

Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and Links-Robot Classifications-Architecture of robotic Systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system.

Unit 2: End Effectors and Robot Controls

Mechanical Grippers-Slider crank mechanism, Screw type, Rotary actuators, cam Type-agnetic Grippers-Vacuum Grippers-Air operated Grippers-Gripper force Analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

Unit 3: Robot Transformations and Sensors

Robot Kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple Transformation-Simple problems. Sensors in robot – Touch Sensors-Tactile sensor – Proximity and range sensors – Robotic vision Sensor-Force Sensor-Light sensors, Pressure sensors.

Unit 4: Robot Cell Design and Micro/Nano Robotics System

Robot work cell design and Control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot. Micro/Nanorobotics system Overview-Scaling effect Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system

Unit 5: Basics of Robot Programming

Robot Programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, Functions-Wrist Mechanism-Interpolation Interlock commands- Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

Unit 6: Val, Val-Ii, Rapid andAml Language Robot Languages

Classifications, Structures- VAL- language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications. RAPID- language basic commands- Motion Instructions Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move-master command language- Introduction, syntax, simple problems. VALII programming-basic commands, applications- Simple problem using conditional Statements-Simple pick and place Applications-Production Rate Syllabus - Eighth Semester calculations using robot. AML Language-General description, elements and functions, Statements, constants and Variables-Program control statements- Operating systems, Motion, Sensor commands Data processing.

Suggested Readings

- Craig, J. J. (2009). Introduction to robotics: mechanics and control, 3/E. Pearson Education India.
- Groover, M. P., Weiss, M., & Nagel, R. N. (1986). Industrial robotics: technology, programming and application. McGraw-Hill Higher Education.
- Klafter, R. D., Chmielewski, T. A., &Negin, M. (1989). Robotic engineering: an integrated approach.
- Deb, S. R., & Deb, S. (1994). Robotics technology and flexible automation. Tata McGraw-Hill Education.

Practical's:

Fundamental of Robotics System and Robot Programming

- Study of different types of robots based on configuration and application.
- Study of different type of links and joints used in robots
- Study of components of robots with drive system and end effectors.
- Determination of maximum and minimum position of links.
- Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
- Estimation of accuracy, repeatability and resolution.
- Robot programming exercises

DC01RM-5C2 –Machine Learning - I

(Total Hours 60)

Goal: Predictive analytics is an area of statistics that deals with extracting informationfrom data and using it to predict trends and behavior patterns. Predicting anoutcome, predicting counts, predicting a value - all these have immumerable usecases in SciKit learn, Fraud detection, Portfolio Management, Sales and Marketing.Predictic Analytics is approached from Regression (glm) and Time Series modelsin this Unit.

Objectives: By the end of this course, a student will

- To learn simple and efficient tools for predictive data analysis
- To learn and understand how to use NumPy, SciPy, and matplotlib.
- To use open source, commercially usable - BSD license

Teaching Learning Methodology:
Lectures, Class discussions, Demonstrations using various tools, Practical and Simulation Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

UNIT 1

Introduction: well posed learning problem, designing a learning system: training experience, target function, final design. Issues in machine learning

Concept, Learning and General to specific ordering: concept learning task, concept learning as search, version spaces and candidate elimination, inductive bias.

UNIT 2

Decision Tree learning (DTL): introduction, decision tree representation, problems for DTL, DTL algorithm, hypothesis space search, inductive bias in DTL, issues in DTL.

Bayesian Learning: Introduction, Bayes Theorem, concept learning, least square hypothesis, predicting probabilities, Bayes optimal classifiers, EM algorithm.

UNIT 3

Instance Based Learning: introduction, K-nearest neighbor learning, locally weighted regression, case based reasoning. Learning set of rule: introduction, sequential covering algorithm, learning rule sets, first order rules.

UNIT 4

Analytical learning: introduction, perfect domain theory, explanation based learning. Inductive analytical approaches to learning.

