UNIVERSITY OF KERALA

BACHELOR OF VOCATION
Information Technology
(To be introduced from academic year 2020-21 onwards)

A. REGULATION

1. INTRODUCTION

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) degree with multiple exits such as Diploma, Advanced Diploma and BVoc degree under the NSQF. The B.Voc programme is focused on universities and colleges providing undergraduate students which would also incorporate specific job roles along with broad based general education. This would enable the graduates completing B.Voc to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge. The proposed vocational programme will be a judicious mix of skills, professional education related to information Technology and also appropriate content of general education. It is designed with the objective of equipping the students to cope with the emerging trends and challenges in the IT field.

2. ELIGIBILITY

Admissions and reservation of seats for B.Voc Information Technology shall be according to the rules framed by the University as for other courses. No student shall be eligible for admission to B.Voc Information Technology unless he/she has passed the Plus Two of the Higher Secondary Board of Kerala. or that of any other University or Board of Examinations in any state recognized as equivalent to the Plus Two of the Higher Secondary Board in Kerala, with Mathematics as one of the optional subjects. A pass in Higher Secondary or any other examination recognized as equivalent thereto by the University of Kerala with Mathematics as one of the optional subjects.

Total marks obtained for the qualifying examination + marks for Mathematics and Physics/Computer Science. The candidate who have studied Computer Science at +2 level, the score obtained in Computer Science paper be added, instead of the score in Physics (2011 Admission onwards – U.O No.Ac.A.IV/3150748/2011 dtd 10.06.2011).

3. PROGRAMME AND DURATION

The duration of the B.Voc Information Technology shall be three years consisting of six semesters. The duration of each semester shall be five months inclusive of the days of examinations. There shall be at least 90 working days in a semester and a minimum 540 hours of instruction in a semester.

4. NATURE OF THE COURSE

This course follows 2(b) pattern of the University under first degree CBCS program with appropriate modifications.
- No open course is envisaged
- No Electives are included
- Total credits is 180 instead of 120 in CBCS (for CCPA calculation course credit will be considered as 174 (excluding credits of industrial training and study tour) as per U.O.No.Ac.A.IV/2/BVoc-SD/2017 dt 10.08.2017)
- Working hours per week is 30

- ➤ All vocational subjects are treated as core course.
- ➤ Multiple exit points are permitted as per clause 8, that is, if willing, candidate can quit after the successful completion of first & second year. If a student exits once, he/she can't be re-entered.
- ➤ There will not be provisions for improvement.
- ➤ A candidate who failed in a semester may get two supplementary chances. Only failed papers are to be written in the supplementary examination.

5. CURRICULUM

The curriculum of each semester of the programme would be a suitable mix of general education and skill development components.

6. PROGRAMME STRUCTURE

The B.Voc Information Technology shall include:
- ➤ Language courses (English)
- ➤ General Education Components
- ➤ Skill Components
- ➤ Project
- ➤ Industrial Training
- ➤ Soft Skills and Personality Development Programmes
- ➤ Industrial visit

7. CREDIT CALCULATION

Calculation methods and grading in the scheme and syllabus of B.Voc programs are been as per the U.O. Ac.AIV/#/26241/BVoc-SD/16 dt 1.2.2016 and Ac.AIV/3/B.Voc-SD/16 dt. 7.5.2016

8. COURSE STRUCTURE

Duration /NSQF Qualification Levels	Total Credit	Semester	Exit point Award
1st year / Level 5	60	Two semester	Diploma
2nd year / Level 6	60	Four Semester	Advanced Diploma
3rd year / Level 7	60	Six Semester	B.Voc.

As per the UGC guidelines, there are multiple exit point for a candidate admitted in this course. If he/she completes the first two semesters she/she will get a diploma in Information Technology. If he/she completes the first four semesters successfully, he/she will get an advanced diploma In Information Technology. If he/she completes all the six semesters successfully, he/she will get B. Voc degree in Information Technology.

9. SOCIAL SERVICE/ EXTENSION ACTIVITIES

Students are to participate in Specific club, sports, literary and cultural activities during 3rd/4th semester. These activities have to be carried out outside the instructional hours and will fetch the required one credit extra over and above the minimum prescribed 180 credits.

10. ATTENDANCE

The minimum number of hours of lectures, tutorials, seminars or practicals which a student shall be required to attend for eligibility to appear at the end semester examination shall not be less than 75 per cent of the total number of lectures, tutorials, seminars or practical sessions. Internships, study tours and soft skill and personality development programmes are part of the course and students must attend in these activities to complete the concerned semester.

11. EVALUATION AND GRADING

The Evaluation of each Course shall consists of two parts

    A. Continuous Evaluation (CE)

    B. End Semester Evaluation (ESE)

    C. The marks of CE and ESE ratio shall be 1:4 for both Courses with or without practical. There shall be a maximum of 80 marks for ESE and maximum of 20 marks for CE for all Courses (Theory and Practical).

A. CONTINUOUS EVALUATION (CE)

All records of Continuous Evaluation shall be kept in the Department and shall be made available for verification by the University, if and when necessary

A.1. ASSIGNMENTS OR SEMINARS: (MAX. MARKS 10)

Each student shall be required to do one assignment or one seminar for each Course. Valued assignments shall be returned to the students. The seminars shall be organized by the teacher/teachers in charge of CE and the same shall be assessed by a group of teachers including the teacher/ teachers in charge of that Course. Assignments/Seminars shall be evaluated on the basis of their quality. The teacher shall define the expected quality of an assignment in terms of structure, content, presentation etc. and inform the same to the students. Due weight shall be given for punctuality in submission. Seminar shall be similarly evaluated in terms of structure, content, presentation, interaction etc.

A.2. TESTS: (MAX. MARKS 10)

For this course there shall be a minimum of two class test during a semester. Valued answer scripts shall be made available to the students for perusal within 10 working days from the date of the test.

A.3. ANNOUNCEMENT OF RESULTS OF CE

The results of the CE shall be displayed within 5 working days from the last day of a semester. Complaints regarding the award of marks for CE if any have to be submitted to the Head of the Department within 3 working days from the display of results of CE. These complaints shall be examined by the Department Committee and shall arrive at a decision, which shall be communicated to the student. The Statement of marks of the CE of all the students shall be approved by the Department Committee, countersigned by the Principal and forwarded to the Controller of Examinations within 15 working days from the last day of the semester. The University has the right to normalize the CE, if required, for which separate rules shall be framed.

B. END SEMESTER EVALUATION (ESE)

End Semester Evaluation of all the Courses in all the semesters shall be conducted by the University. The results of the ESE shall be arranged to be published according to the Examination Calendar prescribed by the University Level Monitoring Committee (ULMC), which shall not exceed 45 days from the last day of the examination (see Clause 7.4).

12. PROJECT / DISSERTATION WORK

During the fifth and sixth semester there shall be a Major Project/Dissertation on a topic related to any issues in Information Technology. The Project/Dissertation work can be done either individually or by a group not exceeding maximum 4 (preferably 3) students under the supervision and guidance of the teachers of the Department. The topics shall either be allotted by the supervising teacher or be selected by the students in consultation with the supervising teacher.

The project work shall have the following stages:

a. System analysis, design and first phase report submission in 5th semester

b. Coding, testing, implementation (if necessary) and final report submission in 6th Semester

The project report should be submitted to the Department at least 15 days before the last working day of the sixth semester. The candidate shall prepare three copies of the report: two copies for submission to the Department and one copy for the student to bring at the time of viva-voce.

13. PROMOTION TO HIGHER SEMESTERS
Students who complete the semester by securing the minimum required attendance and by registering for the End Semester Examination of each semester conducted by the University alone shall be promoted to the next higher semester.

14. GRADING SYSTEM
Both CE and ESE will be carried out using Indirect Grading system on a 7-point scale.

Consolidation of Grades The maximum mark for a Course (ESE theory) is 80. The duration of ESE is 3 hours. The marks of CE shall be consolidated by adding the marks of Attendance, Assignment/ Seminar and Test paper respectively for a particular Course

A	Assignment/Seminar	10 marks
B	Test Paper	10 marks

The marks for the components of Practical for Continuous Evaluation shall be as shown below.

A	Attendance	5 marks
B	Test	5 marks
C	Record	5 marks
D	Punctuality and Performance Skill	5 marks

Total marks for the ESE of Practical is 80. The components of ESE of Practical have to be set by the Chairmen, Boards of Studies, concerned.

The marks of a Course are consolidated by combining the marks of ESE and CE (80+20). A minimum of 40% marks (E Grade) is required for passing a Course with a separate minimum of 40% (E Grade) for Continuous Evaluation and End Semester.

15. EVALUATION
For this calculation refer U.O Ac/AIV/3/26241/B.Voc-SD/16 dt. 1.2.2016

16. PATTERN OF QUESTIONS

Question Type	Total Number of Questions	Total Number of Questions to be answered	Each Question Carries	Total Marks
Very short answer type(One word to Maximum of 2 sentences)	10	10	1	10
Short answer(Not to exceed one paragraph)	12	8	2	16
Short essay(Not to exceed 120 words)	9	6	4	24
Long essay	4	2	15	30
Total	35	26		80

17. GRACE MARKS
Grace Marks shall be awarded for Sports/Arts/NCC/NSS in recognition of meritorious achievements

18. MARK CUM GRADE SHEET

The University under its seal shall issue to the students a Mark cum Grade Sheet on completion of each semester indicating the details of Courses, Credits, Marks for CE and ESE, Grades, Grade Points, Credit Points and Semester Credit Point Average (SCPA) for each Course. The Consolidated Mark cum Grade sheet issued at the end of the final semester on completion of the Programme shall contain the details of all Courses taken during the entire Programme including Additional Courses taken over and above the prescribed minimum Credits for obtaining the Degree. However, for the calculation of CCPA, only those Courses in which the student has performed the best with maximum Credit Points alone shall be taken subject to the minimum requirements of Credits for successful completion of a Programme.