Suggested Reading:

- Alpaydin, E. (2020). Introduction to machine learning. MIT press.
- Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., ... &Vanderplas, J. (2011). Scikit-learn: Machine learning in Python. the Journal of machine Learning research, 12, 2825-2830.
- EthemAlpaydin, "Introduction to machine learning", PHI learning, 2008. [T3] RajjanShinghal,

- Ripley, B. D. (2007). Pattern recognition and neural networks. Cambridge university press.

DC01RM-5C3Artificial Neural Network

(Total Hours 60)

Goal: This course will disseminate the student with the most fundamental knowledge for understanding AI and some basic search algorithms for problem solving; knowledge representation and reasoning; pattern recognition; fuzzy logic; and neural networks.

Course Objective: By the end of this course, a student will

- To introduce the student's fundamentals concepts of Neural network and its various application in computer science.
- To perform cognitive functions as problem solving and machine learning.

Teaching Learning Methodology:

Lectures, Class discussions, Demonstrations using various tools, Practical and Simulation Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1

Artificial Neural Networks (ANN) and biological neural networks, supervised and unsupervised learning rules, neural network applications.

Unit 2

Unsupervised learning: -Hebbian learning and competitive learning. Supervised learning:- Back propagation algorithms, Learning rule:- Delta learning rule, Widrow-Hoff learning rule, Winner-Take-All learning rule.

Unit 3

Feed forward neural network, feed backward neural network, Perceptron and its learning law, singlelayer perceptron, multi-layer perceptron.

Unit 4

Self-organizing networks: Kohonen algorithm, Hopfield Networks: Hopfield network algorithm, Adaptive resonance theory: Network and learning rules.

Unit 5

Associative memory, auto-associative memory, bi-directional associative memory

Suggested Readings

- Hill, T., Marquez, L., O'Connor, M., & Remus, W. (1994). Artificial neural network models for forecasting and decision making. International journal of forecasting, 10(1), 5-15.
- Suzuki, K. (Ed.). (2013). Artificial neural networks: architectures and applications. BoD–Books on Demand.
- Ermentrout, G. B., Beverlin, B., Troyer, T., &Netoff, T. I. (2011). The variance of phase-resetting curves. Journal of computational neuroscience, 31(2), 185-197.

Artificial Neural Network Lab

Course Objective

The aim of this lab to gain the practical knowledge of basic neuron models and learning algorithms.

Lab Assignment

To study some basic neuron models and learning algorithms by using Matlab‟s neural network toolbox

DC01RM-5C4Data Analytics

(Total Hours 60)

Goal: This course will enable the students to familiarize with the fundamentals of computers and to learn how to install Python, start the Python shell, to perform basic calculations, print text on the screen and create lists, and perform simple control flow operations using if statements and for loops; will learn how to reuse code with functions.

Objectives: By the end of this course, a student will

- Apply Python syntax and semantics and be fluent in the use Python flow control and functions.
- Create and run Python Programs using Lists, Dictionaries and handle File Systems.
- Define the concepts of Regular Expressions and Object-Oriented programming as used in Python.
- Build Data Structures using Python.
- Analyze the Network Programming and Web Services in Python.

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Discussion groups, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1 Planning the Computer Program
Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Unit 2 Techniques of Problem Solving
Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Unit 3 Overview of Programming
Structure of a Python Program, Elements of Python.

Unit 4 Introduction to Python
Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator)

Unit 5 Creating Python Programs
Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments.

Suggested Reading:

- Budd, T. A. (2010). Exploring Python. Boston, Mass. Mcgraw-Hill.
- Downey, A., Meyer, C., &Elkner, J. (2016). How to think like a computer scientist: learning with Python. Green Tea Press.
- Perkovic, L. (2011). Introduction to computing using python: An application development focus. Wiley Publishing.

Practical (Total Hours 60)

Software Lab Based on Python:

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

Section: A (Simple programs)

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:
   a. Grade A: Percentage >=80
   b. Grade B: Percentage>=70 and <80
   c. Grade C: Percentage>=60 and <70
   d. Grade D: Percentage>=40 and <60
   e. Grade E: Percentage<40
3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input paramters from user.
4. WAP to display the first n terms of Fibonacci series.
5. WAP to find factorial of the given number.
6. WAP to implement the use of arrays in Python.
7. WAP to implement String Manipulation in python in Python.
8. WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! --------- n/n!
9. WAP to calculate the sum and product of two compatible matrices.

Section: B (OOPs using Python):

All the programs should be written using user defined functions, wherever possible.

1. WAP to create Class and Objects in Python.
2. WAP to implement Data Hiding in Python.
3. WAP to implement constructor and destructor for a class in Python.
4. WAP to implement constructor and destructor in Python.
5. WAP to implement different types of inheritance in Python.
6. WAP to implement concept of Overriding in Python.
7. Write programs to create mathematical 3D objects using class.
   a. curve b. sphere c. cone d. arrow e. ring f. cylinder

List of Exercises

1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:
   Grade A: Percentage >=80
   Grade B: Percentage>=70 and <80
   Grade C: Percentage>=60 and <70
   Grade D: Percentage>=40 and <60
   Grade E: Percentage<40
3. Program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4. Program to display the first n terms of Fibonacci series.
5. Program to find factorial of the given number.
6. Program to find sum of the following series for n terms: 1 – 2/2! + 3/3! ---------n/n!
7. Program to calculate the sum and product of two compatible matrices.
8. Program to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t+2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0.
9. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows:
   P(t) = (15000(1+t))/(15+ e)
   where the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.

10. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:
    I. velocity wrt time (v=u+at)
    II. distancewrt time (s=u*t+0.5*a*t*t)
    III. distancewrt velocity (s=(v*v-u*u)/2*a)

DC01RM-6C1 – Machine Learning – II

(Total Hours 90)

Goal: Predictive analytics is an area of statistics that deals with extracting informationfrom data and using it to predict trends and behavior patterns. Predicting anoutcome, predicting counts, predicting a value - all these have immumerable usecases in SciKit learn, Fraud detection, Portfolio Management, Sales and Marketing.Predictic Analytics is approached from Regression (glm) and Time Series modelsin this Unit.

Objective: By the end of this course, a student will

- To learn simple and efficient tools for predictive data analysis
- To learn and understand how to use NumPy, SciPy, and matplotlib.
- To use open source, commercially usable - BSD license

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Discussion groups, Demonstrations, Practical and Simulations,Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1: Classification

Identifying which category an object belongs to.
Applications: Spam detection, image recognition.
Algorithms for classification

Unit 2: Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms for regression

Unit 3: Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms for clustering

Unit 4: Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency
Algorithms for dimensionality reduction

Unit 5: Model selection

Comparing, validating and choosing parameters and models.

Applications: Improved accuracy via parameter tuning
Algorithms for Model Selection

Unit 6:Preprocessing

Feature extraction and normalization.

Applications: Transforming input data such as text for use with machine learning algorithms.
Algorithms for Pre-processing

Suggested Reading:

- Alpaydin, E. (2020). Introduction to machine learning. MIT press.
- Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., ... &Vanderplas, J. (2011). Scikit-learn: Machine learning in Python. the Journal of machine Learning research, 12, 2825-2830.
- EthemAlpaydin, "Introduction to machine learning", PHI learning, 2008. [T3] RajjanShinghal,
- Ripley, B. D. (2007). Pattern recognition and neural networks. Cambridge university press.

DC01RM-6C2 Kinematics and Dynamics of Robots

(Total Hours 90)

Goal: Studies the relationship between dimension and connectivity of kinematic chain and the position, velocity and acceleration of each of the links in the robotic system.

Objective: By the end of this course, a student will learn

- To study the Architecture and programming issues of microprocessor family and its applications.
- To focus on detailed knowledge of the above microprocessor needed to develop the systems using it.