The Consolidated Mark cum Grade sheet shall indicate the CCPA and CCPA(S)* and the overall letter grade for the whole Programme. The Consolidated Mark cum Grade sheet shall also indicate all the Audit Courses (Zero Credit) successfully completed by the student during the whole Programme. No student shall be eligible for the award of the Degree unless he/she has successfully completed a Programme of not less than 6 semesters duration and secured at least 180 Credits (excluding Credits for Social Service/Extension Activities) as prescribed by the Regulations. The Degree to be awarded shall be called Bachelors of Vocation in Information Technology as specified by the Board of Studies and in accordance with the nomenclature specified by the Act and Statutes of the University.

CCPA(S) is CCPA for specialized subjects. (It is computed in a similar manner but without considering the Language Courses, Foundation Course for Language and Open Course.

SCHEME and SYLLABUS

SEMESTER I

GENERAL EDUCATION					SKILL COMPONENT				
No	Paper code	Title	Credit	Hrs/ Week	No	Paper code	Title	Credit	Hrs/ Week
1.	EN1111.4	LISTENING AND SPEAKING SKILLS	4	4	1.	IT 1611	COMPUTER ARCHITECTURE AND ORGANIZATION	4	4
2.	M1131.10	MATHEMATICS I	4	4	2.	IT 1612	PROGRAMMING IN C	4	4
3.	IT 1511	INTRODUCTION TO IT	4	4	3.	IT 1613	OFFICE TOOLS AND LATEX	4	4
					4.	IT 1612.1	PROGRAMMING IN C LAB	3	3
					5.	IT 1613.1	OFFICE TOOLS AND LATEX LAB	3	3
Total credits			12	12	Total credits			18	18

SEMESTER II

No	Paper code	Title	Credit	Hrs/Week	No	Paper code	Title	Credit	Hrs/Week
GENERAL EDUCATION					**SKILL COMPONENT**				
1.	EN1211.4	WRITING AND PRESENTATION SKILLS	4	4	1.	**IT 1621**	DATA STRUCTURES AND ALGORITHMS	4	4
2.	**IT 1521**	BUSINESS STATISTICS	4	4	2.	**IT 1622**	OBJECT ORIENTED PROGRAMMING IN JAVA	4	4
3.	**IT 1522**	ENVIRONMENTAL STUDIES	4	4	3.	**IT 1623**	WEB DEVELOPMENT	4	4
					4.	**IT 1621.1**	DATA STRUCTURES AND ALGORITHMS LAB	3	3
					5.	**IT 1623.1**	WEB DEVELOPMENT LAB	3	3
Total credits			**12**	**12**	**Total credits**			**18**	**18**

SEMESTER III

No	Paper code	Title	Credit	Hrs/Week	No	Paper code	Title	Credit	Hrs/Week
GENERAL EDUCATION					**SKILL COMPONENT**				
1.	**IT 1531**	PRINCIPLES OF MANAGEMENT	4	4	1.	**IT 1631**	OPERATING SYSTEM	4	4
2.	MM1231.10	MATHEMATICS II	4	4	2.	**IT 1632**	COMPUTER NETWORKS	4	4
3.	**IT 1532**	BUSINESS INFORMATICS	4	4	3.	**IT 1633**	DATABASE MANAGEMENT SYSTEMS	4	4
					4.	**IT 1631.1**	OPERATING SYSTEMS AND NETWORKING LAB	3	3
					5.	**IT 1633.1**	DATABASE MANAGEMENT SYSTEMS LAB	3	3
Total credits			**12**	**12**	**Total credits**			**18**	**18**

SEMESTER IV

No	Paper code	Title	Credit	Hrs/Week	No	Paper code	Title	Credit	Hrs/Week
GENERAL EDUCATION					**SKILL COMPONENT**				
1.	**IT 1541**	APTITUDE AND LOGICAL REASONING	4	4	1.	**IT 1641**	SOFTWARE ENGINEERING	4	5
2.	**IT 1542**	MANAGEMENT INFORMATION SYSTEM	4	4	2.	**IT 1642**	PROGRAMMING IN PYTHON	4	4
3.	**IT 1543**	INTERNET OF THINGS	4	4	3.	**IT 1643**	MACHINE LEARNING	4	5
					4.	**IT 1642.1**	MACHINE LEARNING USING PYTHON LAB	3	4
					5.	**IT 1644**	INDUSTRIAL TRAINING	3	-
Total credits			**12**	**12**	**Total credits**			**18**	**18**

SEMESTER V

	GENERAL EDUCATION					SKILL COMPONENT			
No	Paper code	Title	Credit	Hrs/ Week	No	Paper code	Title	Credit	Hrs/ Week
1.	IT 1551	DATA ANALYTICS	4	4	1.	IT 1651	COMPUTER GRAPHICS	4	4
2.	IT 1552	CLOUD COMPUTING	4	4	2.	IT 1652	ANDROID APP DEVELOPMENT	4	4
3.	IT 1553	ENTREPRENEURSHIP DEVELOPMENT	4	4	3.	IT 1651.1	COMPUTER GRAPHICS LAB	4	4
					4.	IT 1652.1	ANDROID APP DEVELOPMENT LAB	3	3
					5.	IT 1653	MAJOR PROJECT PHASE I	3	3
Total credits			12	12	Total credits			18	18

SEMESTER VI

	GENERAL EDUCATION					SKILL COMPONENT			
No	Paper code	Title	Credit	Hrs/ Week	No	Paper code	Title	Credit	Hrs/ Week
1.	IT 1561	PRINCIPLES OF SECURE CODING	4	4	1.	IT 1661	FREE AND OPEN SOURCE SOFTWARE (FOSS)	4	4
2.	IT 1562	INFORMATION SECURITY	4	4	2.	IT 1662	PROGRAMMING IN R	4	4
3.	IT 1563	BLOCKCHAIN MANAGEMENT	4	4	3.	IT 1662.1	PROGRAMMING IN R LAB	3	3
					4.	IT 1663	MAJOR PROJECT PHASE II	4	7
					5.	IT 1664	INDUSTRIAL VISIT	3	
Total credits			12	12	Total credits			18	18

PROGRAM STRUCTURE

S.NO	Course Code	Course Title	CE	ESE	Total Mark
1	EN1111.4	LISTENING AND SPEAKING SKILLS	20	80	100
2	M1131.10	MATHEMATICS I	20	80	100
3	IT 1511	INTRODUCTION TO IT	20	80	100
4	IT 1611	COMPUTER ARCHITECTURE AND ORGANIZATION	20	80	100
5	IT 1612	PROGRAMMING IN C	20	80	100
6	IT 1613	OFFICE TOOLS AND LATEX	20	80	100
7	IT 1612.1	PROGRAMMING IN C LAB	20	80	100
8	IT 1613.1	OFFICE TOOLS AND LATEX LAB	20	80	100
9	EN1211.4	WRITING AND PRESENTATION SKILLS	20	80	100
10	IT 1521	BUSINESS STATISTICS	20	80	100
11	IT 1522	ENVIRONMENTAL STUDIES	20	80	100
12	IT 1621	DATA STRUCTURES AND ALGORITHMS	20	80	100
13	IT 1622	OBJECT ORIENTED PROGRAMMING IN JAVA	20	80	100
14	IT 1623	WEB DEVELOPMENT	20	80	100
15	IT 1621.1	DATA STRUCTURES AND ALGORITHMS LAB	20	80	100
16	IT 1623.1	WEB DEVELOPMENT LAB	20	80	100
17	IT 1531	PRINCIPLES OF MANAGEMENT	20	80	100
18	MM1231.10	MATHEMATICS II	20	80	100
19	IT 1532	BUSINESS INFORMATICS	20	80	100
20	IT 1631	OPERATING SYSTEM	20	80	100
21	IT 1632	COMPUTER NETWORKS	20	80	100
22	IT 1633	DATABASE MANAGEMENT SYSTEMS	20	80	100
23	IT 1631.1	OPERATING SYSTEMS AND NETWORKING LAB	20	80	100
24	IT 1633.1	DATABASE MANAGEMENT SYSTEMS LAB	20	80	100
25	IT 1541	APTITUDE AND LOGICAL REASONING	20	80	100
26	IT 1542	MANAGEMENT INFORMATION SYSTEM	20	80	100
27	IT 1543	INTERNET OF THINGS	20	80	100
28	IT 1641	SOFTWARE ENGINEERING	20	80	100
29	IT 1642	PROGRAMMING IN PYTHON	20	80	100
20	IT 1643	MACHINE LEARNING	20	80	100
31	IT 1642.1	MACHINE LEARNING USING PYTHON LAB	20	80	100
32	IT 1644	INDUSTRIAL TRAINING	50		50
33	IT 1551	DATA ANALYTICS	20	80	100
34	IT 1552	CLOUD COMPUTING	20	80	100
35	IT 1553	ENTREPRENEURSHIP DEVELOPMENT	20	80	100
36	IT 1651	COMPUTER GRAPHICS	20	80	100
37	IT 1652	ANDROID APP DEVELOPMENT	20	80	100
38	IT 1651.1	COMPUTER GRAPHICS LAB	20	80	100
39	IT 1652.1	ANDROID APP DEVELOPMENT LAB	20	80	100
40	IT 1653	MAJOR PROJECT PHASE I	20	80	100
41	IT 1561	PRINCIPLES OF SECURE CODING	20	80	100
42	IT 1562	INFORMATION SECURITY	20	80	100
43	IT 1563	BLOCKCHAIN MANAGEMENT	20	80	100
44	IT 1661	FREE AND OPEN SOURCE SOFTWARE (FOSS)	20	80	100
45	IT 1662	PROGRAMMING IN R	20	80	100
46	IT 1662.1	PROGRAMMING IN R LAB	20	80	100
47	IT 1663	MAJOR PROJECT PHASE II	20	80	100
48	IT 1664	INDUSTRIAL VISIT	50	-	50
		TOTAL	**1020**	**3680**	**4700**

SEMESTER I	COURSE CODE: **IT 1511**	CREDITS: 4	HRS/WEEK: 4

INTRODUCTION TO IT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of computer systems
CO2	UNDERSTAND roles of various software
CO3	UNDERSTAND concepts of networking and database
CO4	UNDERSTAND IT strategies and importance of IT applications in various domains
CO5	EVALUATE security threats, attacks and features
CO6	EVALUATE practices in Information Technology domain

COURSE CONTENT

Module 1 (16 hrs): Introduction: What is IT? Digital Enterprise; Digital Economy; New Communication Models in Digital Economy; Information Systems: What is an information system? Types of information systems; Roles of IT in various areas of an organisation: role of IT in HRM, Finance and Accounts Management, Marketing Management, Information System Management and in Operations Management. Computer System: Computer and its characteristics, Types of computers, Layered architecture of a computer system. Computer Hardware: Processor, Primary Storage, Secondary Storage, Massive data storage, Hierarchical storage systems, input devices and output devices.