Teaching Learning Methodology:

Lectures, Class discussions, Coding assignments, Discussion groups, Demonstrations, Practical and Simulations, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit-1: Introduction

Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effectors, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates.

Unit-2: Direct Kinematics

Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.

Unit-3: Inverse Kinematics

The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis, Articulated robot.

Unit-4: Workspace Analysis and Tracjectory Planning

Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

Unit-5: Manipulator Dynamics

Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems

Suggested Readings

- Schilling, R. J. (1996). Fundamentals of robotics: analysis and control. Simon & Schuster Trade.
- Klafter, R. D., Chmielewski, T. A., &Negin, M. (1989). Robotic engineering: an integrated approach.
- Janakiraman, P. A. (1995). Robotics and image processing: An Introduction. Tata McGraw-Hill.
- Shahinpoor, M., &Shahinpoor, M. (1987). A robot engineering textbook (pp. 167-227). New York: Harper & Row.
- Hägele, M., Nilsson, K., Pires, J. N., & Bischoff, R. (2016). Industrial robotics. In Springer handbook of robotics (pp. 1385-1422). Springer, Cham.

DC01RM-6C3Fundamentals of Artificial Intelligence for Robots

(Total Hours 60)

Goal: To develop intelligent machine that could learn on their own. It can read and understand human languages as natural learning process.

Course Objective: Objective of this course is to expose the students

- The fundamentals of AI and expert systems and its application in Robotics and to familiarize the students with the Fundamental concept of AI and expert system.
- Ability to realize the intelligent human behaviors on a computer

Teaching Learning Methodology:
Lectures, Class discussions, Coding assignments, Discussion groups, Student Presentation, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching.

Unit-1:
Introduction– History, Definition of AI, Emulation of human cognitive process, Intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

Unit-2:
Search Methods Problem – Solving Agents: Problem Definitions, Formulating Problems, searching for solutions – Measuring Problem – Solving Performance with examples. Search Strategies: Uninformed search strategies – Breadth – first Search, Uniform – Cost Search, depth –first search, depth – limited search, Iterative deepening depth – first search, bidirectional search, comparing uniformed search strategies. Informed search strategies – Heuristic information, Hill climbing methods, best – first search, branch – and – bound search, optimal search and A* and Iterative Deepening A*.

Unit-3:
Programming and Logics in Artificial Intelligence LISP and other programming languages – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non-deductive inference methods.

Unit-4:
Expert system – Introduction, difference between expert system and conventional programs, basic activities of expert system – Interpretation, Prediction, Diagnosis, Design, Planning, Monitoring, Debugging, Repair, Instruction, Control. Basic aspects of expert system – Acquisition Unit, Knowledge base – Production rules, semantic net, frames. Inference engine – Backward chaining and forward chaining. Explanatory interface

Suggested Readings

- Russell, S., &Norvig, P. (2002). Artificial intelligence: a modern approach.
- Patterson, D. W. (1990). Introduction to artificial intelligence and expert systems. Prentice-hall of India.
- E. Rich and K. Knight, “Artificial intelligence”, TMH, 2nd ed., 1992.
- Nilsson, N. J. (1986). Principles of artificial intelligence. Morgan Kaufmann.
- Craig, J. J. (2009). Introduction to robotics: mechanics and control, 3/E. Pearson Education India.

DC01RM-6C4 – PROJECT

(Total Hours 90)

Goal: Using a project-learning approach can invigorate the learning environment, empowering and engaging students as they explore authentic, real-world challenges.

Project based learning is an instructional approach that lends itself easily to the creation of projects. A project is an open-ended assignment that uses technology to create a unique product that is student-driven with the goal of achieving specific learning Goal from multiple subject areas. Throughout the learning process, technology is used to acquire, organize, demonstrate, and communicate information. The seamless integration of technology into each stage of the project creates a meaningful learning experience.
Project Based Learning is personally meaningful to students because although everyone in the class may be learning the same technology skill, each student can pursue their own interests within the framework of the technology project.