Module II (20 hrs): Computer software: Types of software, Obtaining desired software, SDLC, Program planning, Programming languages, Programming language translators, software development tools, software testing, Operating systems, Communication Software, Software utilities, software editions. Computer Networks: Communication systems, communication medium, networking devices, network types based on topology, network types based on geographical scope, network protocols and OSI communication model, wireless networks, Communication service providers and their services.

Module III (16 hrs): Database systems: Three level views of a database system, Database vs file system, database models, DBMS, DBA, Database design and development process, Database query process, Types of database systems. Data mining, Data mining software systems, Dig data analytics, Data visualisation. Internet, World Wide Web, Using internet for business activities, Intranet, Extranet and enterprise network. Internet of things.

Module IV (20 hrs): Cyber security: Security goals, Security threats and attacks, basic mechanism for cyber security, security solutions for specific purposes, sound practices for cyber security, dealing with cybercrimes. Enterprise systems: ERP, SCM, CRM systems. IT strategies for business recovery and growth: Disaster recovery planning, cloud computing, green computing, Offshore outsourcing.

Core Text Book:
    1.   Information Technology: Theory and Practice. India: Prentice Hall India Pvt., Limited, Sinha, P. K., Sinha, P. (2016).
Additional Reference:
    2.   Introduction to Computers, Peter Norton, McGraw Hill, 2010.
    3.   Fundamentals of Information Technology, Durgesh Pant, Mahesh Kumar Sharma, Laxmi Publication, 2008.

SEMESTER I	COURSE CODE: **IT 1611**	CREDITS: 4	HRS/WEEK: 4

COMPUTER ARCHITECTURE AND ORGANIZATION

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of computer architecture
CO2	UNDERSTAND memory architecture
CO3	APPLY concepts of pipelining and multithreading
CO4	ANALYSE RISC-V architecture
CO5	EVALUATE application of various computer architectures
CO6	CREATE an assembly language program

COURSE CONTENT

Module 1 (18 hrs): Moore's Law, Binary and hexadecimal numbers; Digital logic: electrical circuits, transistors, logic gates, latches, flip-flops, registers, adders, clocking, sequential logic, hardware description languages; Processor Elements: A simple processor, control unit, arithmetic logic unit, registers; The instruction set; Addressing modes; instruction categories; Interrupt processing, I/O operations.

Module II (17 hrs): Introducing MOSFET; constructing DRAM circuits with MOSFETs; I/O subsystem; Graphics displays; Network Interface; Keyboard and mouse; Modern computer system specifications; Hardware-Software Interface: Device drivers, BIOS, The Boot Process; Processor and Memory architectures: The von Neuman, Harvard and modified Harvard architectures; Physical and virtual memory, paged memory, memory management unit. Performance enhancing techniques: Cache memory; Instruction Pipelining; Simultaneous multithreading.

Module III (19 hrs): Specialized processor extensions**:** Privileged processor modes, floating -point mathematics; power management, system security management; RISC-V architecture and features; The RISC-V base instruction set, RISC-V extensions. 64-bit RISC-V; Standard RISC-V configurations. RISC-V assembly language.

Module IV (18 hrs): Applications of Computer architectures: processor virtualisation -introducing virtualisation; virtualisation challenges, virtualising modern processors, virtualisation tools, virtualisation and cloud computing. Domain specific Computer architectures, architecting computer systems to meet unique requirements, smartphone architecture, Personal computer architecture, Warehouse-scale computing architecture, neural networks and machine learning architectures.

Core Text Book:
> 1.   Modern Computer Architecture and Organization: Learn X86, ARM, and RISC-V Architectures and the Design of Smartphones, PCs, and Cloud Servers. United Kingdom: Packt Publishing. Ledin, J. (2020).

Additional Reference:
> 2.   Hamacher C., Z. Vranesic and S. Zaky, Computer Organization ,5/e, McGraw Hill, 2011
> 3.   Computer Organization and Design RISC-V Edition: The Hardware Software Interface By David A. Patterson, John L. Hennessy 2017
> 4.   William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.

SEMESTER I	COURSE CODE: **IT 1612**	CREDITS: 4	HRS/WEEK: 4

PROGRAMMING IN C

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER programming basics
CO2	UNDERSTAND various loops and decision making in C
CO3	APPLY arrays and functions in various programs
CO4	ANALYSE working of pointers in C
CO5	EVALUATE the output for given C code
CO6	CREATE algorithms, flowcharts and C programs

COURSE CONTENT

Module I (15 hrs): Programming basics, Basic model of computation, algorithms, flowcharts, Stages in development of a C program, Getting started with C; The first C program, receiving input, arithmetic instruction, integer and float conversions, type conversion in assignments, more operators, hierarchy of operations, associativity of operators Storage classes in C.

Module II (20 hrs): Conditional program execution and functions: Decision making with IF statement, IF-ELSE statement, Nested IF statement, ELSE-IF ladder, use of logical operators, switch statement, goto statement. Decision making & looping: For, while, and do-while loop, jumps in loops, break, continue statement, Nested loops. Functions: passing values between functions, return type of a function, recursion.

Module III (20 hrs): Arrays: single and two dimensional arrays, Structure, Why and additional features of Structures. Union, Utility of unions, Enumerated datatypes. (including passing them as arguments in a function call by value, call by reference.)

Module IV (17 hrs): Pointers: Pointer notation, function calls with pointers, File handling, data organisation, file I/O operations, counting characters, tabs, spaces etc, File copy program, String(Line) I/O in files, Record I/O in files, C preprocessors, Features of C preprocessor, macro expansion, File inclusion, conditional compilation, command line arguments.

Core Text Book:
    1.   Computer System and Programming In C: Learn the fundamentals of C Programming By Yashavant kanetkar BPB Publications, 2018

Additional Reference:
    2.   The C Programming Language, Brian W. Kernighan, Dennis Ritchie, 2015.
    3.   Programming in ANSI C 8/e, E. Balagurusamy, 2019.
    4.   C: The Complete Reference, Herbert Schildt, McGraw Hill, 2000.

SEMESTER I	COURSE CODE: **IT 1613**	CREDITS: 4	HRS/WEEK: 4

OFFICE TOOLS AND LATEX

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER various MS tools
CO2	UNDERSTAND working of Office Tools and Latex
CO3	APPLY office tools to a real-world requirement
CO4	ANALYSE data using Excel
CO5	CREATE MS word, Latex documents
CO6	CREATE presentations using PowerPoint

COURSE CONTENT

Module I (18 hrs): Microsoft Word- Introduction- How To Open, Work And Close MS Word. File - Create A Text File, View Content of File, Insert New File, Saving And Printing The Workbook, Using Page Setup Command. Home - Clipboard Menu, Deleting Text, Cutting, Copying And Pasting , Undoing And Redoing Actions, Changing Font Style, Size And Colour. Using Indent And Paragraph, Alignment, Line, Paragraph Spacing, Paragraph Borders, Finding And Replacing Text File. Insert- Add Cover Page, Inserting Table, Picture, Online Picture, Setting Hyperlink And Bookmark, Using Header And Footer, Inserting Symbols. Design- Using Watermark, Page Colour And Page Borders. Page Layout- Using Margin Orientation, Size And Column. References - Using Table-Contents, Update Table of Contents, Insert Captions, Insert Table Of Figures. Mailings - Using Mail Merge, Step By Step Mail Merge, Creating A Data Source, Finishing Mail Merge. Review- Using New Comment, Accept And Reject Tracking. View - Arrangement And Recording Macro.

Module II (18 hrs): Microsoft Excel - Create Workbook, Modify Workbooks, Modify Worksheet, Merge And Unmerge Cells, Using Flash Fill. Move Data Within A Workbook, Expand Upon Data, Define Excel Tables. Perform Calculations On Data- Name Groups Of Data, Create Formula To Calculate Values, Summarise Data That Meet Specific Conditions, Iterative Calculation Options, Enable Or Disable Automatic Calculation, Use Array Formula, Find And Correct Errors In Calculations. Change Workbook Appearance- Format Cells, Apply workbook Themes, Apply Excel Table Styles, Make Numbers Easier To Read, Change The Appearance Of Data Based On Its Value, Add Images To Worksheets. Manage Worksheet Data- Manipulate Worksheet Data, Define Valid Sets Of Value For Range Of Cell. Reorder And Summarise Data- Sort Worksheet Data, Sort Custom Lists, Organise Data Into Levels, Lookup Information In A Worksheet. Create Charts And Graphics- Create New Types Of Charts, Customise Appearance, Find Trend In Your Data, Create Dual Axis Chart, Using SmartArt, Create Shapes And Mathematical Equations. Using Pivot Table- Analyse Data, Filter, Show, And Hide Pivot Table Data, Edit Pivot Tables, Format Pivot Tables, Using Pivot Chart.