Objective of the project is to provide

- A professional portfolio of projects and real experience with data analysis that will give you the necessary confidence to be successful as a Data Analyst.
- Interdisciplinary activities target learning Goal from multiple subject areas
- Simulates real problems to have students actively devise solutions
- Creates learning opportunities based upon student interest and strengths
- Engages learners by offering a meaningful learning activity
- Offers multiple ways for students to participate and demonstrate their knowledge
- Accommodates different learning styles
- Encourages the mastery of technological tools
- Prompts students to collaborate
- Offers a learning experience that draws on creative and critical thinking

Teaching Learning Methodology:
Lectures, Class discussions, reading assignments, Discussion groups, Student Presentation, Textbook assignment, Problem solving or case studies. Use of flip chart board by instructor as aid in teaching, Use of diagrams, tables, graphs, and charts by instructor in teaching. Use of displays by instructor, Use of slides, Quiz, Jigsaw and crosswords.

Course Content and Process
The students with the assistance of their faculty–in-charge or course coordinator will do the project (which may also be a continuation of their mini project or an altogether new project) individually in collaboration with an industry which would be assessed.

Total creditswould be 6 (90).
The students have to submit a project report and also have to attend a viva after their project presentation.

Marks would be out of 100.
You will be working in a team, as is usually the case in the world of work. You will be supervised by a tutor, who is always available to answer any questions or clear up any doubts, and who will assess your performance and advice on the project "deliverables". The project work

is an educational pedagogy that enables a student in learning-by-doing approach in all its complexity and scope.
At the start of the course you are assigned a tutor who is a professional expert. The tutor will foster teamwork and promote discussion of issues, helping you find Syllabus: Data Analytics & Big Data solutions and resolve the difficulties of the project by drawing on your own resources. They will give you feedback on the "deliverables" for each project at every stage, so that you can continually refine them, learning from your mistakes and achieving the mastery needed for each task.

Some topics:
Modern scientific instruments and Internet-scale applications generate voluminous data pertaining to vital signs, weather phenomena, social networks that connect millions of users, the origins of distant planets. Data produced in these settings hold the promise to significantly advanced knowledge.

Fundamental issues in Robotics, Machine Learning and Artificial Intelligence
Issues related to data organization, storage, retrieval, analysis and knowledge discover at scale. This will include topics such as large-scale data analysis, data storage systems, self-descriptive data representations, semi-structured data models.
Will involve hands-on programming assignments and term project using real-world datasets.

DC01RM-6C5 Ethics in Information Technology and Computer Communication
(Total Hours 30)

Goal: To develop ethics related to computer profession and development.

Course Objective: Objective of this course is to expose the students

- To ensure the privacy and safety of the computer users.
- To helps people, use the computer in the right ways.
- To guarantee that the works that done by someone did not declare by other people.

Teaching Learning Methodology:
Lectures, Class discussions, Discussion groups, Student Presentation, case studies. Use of flip chart board by instructor as aid in teaching.

Unit 1: Risk and Responsibility
In this segment of the course we evaluate the risks of computer technology. Some of these risks are the results of imperfections in the technology itself, while others are the consequence of human misunderstandings and misinterpretations. We will ask questions such as: how to assess the gravity of risks against the clear benefits of computer technology? Who bears the risks and who should be making the decisions about whether they are acceptable? Is computer technology in any way a unique technology in the nature and extent of the risks it poses?
Following the discussion of risk, we examine responsibility. Who is responsible for risks and harms caused by computing? What are the special responsibilities, if any, of computer professionals? Beyond the responsibility to produce systems that work, do computer professionals have a social responsibility to see that their technology is used only for the betterment of society? We will apply legal and philosophical concepts to these discussions.