Module III (18hrs): PowerPoint Basics - Start PowerPoint, User Interface, Manage Office And App Settings. Create And Manage Presentation - Create Presentation, Open And Navigate Presentations, different views of presentations, Display And edit Its Presentation Properties, Save And Close Presentations. Create And Manage Slides- Add And Remove Slide, Divide Presentation Into Section, Rearrange Slides And Section. Apply Themes-Change Slide Background, Enter And Edit Text On Slide- Enter Text On Slide, Copy, Move, Delete Format Characters And Paragraph, Apply Word Text Effects, Check Spelling And Choose The Best Wording. Present Text In Table- Insert and Format Tables, Modified Table Structure, Embedded And Link To Excel Content. Insert And Manage Visual Element Insert, Move, Resize Pictures, Edit And Format Pictures, Draw And Modify Shapes, Capture And Insert Screen Clipping, Create Photo Album. Create And Manage Business Graphics- Create, Modify and Format Diagrams and Charts, Add Notes To Slides Presentation And Set Slide Timings, Present Slideshow, Customise Slide Masters And Layouts, Restrict Access Using Password.

Module IV (18 hrs): Introduction- What Is Latex?, Prepare Latex Input File, Compile Latex File, Latex Syntax, Keyboard Characters In Latex. Font Selection: Text-Mode Fonts, Math-Mode Fonts,

Emphasised Fonts, Coloured Fonts. Formatting Text – Sectional Units, Labelling And Referring Numbered Items, Text Alignments, Quoted Text, Creating And Filling Blank Space, Producing Dashes Within Text, Preventing Line Break, Adjusting Blank Space After A Period Mark, Hyphenating A Word. Multiple Columns, Footnotes, Marginal Notes. Page Layout And Style – Page Layout, Page Style, Running Header And Footer, Page Breaking And Adjustment, Page Numbering. Listing And Tabbing – Enumerate, Itemize, Description, Tabbing Environments. Table Preparation – Tabular Environment, Merging Rows And Columns Of Tables, Nested Tables, Long Tables On Multiple Pages. Insert Figures – side by side figures, sub-numbering of figures, figures in tables. Letter writing, article preparation.

Core Text Book:

1.   Lambert, J. (2015). Microsoft Word 2016 Step by Step. United States: Pearson Education.
2.   Frye, C. (2015). Microsoft Excel 2016 Step by Step: MS Excel 2016 Step by Step _p1. United States: Pearson Education.
3.   Lambert, J. (2015). Microsoft PowerPoint 2016 Step by Step: MS PowerP 2016 Step by _p1. United States: Pearson Education.
4.   Datta, D. (2017). LaTeX in 24 Hours: A Practical Guide for Scientific Writing. Germany: Springer International Publishing..

PROGRAMMING IN C LAB

This laboratory course will comprise as exercises to supplement what is learnt under paper Programming in C. Students are required to develop the following programs with internal documentation:

PART A

Any 5 basic programs below.
1. Write a program to print the size of all the data types supported by C.
2. Write a program to check whether the given number is even number or not.
3. Write a program to accept three numbers and find the largest among them.
4. Write a program to count the different vowels in a line of text using switch.
5. Write a program to find factorial of a number.
6. Write a program to print all prime numbers between any 2 given limits.
7. Write a program to print all the Armstrong numbers between any 2 given limits.
8. Write a program to demonstrate the use of break and continue statements.

Assignment on Arrays (one and two dimensional) and strings (string handling functions)
9. Write a program to find largest element in an array.
10. Write a program to search an element in an array.
11. Write a program to find sum and average of numbers stored in an array.
12. Write a program to check whether a string is a Palindrome.
13. Write a program to perform matrix addition.
14. Write a program to perform matrix multiplication.
15. Write a program to demonstrate string handling functions.

Assignment on Pointers and Array of Pointers
16. Write a function to swap two numbers using pointers.
17. Write a program to access an array of integers using pointers.

Assignment on Structures and Unions
18. Write a program to create an employee structure and display the same.

PART B
1. Implement a calculator in C program.
2. Create a file that has academic details of 5 students using structures and file i/o operations.

OFFICE TOOLS AND LATEX LAB

PART A

1. Prepare your C.V in MS Word.
2. Using Excel prepare chart to compare values (Use any data)
3. Using PowerPoint, make a presentation on a topic of your choice.
4. Using Latex write a report on any recent incident in your area.
5. Work with Lookup tables in Excel

PART B

1. Export your CV into other formats from MS Word.
2. Insert the chart you prepared in to the Powerpoint and edit any value.
3. Prepare an article with multipage long text using Latex
4. Use MailMerge features in MS Word.

SEMESTER II	COURSE CODE: **IT 1521**	CREDITS: 4	HRS/WEEK: 4

BUSINESS STATISTICS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER various statistical techniques
CO2	UNDERSTAND statistical techniques as are applicable to business.
CO3	APPLY appropriate statistical tools and techniques in different situations.
CO4	APPLY statistical techniques for quantification of data
CO5	ANALYZE data using various statistical methods
CO6	CREATE a comparison of various statistical methods

COURSE CONTENT

Module I—Introduction: Meaning, definition, functions, objectives and importance of statistics.- Distrust of statistics - Collection, classification, tabulation and presentation of data. Measures of central tendency and Measures of dispersion - relevance and applicability of each technique in business.

Module II—Correlation: Meaning and definition-correlation and causation – Types of correlation – Methods of measuring correlation for ungrouped data -Karl Pearson's coefficient of correlation and its interpretation, Probable error - , Coefficient of determination Spearman's rank correlation- co-efficient of Concurrent deviation- Application of different measures of correlation in business.

Module III--Regression analysis: Meaning and definition - Types of Regression -Regression lines- determination of simple linear regression-. Regression equations and their application in business. Properties of correlation and regression co-efficients – Comparison of regression and correlation

Module IV--Index numbers: Meaning and importance-Problems in construction of index numbers- Methods of constructing of index numbers- Simple aggregative, Average of Price relatives, Lasperye's, Paasche's, Dorbisch- Bowley's, Marshall-Edgeworth's and Fisher's ideal index numbers, Test of Consistency: Time Reversal Test and Factor Reversal Test. Chain Base Index Nos. Shifting of Base year. Cost of living Index and its use in determination of wages –Wholesale Price Index Number, Population index, inflation index, Operational indices- Sensex and Nifty.

Time series analysis: Meaning and definition- components- Measurement of long term trend- Moving average method- Method of Least squares- Application in business.

Core Text Book:
1. Gupta.S.P. *Statistical Methods*, Himalaya Publishing House, Mumbai.

Additional Reference:
2. Elhance. D.L .*Fundamentals of Statistics*, Kitab Mahal, Allahabad.
3. Gupta. B.N. Statistics - Theory and Practice, Sahitya Bhawan Publications, Agra.

SEMESTER II	COURSE CODE: **IT 1522**	CREDITS: 4	HRS/WEEK: 4

ENVIRONMENTAL STUDIES

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER and Have better awareness and concern about current environmental issues.
CO2	UNDERSTAND about the deteriorating condition of our environment among students.
CO3	UNDERSTAND factors that impact environment.
CO4	APPLY environment betterment measures.
CO5	CREATE pride in social and environmental activism
CO6	CREATE a healthy respect and sensitivity to environment

COURSE CONTENT

Module–I: The Multi-disciplinary Nature of Environmental Studies: Definition, scope and importance, Need for Public Awareness, Ecology and Ecosystems: Definition of Ecology, Structure and function of an ecosystem, Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristics features and function of – forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem(ponds, streams, lakes, rivers, oceans, estuaries).

Module-II: Biodiversity and its conservation: Introduction, genetic, species and ecosystem diversity definition, value of biodiversity, biodiversity at global, national and local levels, India as a mega diversity nation, hot spots of biodiversity, threats to biodiversity – habitat lose, poaching of wild life, man wild life conflicts, endangered and endemic species of India, conservation of bio diversity in in-situ EX-situ

Module-III Natural Resources: Air resources-features, composition, structure, air quality management, forest resources-, water resources, mineral resources, food resources, energy resources, land resources, Environmental pollution: definition, air pollution, water pollution, marine pollution, thermal pollution, soil pollution, noise pollution, nuclear hazards, waste management, cleaner technologies, reuse and recycling, solid waste management, role of individuals to prevent pollution, pollution case studies, disaster management – floods, earthquake, cyclone and landslides

Module –IV: Social issues and the environment: From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, water shed management, resettlement and rehabilitation of people- it's problems and concerns, case studies, environmental ethics- environmental value relationships, environmental ethics and species preservation, climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocaust, case studies, waste land reclamation, consumerism and waste products, legislation to protect the environment, environmental protection act, dir (prevention and control of pollution) act, water(prevention and control of pollution) act, wild life protection act, forest conservation act, environmental management systems(EMS), environmental information systems(EIS), P.I.L public hearing and role of NGOS, ISO 9000 and 14000, issues involved in enforcement of environment legislation, public awareness, environmental economics-environment and standard of living.

Core Text Book:
1. Kiran B Chokkas and others : "Understanding Environment", Sage 2004

Additional Reference:
2. P. Venugopala Rao, Environmental Science & Engineering, PHI
3. Benny Joseph: Environmental Studies, Tata McGraw Hill.

SEMESTER II	COURSE CODE: **IT 1621**	CREDITS: 4	HRS/WEEK: 4

DATA STRUCTURES AND ALGORITHMS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER various data structures
CO2	UNDERSTAND how data structures are used.
CO3	APPLY data structure algorithms
CO4	ANALYSE complexities of various algorithms
CO5	EVALUATE programs implementing Data structures
CO6	CREATE an algorithm using data structures

COURSE CONTENT

Module I (17 hrs): Algorithms- Introduction Pseudocode Asymptotic Time Complexity, Analysing Algorithm with Asymptotic Notation, Logarithms And Exponential, Ascending Race Significance Of Asymptotic Complexity, Basic Approach To Algorithm Design. List- Introduction Of Stack, Queue, Array Implementation Of Queue, General Purpose List. Basic List Operations- Insert, Delete, Reverse, And Pop () Function

Module II (19hrs): Induction And Recursion- Binary Search, Linked List. Trees- Presenting Trees, Pre-order Traversal, Level Order Traversal Search Trees Rotation Operation For Binary Search Trees Self-Adjusting Binary Search Tree. Algorithm Design- Divide And Conquer, Divide And Conquer Recurrence Relation, Dynamic Programming, Dynamic Programming Sums, Randomised Algorithms, Greedy Algorithm, Simulated Annealing.

Module III (18 hrs): Hashing- Introduction, Basic Hashing Algorithm, Hash Functions For Data Items With Many Bits, Complexity Of Hashing, The Constant *e*, Expected Number Of Empty Buckets, Chernoff Bound, Size Of The Largest Bucket, Overfilling Hash Table, Resizing Hash table Universal Hashing, Twin Hashing, Bloom Filters. Heaps- Complete K-Ary Trees. Full K-Ary Trees, Heap Implementation Using Full Trees, Building A Heap In Linear Time, Heap Sort. Balance Trees-2-3 Trees, Red Black Trees, AVL Trees, Sorting Data Only In The Leaves. Sets - Bucket Sorting, Union Find Problem

Module IV (18 hrs): Graph- Representing Graph, Depth First Search, Breadth First Search Biconnected, Strongly Connected Components, Minimum Weight Spanning Trees, Topological Sort Of A Directed Graph, Euler Path, Single Source Minimum Cost Path, All Pairs Minimum Cost Path. NP-Complete Graph Problem. Strings, Lexicographic Sorting Of Strings KMP String Matching, Boyer-Moore String Matching, Shift And String Matching, Comparison Of String Matching Methods, Pattern Matching. Tries - Suffix Tries, Cliding Suffix Tries, Edit Distance.

Core Text Book:

- Storer, J. (2012). An Introduction to Data Structures and Algorithms. United States: Birkhäuser Boston.

Additional Reference:

1. Shaffer, C. A. (2012). Data Structures and Algorithm Analysis in Java, Third Edition. United States: Dover Publications.

SEMESTER II	COURSE CODE: **IT 1622**	CREDITS: 4	HRS/WEEK: 4

OBJECT ORIENTED PROGRAMMING IN JAVA

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of classes and objects
CO2	UNDERSTAND concepts of arrays, strings, and files
CO3	APPLY concepts of exception handling and multi-threading
CO4	ANALYSE inheritance and polymorphism
CO5	EVALUATE exception handling techniques
CO6	CREATE a Java program including java applets

COURSE CONTENT

Module I (20 hrs): Familiarizing Java Environment; Introduction To Java – Keywords And Identifiers, Constants, Variables, Data Types, Console I/O – Structure Of A Java Program, Sample Program, Executing A Java Program; Operators And Expressions – Assignment Operator, Arithmetic Operators, Relational Operators, Short Circuit Logical Operators, Arithmetic Assignment Operators, Increment Decrement Operators, Conditional Operator, Instanceof() Operator, Dot Operator, Bitwise Operators, Type Conversion, Operator Precedence And Associativity. Selection – Simple If, If-Else Statement, Nested If-Else, If-Else Ladder, Switch, Nested Switch. Iterations – While Loop, For Loop, Do-While Loop, Jumps In Loops, Nesting Of Loops, Labelled Loops.

Module II (18 hrs): Classes Objects And Methods: Class Definition, Instance Variables And Member Methods, Declaration And Creation Of Objects, Accessing Members, Classification Of Member Methods, Constructors, this Keyword, Passing Objects To Methods As Arguments, Methods Returning An Object, Static Member Data, Static Member Methods, Static Blocks, Nesting Of Member Methods, Recursion, Nested Classes, Local Classes, Anonymous Classes, Final Members, Variable Arguments, Containment, Garbage Collection And Finalise Method. Inheritance – Types Of Inheritance, Constructors And Inheritance, Abstract Classes And Methods, Dynamic Method Dispatch, Object Slicing, Object Typecasting, The Final Keyword. Interfaces- Definition, Implementing Interfaces, Polymorphism Through Interfaces, Implementing Interface Partially, Extending Interfaces, Implementing Multiple Interfaces, Multiple Inheritance Through Interfaces.

Module III (17 hrs): Packages – Classification Of Packages, Creating And Using A Package, To Create A Package Across Multiple Files, Importing Classes From A Package, Nested Packages, Extending Imported Classes, Classes And Interfaces In A Package And Using Them, Static Importing, Access Control. Arrays – One Dimensional, Multi-Dimensional Arrays, Arrays And Methods, Arrays Within Class, Arrays Of Objects; String Handling: String Class, The String buffer Class. Exception Handling – Types Of Exception, Default Exception Handling Mechanism, User-Defined Exception Handling, Single Try Block And Multiple Catch Blocks, Catching Multiple Exceptions With A Single Catch Block, Nested Try Blocks, Stack Unwinding, Chained Exceptions, Throw Statement, Throws Statement, Finally Statement, Try With Resources Statement, Custom Exceptions.

Module IV(20 Hrs): Multithreaded Programming – Java Thread Model, Life Cycle Of A Thread, Thread Class, Main Thread, Creating Our Own Threads, Creating Multiple Children Threads, Forming Groups Of Threads, Thread Priorities, Synchronisation, Deadlock, Suspend And Resume Threads, Producer-Consumer Relationship Between Threads, Daemon Threads. File Handling – File Class, I/O Stream Classes Related To File Handling, Character Stream Classes, The Byte Stream Classes, Mixed Data I/O Streams, Object I/O Streams, Random Access Files. Applets – Types Of Applets, Life Cycle Of An Applet, Creating And Executing As Applet, Attributes In The <Applet> Tag, Passing Parameters To Applets.

Core Text Book:
1.   Guru, D. S., Somashekara, M. T., Manjunatha, K. S. (2017). Object Oriented programming with Java. India: Prentice Hall India Pvt., Limited.

Additional Reference:
2.   Programming with java – a primer, E. Balagurusamy, TMH, 2012.
3.   The complete reference java 2, Patrick Naughton & Hebert Schildt, McGraw Hill, 2012.
4.   The programming with Java, John R. Hubbard, TMH, 2009.

SEMESTER II	COURSE CODE: **IT 1623**	CREDITS: 4	HRS/WEEK: 4

WEB DEVELOPMENT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER how internet and web works
CO2	UNDERSTAND concepts of HTML and tags
CO3	APPLY web design principles in practice
CO4	APPLY PHP and MySQL programming to create web pages
CO5	EVALUATE responsiveness and appearance of web pages
CO6	CREATE a responsive web page

COURSE CONTENT

Module I (16 hrs): Getting started with web design ; How the web works – Internet Vs the Web, Serving up your information, A word about browsers, Web page addresses, The anatomy of web page; Concepts you should know – A multitude of devices, Sticking with the standards, progressive enhancement, responsive web design, accessibility, site performance. HTML- Creating a simple page, Launch a text editor, Step1 to 5, When good pages go bad, Document validation. Marking up text – Paragraphs, headings, Thematic breaks (horizontal rule), Lists, more content elements, organising page content, the inline element roundup, generic elements (div and span), improving accessibility with ARIA, character escapes. Adding Links – the *href* attribute, linking to pages on the web, linking within your own site, targeting a new browser window, mail links, telephone links.

Module II (16 hrs): Adding images – Various image formats, the *img* element, adding SVG images, responsive image *markup*. Table *markup* – how to use tables, minimal table structure, table headers, spanning cells, table accessibility, row and column groups, wrapping up tables. Forms – how forms work, the form element, variables and content, The great form control roundup, form accessibility features, form layout and design. Embedded Media – iframe, multipurpose embedder, video and audio, canvas,

Module III (20 hrs): CSS: formatting text – basic font properties, advanced typography with CSS3, changing text colour, text line adjustments, underlines and other decorations, changing capitalization, spaced out, text shadow, Changing list, bullets and numbers. Colours and backgrounds – Specifying colour values, Foreground colour, background colour, clipping the background, opacity, pseudo-class selectors, pseudo-element selectors, attribute selectors, background images, Shorthand background property, gradients, External style sheets. Box – The element Box, specifying box dimensions, padding, borders, margins, assigning display types, box drop shadows. Floating and positioning – Normal flow, floating, fancy text wrap with CSS shapes, positioning basics, relative positioning, absolute positioning, fixed positioning. CSS flexbox and Grid layout. Responsive web design -responsive recipe, choosing breakpoints, designing responsively, Testing, More RWD resources.

Module IV (20 hrs): CSS: Transitions, transforms, animations. JavaScript for behaviour: Introduction to JavaScript – what is JavaScript? adding JavaScript to a Page, The anatomy of a script, the browser object, events. Using JavaScript: DOM, polyfills, JavaScript libraries. Web Images: Web image basics – image sources, formats, image size and resolution, image asset strategy, favicons. Image assest production – saving images in web formats, working with transparency, responsive image production, image optimisation. SVG – Drawing with XML, Features of SVG as XML, SVG Tools, SVG production, responsive SVGs.

Core Text Book:
1. Robbins, J. (2018). Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics. United States: O'Reilly Media.