Unit 2: Ethical Theory
Ethical theories and concepts from the Western philosophical tradition offer ways to analyze and clarify practical questions about values and information technology. In this segment of the course we review two basic approaches to ethical theorizing: deontology and consequentialism. We also study the concept of rights and justice. These enhance our understanding of the many issues in information technology ethics that are framed in terms of "rights": the right to own software, the right to privacy, and the right to benefit from computing. We also examine the relationship between law and morality. The theoretical approaches and concepts will be applied and developed throughout the rest of the course.

Unit 3: Intellectual Property and Computer Software
Is it wrong to make unauthorized copies of software? Should software be free? Is the patenting of software good for society? These are some of the questions addressed in this section on the private ownership of computer software. Although much of the scholarly work in the area of software ownership is concerned with detailed legal questions, we will focus on its philosophical and ethical aspects.

Unit 4: Privacy and Information Technology

Poll after poll show that Americans are concerned about the erosion of their privacy. They think the government knows too much about them and they are becoming increasingly aware of the many other institutions that have access to their records. Information technology is at the heart of many of these intrusions on privacy. This section of the course examines the use of computerized record-keeping and its effects on privacy. Drawing on moral and legal understandings of privacy, it evaluates the claims by individuals in technologically advanced societies to be free of surveillance.

Unit 5: Crime by Computer

Reports of computer crime elicit a mixture of reactions. On the one hand, people are worried about how vulnerable society's computerized infrastructure is to infiltration and destruction. One the other, they are impressed by the ingenuity of the so-called "hackers." How should we regard infiltration onto computer systems? What computer crimes are really bad? Are hackers mere villains of are they Robin Hoods?

Unit 6: The Networked World

More than any other application of computer technology, digital networks have captured the public's fascination and imagination. But is all of the attention warranted? Will computer networks transform society, revolutionize social institutions, remake communities and the political landscape, and change the world economy; or will they merely provide new outlets for consumerism and entertainment? How much should society invest in the new networks? Should the government ensure universal access to networks even to those who cannot afford to pay the cost?

The final segment of the course will discuss these questions and others. It will evaluate debates about civil liberties, like free speech, on the internet. What rules should govern behavior on the internet? We will also consider the effects that networks may have on fundamental values such as privacy and property.

Suggested Readings:

- Johnson, D. G. (1985). Computer ethics. Englewood Cliffs (NJ).
- Bynum, T. W. (2001). Computer ethics: Its birth and its future. Ethics and Information Technology, 3(2), 109-112.
- Bynum, T. W., & Simon, R. (2004). Computer ethics and professional responsibility.

Timetable – I Semester BCA (Robotics, Machine Learning and Artificial Intelligence)

	I	II		III	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm -1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Fundamentals of Information Technology	Computer System Architecture	Snack Break	Soft Skills & Business Communication	Lunch Break	Fundamentals of Information Technology(lab)	
Tuesday	Soft Skills & Business Communication	Basic Mathematics & Statistics		Fundamentals of Information Technology		Computer System Architecture (lab)	
Wednesday	Fundamentals of Information Technology	Computer System Architecture		Basic Mathematics & Statistics		Fundamentals of Information Technology(lab)	
Thursday	Computer System Architecture	Soft Skills & Business Communication		Fundamentals of Information Technology		Computer System Architecture (lab)	
Friday	Computer System Architecture	Basic Mathematics & Statistics		Social Responsibility and Community Engagement		Fundamentals of Information Technology(lab)	
Saturday	Basic Mathematics & Statistics	Soft Skills & Business Communication		Social Responsibility and Community Engagement		Computer System Architecture (lab)	