Additional Reference:
2. HTML, CSS, and JavaScript All in One Covering HTML5, CSS3, and ES6, Sams Teach Yourself By Julie C. Meloni, Jennifer Kyrnin · 2018.
3. Web Technologies: A Computer Science Perspective, Jackson, Pearson Education, 2007.
4. PHP: The Complete Reference, S. Holzner, TMH, 2007.
5. HTML & Web Design, K. Jamsa, Konrad King, TMH, 2002.

SEMESTER II	COURSE CODE: **IT 1621.1**	CREDITS: 3	HRS/WEEK: 3

DATA STRUCTURES AND ALGORITHMS LAB

PART A

Basic programs using datatypes, operators, and control statements in Java.

1) Write a Java program that checks whether a given string is a palindrome or not. Ex: MALAYALAM
2) Write a Java Program to find the frequency of a given character in a string. **
3) Write a Java program to multiply two given matrices. **

Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection:

4) Write a Java program which creates a class named 'Employee' having the following members: Name, Age, Phone number, Address, Salary. It also has a method named 'printSalary( )' which prints the salary of the Employee.
Two classes 'Officer' and 'Manager' inherits the 'Employee' class. The 'Officer' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an officer and a manager by making an object of both of these classes and print the same. (Exercise to understand inheritance). **

5) Write a java program to create an abstract class named Shape that contains an empty method named NumberOfSides( ). Provide three classes named Rectangle, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides() that shows the number of sides in the given geometrical structures. (Exercise to understand polymorphism). **

6) Write a Java program to demonstrate the use of garbage collector.

Handling different types of files as well as input and output management methods:

7) Write a file handling program in Java with reader/writer.
8) Write a Java program that read from a file and write to file by handling all file related exceptions. **
9) Write a Java program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util). **

Exception handling and multi-threading applications:

10) Write a Java program that shows the usage of try, catch, throws and finally. **
11) Write a Java program that implements a multi-threaded program which has three threads. First thread generates a random integer every 1 second. If the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the value of cube of the number.
12) Write a Java program that shows thread synchronization. **

PART B

13) Write a Java program that works as a simple calculator. Arrange Buttons for digits and the + - * % operations properly. Add a text field to display the result. Handle any possible exceptions like divide by zero.

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

Standard Searching and Sorting Algorithms using data structures and algorithms learned from course Data Structures:

16) Write a Java program for the following:
    1)   Create a doubly linked list of elements.
    2)   Delete a given element from the above list.
    3)   Display the contents of the list after deletion.

17) Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order.

18) Write a Java program that implements the binary search algorithm.

SEMESTER II	COURSE CODE: **IT 1623.1**	CREDITS: 3	HRS/WEEK: 3

WEB DEVELOPMENT LAB

Part A

1. Practicing
      i. basic HTML tags,
     ii. text tags,
    iii. text styles,
     iv. paragraph styles,
      v. headings,
     vi. lists
    vii. Tables in HTML
   viii. Frames in HTML,
     ix. nested frames,
      x. Link and Anchor Tags
2. Including graphics, video and sound in web pages, including Java applets
3. Layers & Image Maps
4. Adding animated Gifs, simple flash animations
5. Cascading Style sheets
6. DHTML
7. Creating and browsing XML database
8. Installing VRML plugins and viewing VRML source files
9. HTML forms and Fields

PART B

10. Exercises covering basic introduction to Javascript
11. Development of a web site involving a variety of tools practiced above.
12. Exercises covering basic introduction to PERL
13. Installing web server, setting CGI, connecting HTML forms to Perl Scripts (CGI programming)

SEMESTER III	COURSE CODE: **IT 1531**	CREDITS: 4	HRS/WEEK: 4

PRINCIPLES OF MANAGEMENT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER the basic principles of management.
CO2	UNDERSTAND Concept of Management and Organisations
CO3	UNDERSTAND Concepts of organizational behaviour and HR management
CO4	UNDERSTAND quality management standards
CO5	APPLY Planning and decision making strategies
CO6	APPLY Leadership qualities

COURSE CONTENT

Module 1: Definition of Management – evolution of management principles - styles of Management – levels in management-structured and unstructured decision making – functions of management. Organizational behaviour – motivational theories

Module 2: Production & Marketing Management: Time management–workflow design – scheduling CP/M – critical path – PERT, Problems, Types of Markets – Marketing Mix – Product life cycle – pricing strategies – advertisement-sales promotion

Module 3: Quality Management. Concept of quality, total quality management, 7 sigma principles, ISO certifications, Component maturity models, CMM Levels.

Module 4: Human Resource Management: Meaning of HRM, Recruitment- selection and training – difference between training and development – on the job and off the job training.

Core Text Book:
1. PC Tripathi and P N Reddy, *Principles of management*, 2/e, Tata McGraw Hill
2. Poornima M. Charantimath, *Total Quality Management*, Pearson Education

Additional Reference:
3. E H McGrath, *Basic Managerial Skills for All*, Prentice Hall of India

SEMESTER III	COURSE CODE: **IT 1532**	CREDITS: 4	HRS/WEEK: 4

BUSINESS INFORMATICS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER basic concepts of e-commerce.
CO2	UNDERSTAND about role of IT in business
CO3	UNDERSTAND different types of e-commerce web sites
CO4	UNDERSTAND security and legal issues in e-commerce
CO5	APPLY mobile-commerce techniques
CO6	APPLY different modes of payments

COURSE CONTENT

Module–I: History of e-commerce, definition, classification- B2B, B2C, C2C, G2C, B2G sites, commerce in education, financial, auction, news, entertainment sectors, Doing e-Commerce.

Module–II: Electronic payment systems – relevance of currencies, credit cards, debit cards, smart cards, e-credit accounts, e-money, security concerns in e commerce, authenticity, privacy, integrity, non-repudiation, encryption, secret key cryptography, public key cryptography, digital signatures, firewalls

Module–III: Mass marketing, segmentation, one-to-one marketing, personalization and behavioural marketing, web advertising, online advertising methods, advertising strategies and promotions, special advertising and implementation topics.

Module IV-Mobile Commerce: attributes and benefits, Mobile Devices, Computing software, Wireless Telecommunication devices, Mobile finance applications, Web 2.0 Revolution, social media and industry disruptors, Virtual communities, Online social networking: Basics and examples, Web 3.0 and Web 4.0, Civil law, intellectual property law, common law and EC legal issues

Core Text Book:
1. Erfan Turban et.al., *Electronic Commerce–A Managerial Perspective*, Pearson Education

Additional Reference:
2. R Kalokota, Andrew V. Winston, *Electronic Commerce – a Manger's guide*, Pearson

SEMESTER III	COURSE CODE: **IT 1631**	CREDITS: 4	HRS/WEEK: 4

OPERATING SYSTEM

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER types of files and access rights
CO2	UNDERSTAND process management
CO3	UNDERSTAND deadlocks in OS
CO4	UNDERSTAND distributed computing and its applications
CO5	APPLY resource management techniques
CO6	CREATE a job scheduling algorithm for an OS.

COURSE CONTENT

Module I (18 hrs): Introduction to operating system - processes and tools. File systems and Management - file types and operations, file access rights, file access and security concerns, file storage management, the root filesystem, block-based file organisation, policies in practice, flash memory. Process management - what is a process, multiprogramming and time sharing, process States, scheduling, scheduling a few scenarios, Choosing a scheduling policy, how to estimate completion time, context switching.

Module II (18 hrs): Memory management - main memory management, memory relocation context, linking and loading concept, process and main memory management, First fit policy, the best fit policy, fixed and variable partition, virtual storage space and main memory partition, virtual memory paging, paging replacement, paging implementation, paging HW support, Segmentation. Input output management - issue in input output management, input output organisation, HW/SW interface, management of buffers, disk scheduling, disk scheduling policies, universal serial bus, the PCI bus, bluetooth interface.

Module III (19 hrs): Resource sharing and management - need for scheduling, mutual exclusion, deadlock, deadlock detection and prevention algorithm, critical section. Inter process communication - creating a new process fork() system call, assigning task to a newly spawned process, establishing inter process communication. Distributed computing – architecture, Flynn's classification, OS design considerations, impact of computer network on Distributed System Architecture, distributed system models and configurations, the enabling mechanism, time management and global state, Raymond mutual exclusion algorithm, deadlocks in distributed system.

Module IV (17 hrs): Real Time Operating System And Microkernel - Characteristics Of Real Time Systems, Scheduling In RTOS, Microkernel And RTOS Resources OS And Security - Security Breaches, Attack Prevention Methods, Recent Trend In OS - Virtualisation, Usability Of Operating System, User Context Aware Computing.

Core Text Book:
1. An Introduction To Operating Systems: Concepts And Practice (Gnu/Linux And Windows), Fifth Edition. (2019). Phi Learning Pvt. Ltd.

Additional Reference:
2. Andrew S Tanenbaum, "Modern Operating Systems", 4th Edition, Prentice Hall, 2015.
3. William Stallings, "Operating systems", 6th Edition, Pearson, Global Edition, 2015.

SEMESTER III	COURSE CODE: **IT 1632**	CREDITS: 4	HRS/WEEK: 4

COMPUTER NETWORKS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER layers of OSI model
CO2	UNDERSTAND functionalities of various layers
CO3	APPLY network communication techniques
CO4	APPLY Dynamic network addressing techniques
CO5	ANALYSE Network addressing in a network
CO6	CREATE a communication program implementing TCP or UDP

COURSE CONTENT

Module I (16 hrs): Network OSI 7 Layer Model - Analogue Signals, Digital Signals, Asynchronous And Synchronous Communication, The Seven Layer OSI Model, Communication Layers, Layer 1 Physical Layer, Shared Media Layer 2 To The Data Layer, Layer 3 Network Layer, Upper Layers, Layer 4 The Transport Layer, Layer 5 The Session Layer, Layer 6 The Presentation Layer, Layer 7 The Application Layer, TCP And UDP Upper Layers, Mapping OSI And TCP Stacks To Client Server Process. The Physical Layer - Network Interface Card, Communication Between Two NICs At Layer 1, Cables And Signalling, Repeaters And Hubs, Shared Physical Media.