Timetable – II Semester BCA (Robotics, Machine Learning and Artificial Intelligence)							
	I	II		III	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm -1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Programming Fundamentals using C++	DBMS	Snack Break	Statistical techniques with R	Lunch Break	DBMS(lab)	
Tuesday	EVS	DBMS		Programming Fundamentals using C++		Programming Fundamentals using C++(LAB)	
Wednesday	Programming Fundamentals using C++	Statistical techniques with R		EVS		DBMS(lab)	
Thursday	DBMS	Statistical techniques with R		Programming Fundamentals using C++		Programming Fundamentals using C++(LAB)	
Friday	DBMS	EVS		Mentoring		DBMS(lab)	
Saturday	Programming Fundamentals using C++	Statistical techniques with R		Library		Programming Fundamentals using C++(LAB)	

Timetable – III Semester BCA (Robotics, Machine Learning and Artificial Intelligence)

	I	II		III	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm -1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Robotics - I	Data Structures	Snack Break	Operating System	Lunch Break	OS (lab)	
Tuesday	Data Structures	Operating System		Robotics - I		Web development (lab)	
Wednesday	Research Methodology	Data Structures		Library		OS (lab)	
Thursday	Research Methodology	Robotics - I		OS (lab)		Web development (lab)	
Friday	Data Structures	Operating System		Web development (lab)		OS (lab)	
Saturday	Operating System	Robotics - I		Mentoring		Web development (lab)	

Timetable – IV Semester BCA (Robotics, Machine Learning and Artificial Intelligence)							
	I	II		III	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm -1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Artificial Intelligence - I	Software engineering	Snack Break	Programming in java	Lunch Break	Java (lab)	
Tuesday	Programming in java	Computer networks		Entrepreneurship		Artificial Intelligence - I (Lab)	
Wednesday	Software engineering	Artificial Intelligence - I		Computer Networks		Java (lab)	
Thursday	Computer networks	Programming in java		Software engineering		Artificial Intelligence - I (Lab)	
Friday	Artificial Intelligence - I	Entrepreneurship		Computer Networks		Java (lab)	
Saturday	Programming in java	Software engineering		Artificial Intelligence - I		Artificial Intelligence - I (Lab)	

Timetable – V Semester BCA (Robotics, Machine Learning and Artificial Intelligence)							
	I	II		III	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm - 1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Fundamentals f robotics system and robot programming	Library	Snack Break	Artificial Neural Network	Lunch Break	Data Analytics (lab)	
Tuesday	Mobile And Wireless Security	Machine Learning - I		Data Analytics		Data Analytics	Open Electives I
Wednesday	Artificial Neural Network	Mentoring		Fundamentals f robotics system and robot programming		Data Analytics (lab)	
Thursday	Machine Learning - I	Data Analytics		Library		Mentoring	Library
Friday	Artificial Neural Network	Fundamentals f robotics system and robot programming		Machine Learning - I		Data Analytics (lab)	
Saturday	Artificial Neural Network	Machine Learning - I		Fundamentals of robotics system and robot programming		Open Electives I	Data Analytics

Timetable – VI Semester BCA (Robotics, Machine Learning and Artificial Intelligence)							
	I	I I		II I	IV	V	VI
	9.30am - 10.30am	**10.30am - 11.30am**	**11.30 am - 11.45 am**	**11.45am - 12.45pm**	**12.45pm - 1.45pm**	**01.45pm - 2.45pm**	**2.45pm - 3.45pm**
Monday	Fundamentals of Artificial Intelligence for Robotics	Kinematics and Dynamics of Robots	Snack Break	Machine Learning - II	Lunch Break	Kinematics and Dynamics of Robots (Lab)	
Tuesday	Machine Learning - II	Library		Fundamentals of Artificial Intelligence for Robotics		Machine Learning - II	
Wednesday	Kinematics and Dynamics of Robots	Fundamentals of Artificial Intelligence for Robotics		Machine Learning - II		Machine Learning - II	
Thursday	Kinematics and Dynamics of Robots	Machine Learning - II		Fundamentals of Artificial Intelligence for Robotics		Kinematics and Dynamics of Robots	
Friday	Fundamentals of Artificial Intelligence for Robotics	Kinematics and Dynamics of Robots		Ethics		Project	
Saturday	Project			Ethics		Project	

The Yenepoya Institute of Arts, Science, Commerce and Management, Balmatta, Mangalore

Undergraduate Programme

Academic Calendar for the admission year 2020-21

Name of the Course: -

1. B. Com (Finance, Taxation and Auditing)
2. B. Com (International Management Accounting)
3. B. Com(Honors) (International Accounting and Finance)
4. B. Com (Honors) (Aviation and Logistics)
5. BBA (Aviation & Logistics)
6. BBA (Aviation, Travel & Tourism)
7. BBA (Entrepreneurship, International Business and Business Analytics)
8. BBA (Journalism, Media, event and Communication)
9. BBA (Logistics and Port Management)
10. BCA (Big Data Analytics and Cloud Computing)
11. B.Sc. Hospitality Science (Aviation, Travel and Tourism)
12. B.Sc, Food Science and Nutrition
13. B.Sc (Honours) Forensic Science
14. B.Sc (Cyber Forensic, Data Analytics and Cyber Security)

Name of the Events	**Stream**
Orientation Programme **I Semester**	14-09-2020
University Induction Programme	15-09-2020
YIASCM Induction Programme	16-09-2020
Introduction of the subjects	17-09-2020
Introduction to faculty, Clubs, Co-curricular activities and Personal and Professional development Programme	18-09-2020
Commencement of classes	21-09-2020
Internal Exam	3rd week of November 2020
Co curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	4th week of November 2020
Parents Teacher Students Meeting	1st week of December 2020
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1st month before the exams 3rd weeks before the exams 2nd weeks before the exams
Commencement of University Examinations Theory Exam	4th week of January 2021
Declaration of University Exam Results	4th week of February 2021
Commencement of classes for II Semester	22-02-2021
Student council installation programme	1st week of March 2021
Internal Exam	2nd week of April 2021
Co curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	3rd week of April 2021
Parents Teacher Students Meeting	4th week of April 2021
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1 month before the exams 3 weeks before the exams 2 weeks before the exams
Commencement of University Examinations	

Theory Exam	1st week July 2021
Declaration of University Exam Results	1st week August 2021
Commencement of classes for III Semester	**05.08.2021**
Internal Exam	2nd week of September 2021
Co curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	3rd week of September 2021
Parents Teacher Students Meeting	4th week of September 2021
Study leave	
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1 month before the exams 3 weeks before the exams 2 weeks before the exams
Commencement of University Examinations Theory Exam	1st week of December 2021
Declaration of University Exam Results	1st week of January 2022
Commencement of classes for IV Semester	**03.01.2022**
Internal Exam	2nd week of March 2022
Co curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	3rd week of March 2022
Parents Teacher Students Meeting	4th week of March 2022
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1 month before the exams 3 weeks before the exams 2 weeks before the exams
Commencement of University Examinations Theory Exam	1st week of May 2022
Declaration of University Exam Results	1st week of June 2022
Commencement of classes for V Semester	**04.07.2022**
Internal Exam	2nd week of September2022
Co-curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	3rd week of September2022
Parents Teacher Students Meeting	4th week of September2022
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1 month before the exams 3 weeks before the exams 2 weeks before the exams
Commencement of University Examinations Theory Exam	1st week of November 2022
Declaration of University Exam Results	1st week of December 2022
Commencement of classes for VI Semester	**04.01.2023**
Internal Exam	2nd week of March 2023
Co-curricular activities (Fine Arts Association, Commerce Association, Language Association, NSS, Sports, Management Association, IT Club etc.,)	3rd week of March 2023
Parents Teacher Students Meeting	4th week of March 2023
1. Last date for payment of exams fees without fine 2. With fine of Rs. 200 3. With fine of Rs. 500	1 month before the exams 3 weeks before the exams 2 weeks before the exams
Commencement of University Examinations Theory Exam	1st week of May 2023
Declaration of University Exam Results	1st week of June 2023