Module II (16hrs): The Data Link Layer – Broadcasts Unicast And Multicast, Frames, Lans, Bridges And L2 Switches, Connecting Layer 2 Networks. The Network Layer - Layer 3 Logical Networks, Flat Addressing, Network Addressing And Host Addressing, IPX And AppleTalk, Ipv4 Address, Classful Ipv4, Reserved IPv4 Networks, Private IPv4 Networks, Public IPv4 Networks, Classless Ipv4, Sending a Unicast, Layer 3 Devices, Ipv4 Subnet Planner, Ipv6 Address, Ipv6 Header, Ipv6 Route Summarisation. The Upper Layers – The Transport Layer: Layer 4, Session Layer: Layer 5, Presentation Layer: Layer 6, Application Layer: Layer 7.

Module III (20 hrs): Flow Control - No Flow Control, Start Stop, Lock Step, Fixed Window, Sliding Window, Poll Select. Routing - Introduction To Routing, Network Requirements, IP Forwarders, Parts Of A Router, Network Interfaces, The Routing Engine, The Route Table, Optional Route-Cache, Duties Of A Router, Populating And Maintaining The Route Table, Static Routing And Dynamic Routing. Dynamic Host Configuration - The Need For DHCP, BOOTP Protocol, DHCP Client And Server, Decentralized DHCP, Centralised DHCP, DHCP And Dynamic DNS. Routing Protocols: Proprietary Protocols, Open Standard Protocols, Precedence Of Routing Protocols, Configuring Static Routes.

Module IV (20 hrs): Open Shortest Path First - Overview Of OSPF, OSPF Areas, Area Border Routers, Best Route, OSPF Adjacent Relationship, OSPF Link State Database, Convergence, Advantages Disadvantages Of OSPF Network. Domain Name Service - Fully Qualified Domain Name, Top Level Domain Name, Registered Domains, Sub-Domains, Host name, Types Of Name Servers, Name Service Configuration, Named And Configuration Files, Primary And Secondary Name Server, Zone Files, Inverse Zone File, Dynamic DNS And DHCP, Advanced Zone File Transfers, DNS In Isolation, DNS Tools, Client DNS, DNS Security. Simple Mail Transfer Protocol: Email - The SMTP Server, SMTP Relay And Spam, DNS MX Record And SMTP, Configure SMTP And SendMail, Postfix MTA, Client Support Services, Alpine, POP3, IMAP Services, Web Based Service, Automatic Email Lists, Network Address Translation, Firewall, The Telnet Service.

Core Text Book:
1. Howser, G. (2019). Computer Networks and the Internet: A Hands-On Approach. Germany: Springer International Publishing.

Additional Reference:
1. Andrew S. Tanenbaum, Computer Networks, 4/e, PHI (Prentice Hall India).

SEMESTER III	COURSE CODE: **IT 1633**	CREDITS: 4	HRS/WEEK: 4

DATABASE MANAGEMENT SYSTEMS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER database concepts
CO2	UNDERSTAND data models, data architecture and schema
CO3	APPLY querying on databases
CO4	ANALYSE SQL and NoSQL databases
CO5	EVALUATE performance of database queries
CO6	CREATE a DBMS.

COURSE CONTENT

Module 1 (15 hrs): Database concepts – introduction, data, information, metadata, terminologies of a file, association between fields, association between files, file organisation. Data structure-introduction, location methods, types of pointers, inter-record data structure. Data models – introduction, classification, ER-model. Database design – steps of database design, normalisation, case problem, data volume and usage analysis. Integrated case study. Implementation design – guidelines for mapping conceptual data model into a desired logical data model, program design guidelines.

Module II (20 hrs): Hierarchical DBMS - information management systems, PC-FOCUS, network DBMS - IDBMS. Introduction to Relational DBMS. Introduction to Oracle 11g SQL, data types, CREATE, display structure of table, INSERT, SELECT, DROP, WHERE, UPDATE, DELETE, Order data, Numeric Functions, Aggregate Functions, Date Functions. tables for operations relating to two or more tables, JOIN, SELF-JOIN, GROUP BY, HAVING, sub-queries, UNION, INTERSECT, MINUS, VIEWS, Formatted reports.

Module III (17 hrs): Database Languages – graph-based languages, embedded languages. Ensuring data consistency: multi-user operation, transaction concept, consistency in massive distributed data, compare ACID and BASE. System architecture: processing of homogenous and heterogenous data, storage and access structures, translation and optimisation of relational queries, parallel processing with MapReduce, Layered architecture, Use of storage structures.

Module IV (20 hrs): Federated databases, temporal databases, multidimensional databases, data warehouse, Object relational databases, knowledge databases, fuzzy databases. NoSQL databases: Key-value stores, column family stores, document stores, XML databases, Graph databases.

Core textbook:
1.   Module I & II: PANNEERSELVAM, R. (2018). DATABASE MANAGEMENT SYSTEMS. PHI Learning Pvt. Ltd.
2.   Module III & IV: Kaufmann, M., Meier, A. (2019). SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management. Springer Vieweg.

Reference Books:
1.   Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
2.   Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

SEMESTER III	COURSE CODE: **IT 1631.1**	CREDITS: 3	HRS/WEEK: 3

OPERATING SYSTEMS AND NETWORKING LAB

PART A

1. Basic Linux commands
2. Shell programming
3. Command syntax
4. Write simple functions with basic tests, loops, patterns
5. System calls of Linux: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
6. Write programs using the I/O system calls of Linux operating system (open, read, write)
7. Implementation of the Memory Allocation Methods for fixed partition
8. a) First Fit b) Worst Fit c) Best Fit
9. Implement l page replacement algorithms a) FIFO b) LRU c) LFU*

PART B

10. Implement programs for Inter Process Communication using Shared Memory
11. Implement Semaphores
12. Implementation of CPU scheduling algorithms. a) Round Robin b) SJF c) FCFS d)Priority
13. Implement the banker's algorithm for deadlock avoidance.
14. Implementation of Deadlock detection algorithm
15. Simulate file allocation strategies.
        a) Sequential b) Indexed c) Linked
16. Simulate disk scheduling algorithms.
        a) FCFS b) SCAN c) C-SCAN

Networking (any 7 experiments)

PART A

17. Programs using TCP Sockets (like date and time server & client, echo server &client, etc..)
18. Programs using UDP Sockets (like simple DNS)
19. Programs using Raw sockets (like packet capturing and filtering)
20. Programs using RPC

PART B

21. Simulation of sliding window protocols
22. Experiments using simulators (like OPNET)
23. Performance comparison of MAC protocols
24. Performance comparison of Routing protocols
25. OPEN SHORTEST PATH FIRST ROUTING PROTOCOL
26. Study of TCP/UDP performance

DATABASE MANAGEMENT SYSTEMS LAB

PART A

1. Draw E-R diagram and convert entities and relationships to relation table for a given scenario. Perform one of the two different scenarios (eg. bank, college)
2. Write relational algebra queries for a given set of relations. Perform the following:
   a. Viewing all databases,
   b. Creating a Database,
   c. Viewing all Tables in a Database,
   d. Creating Tables (With and Without Constraints),
   e. Inserting/Updating/Deleting Records in a Table,
   f. Saving (Commit) and Undoing (rollback)
3. Perform the following:
   a. Altering a Table,
   b. Dropping/Truncating/Renaming Tables,
   c. Backing up/Restoring a Database.
4. For a given set of relation schemes, create tables and perform the following
   a. Simple Queries,
   b. Simple Queries with Aggregate functions,
   c. Queries with Aggregate functions (group by and having clause),
   d. Queries involving- Date Functions, String Functions, Math Functions
   e. Join Queries- Inner Join, Outer Join
   f. Subqueries- With IN clause, With EXISTS clause

PART B

5. For a given set of relation tables perform the following
   a. Creating Views (with and without check option),
   b. Dropping views,
   c. Selecting from a view
6. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
7. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.
8. Implement EMPLOYEE database in a NoSQL database (MONGODB).

SEMESTER IV	COURSE CODE: **IT 1541**	CREDITS: 4	HRS/WEEK: 4

APTITUDE AND LOGICAL REASONING

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	UNDERSTAND aptitude questions
CO2	UNDERSTAND reasoning questions
CO3	APPLY problem solving techniques
CO4	APPLY logical skills to solve problems easily
CO5	ANALYSE and interpret different data
CO6	EVALUATE patterns in logical reasoning questions

COURSE CONTENT

Module I: Data sufficiency, Measurement, Time and distance, Arithmetic, Relationship between numbers

Module II: Basic mathematical relations and formula, Computation, Data interpretation

Module III: Differences, Discrimination, Decision-making, Judgment, Problem-solving, Analogies, Analysis

Module IV: Arithmetic reasoning, Relationship concept, Arithmetic number series, Similarities, Verbal and figure classification, Space visualization, Observation

Core Text Book:
1. Arun Sharma , How to Prepare for Logical Reasoning for the CAT
2. A.K. Gupta, Logical and Analytical Reasoning

SEMESTER IV	COURSE CODE: **IT 1542**	CREDITS: 4	HRS/WEEK: 4

MANAGEMENT INFORMATION SYSTEMS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	UNDERSTAND an information system
CO2	UNDERSTAND IT management techniques applied in business systems
CO3	APPLY managerial control tools in MIS
CO4	APPLY optimization techniques
CO5	ANALYSE Decision support systems
CO6	ANALYSE MIS performance

COURSE CONTENT

Module I: An introduction to information systems, Information systems in organizations, Information Technology Concepts, The IS Revolution; Information requirement for the different levels lf management, transaction processing system, Management information system, Decision support system. Strategic Role of Information Systems. Business Processes; Information management, and Decision Making. Computers and Information Processing;

Module II: Transaction processing system; hardware and software requirements, tools used, case studies, merits and demerits of transaction processing system.

Module III: Managerial control, Information and tools required, difference between transactional system and managerial system. Frequency of taking outputs, Need for interconnected system, common database, Redundancy control, case studies. Decision support system, concept and tools, case studies, virtual organizations, strategic decisions-unstructured approach, cost and values of unstructured information.

Module IV: Optimization techniques, difference between optimization tools and DSS tools expert system, difference between expert system and management information system. Role of chief Information officer.

Core Text Book:
1. Rajaraman, V. (2018). Analysis and Design of Information Systems. India: Prentice Hall India Pvt., Limited.

Additional Reference:
2. Management Information Systems, by By S. SADAGOPAN, Prentice-Hall of India
3. Management Information Systems By Uma G. Gupta, Galgotia Publications

SEMESTER IV	COURSE CODE: **IT 1543**	CREDITS: 4	HRS/WEEK: 4

INTERNET OF THINGS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER impacts of IoT
CO2	UNDERSTAND smart objects
CO3	APPLY IP in IoT network
CO4	ANALYSE communication criteria in IoT networks
CO5	EVALUATE application of IoT in a given scenario
CO6	CREATE IoT network design.

COURSE CONTENT

Module I (18 hrs): What Is IoT? IoT And Digitisation, IoT Impact, Convergence Of It And OT Challenges Network Architecture And Design Simplified IoT Architecture The Core IoT Functional Stack Data Management And Compute Stack

Module II (18 hrs): Smart Objects - Sensors, Actuators And Smart Objects, Sensor Networks Connecting Smart Objects - Communication Criteria, Access Technologies

Module III (18 hrs): IP as the IoT The Network Layer - The Business Case For IP, The Need For Optimisation, Optimising IP For IoT, Profiles And Compliances, Application Protocols For IoT.

Module IV(18 hrs): IoT In Industry - Smart And Connected Cities, IoT Strategy For Smart Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use Case Examples.

Core Text Book:
1. Grossetete, P., Henry, J., Salgueiro, G., Hanes, D., Barton, R. (2017). IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. (n.p.): Pearson Education.

Additional Reference:
2. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures: Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29, 2015, Revised Selected Papers, Part II. (2016). Germany: Springer International Publishing.

SEMESTER IV	COURSE CODE: **IT 1641**	CREDITS: 4	HRS/WEEK: 4

SOFTWARE ENGINEERING

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER system analysis and design
CO2	UNDERSTAND SDLC and feasibility of system designs
CO3	UNDERSTAND Design principles
CO4	ANALYSE system through testing
CO5	ANALYSE reliability of a system
CO6	CREATE a project following SDLC using CASE

COURSE CONTENT

Module I (16 hrs): Introduction - Overview Of System Analysis And Design, Business System Concept, SDLC, Feasibility Analysis, Cost Benefit Analysis, Software Process, Project And Product. Software Life Cycle Models - Waterfall Model, Prototyping Model, Spiral Model. Software Cost Estimation - Basics Of Cost Estimation, Cost Estimation Models.

Module II (20 hrs): System Requirements: Types Of Requirements, Requirement Analysis, Process Organisation And Interaction, System Requirement Specification (SRS). System Design -Functional Versis Object Oriented Approach, Design Principles, Design Concept, Developing A Design Model, Design Notation, Object Oriented Design. Coding And Documentation - Features Of Software Code, Programming Practices, Object Oriented Programming, System Documentation.

Module III (18hrs): System Testing And Reliability- Testing Basics, Test Plan And Test Case Design, Levels Of Software Testing, Testing Techniques, Reliability Assessment, Monitoring And Control. 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, Issues In Software Metrics

Module IV: Software Project Management And Quality Assurance - Project Planning, Project Scheduling, Project Staffing, Project Monitoring, Software Quality Assurance. Software Configuration Management - Basics Of Software Configuration Management, Software Configuration Management Process, Software Configuration Management Tools. Computer Aided Software Engineering – CASE Concepts, Use and Application Of Case Tools, Tools For Project Management, Integrated Case Environment.

Core Text Book:
1.   Rohit Khurana (2012) Software Engineering (WBUT), 2nd Edition. Vikas Publishing House.

Additional Reference:
2.   Software Engineering Concepts, Richard Fairley, TMH, 1997.
3.   Software Engineering For Internet Applications, Eve Anderson, Philip Greenspun, Andrew Grumet, PHI, 2006.
4.   Software Quality Engineering, Jeff Tian, Wiley India, 2006.

SEMESTER IV	COURSE CODE: **IT 1642**	CREDITS: 4	HRS/WEEK: 4

PROGRAMMING IN PYTHON

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER Python data types
CO2	UNDERSTAND Python programming constructs
CO3	APPLY OOP in Python programs
CO4	ANALYSE various Python constructs used
CO5	CREATE simple Python programs using various data structures
CO6	CREATE a Python program for file I/O operations

COURSE CONTENT

Module I (15 hrs): Introduction-History Of Python Programming Language. Parts Of Python Programming Language – Identifiers, keywords, Statements And Expressions, Variables, Operators, Precedence And Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversion, Type() Function and Is Operator, Dynamic And Strongly Typed Language. Control Flow Statements -If, If Else, If Elif Else, Nested If, While Loop, For Loop, Continue and Break Statements, Catching Exception Using Try And Except Statement

Module II (17 hrs): Functions – Built-in Functions, Commonly Used Modules, Function Definition And Calling The Function, The *return* Statement And *void* Function, Scope And Lifetime Of Variables, Default Parameters, Keyword Arguments, **args* And ***kwrgs*, Command Line Arguments. Strings - Creating And Storing Strings, Basic String Operations, Accessing Character In String By Index Number, String Slicing And Joining, String Methods, Formatting strings.

Module III (20 hrs): List - Creating List, Basic List Operation, Indexing And Slicing In List, Built-in Function Using List, List Methods, *del* Statement. Dictionaries - Creating Dictionary, Accessing and Modifying *Key: Value* Pair In Dictionary, Built-in Functions Used In Dictionaries, Dictionary Methods, *del* Statement. Tuples And Sets - Creating Tuples, Basic Tuple Operation, Indexing And Slicing tuples, Built-in Functions Used On Tuples, Relation Between Tuples And Lists, Relation Between Tuples And Dictionaries, Tuple Methods, Using *zip*() Function, Sets, Set Methods, Frozen Set.

Module IV (20 hrs): Files - Types Of Files, Creating And Reading Text Data, File Method To Read And Write Data, Reading And Writing Binary Files, The Pickle Module, Reading And Writing Csv Files. Regular Expression Operations - Using Special Characters, Regular Expression Methods, Named Group In Python, Regular Expressions with *glob* Module. Object Oriented Programming - Classes And Objects, Creating Classes In Python, Creating Object In Python, The Constructor Method, Class Attributes Versus Data Attributes, Encapsulation, Inheritance, Polymorphism

Core Text Book:
    1.   A, Veena., S, Gowrishankar. (2018). Introduction to Python Programming. United Kingdom: CRC Press.

Additional Reference:
    2.   Lutz, M. (2013). Learning Python: Powerful Object-Oriented Programming. United States: O'Reilly Media.
    3.   Müller, A. C., Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists. United States: O'Reilly Media.

SEMESTER IV	COURSE CODE: **IT 1643**	CREDITS: 4	HRS/WEEK: 4

MACHINE LEARNING

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER types of machine learning
CO2	UNDERSTAND machine learning concepts
CO3	APPLY data pre-processing techniques
CO4	ANALYSE various Python constructs used
CO5	EVALUATE Python program
CO6	CREATE a Python program

COURSE CONTENT

Module I (17 hrs): Machine Learning – Introduction, Three Different Types Of Machine Learning, Basic Terminology And Notations, Roadmap For Building Machine Learning Systems. Training Machine Learning Algorithm For Classification - Implementing A Perceptron Learning Algorithm In Python, Adaptive Linear Neurons And The Convergence Of Learning. Machine Learning Classifiers - Choosing, A Classification Algorithm, Modelling Class Probability via Logistic Regression, Maximum Margin Classification With Support Vector Machines, Solving Nonlinear Problems Using A Kernel SVM, Decision Tree, Learning KNN algorithm.

Module II (18 hrs): Data Pre-processing - Dealing With Missing Data, Handling Categorical Data, Partitioning a Dataset In Training And Test Sets, Bringing Features On To The Same Scale, Selecting Meaningful Feature, Assessing Feature Importance With Random Forest. Dimensionality Reduction - Principal Component Analysis, Linear Discriminant Analysis, Using Kernel PCA For Non-Linear Mapping. Model Evaluation And Hyperparameter Tuning- Streamlining Workflows With Pipelines, Using K-Fold Cross-Validation To Assess Model Performance, Debugging Algorithms With Learning And Validation Curves, Fine Tuning Machine Learning Model Via Grid Search, Different Performance Evaluation Metrics. Combining Different Model For Ensemble Learning- Learning With Ensembles, Majority Vote Classifier, Evaluating And Tuning Ensemble Classifier, Bagging, Adaptive Boosting.

Module III (19 hrs): Applying Machine Learning To Sentiment Analysis- Introducing The Bag Of Words Model, Training A Logistic Regression Model For Document Classification. Embedding A ML Model in a Web Application- Serialising With Scikit-learn Estimators, Setting Up A SQLite Database For Data Storage, Developing A Web Application With Flask, Turning The Movie Classifier Into A Web Application, Deploying The Web Application To A Public Server. Predicting Continuous Target Variable With Regression Analysis- Introducing A Simple Linear Regression Model, Exploring The Housing Dataset, Implementing And Ordinary Least Square Linear Regression Model, Fitting Robust Regression Model, Evaluating The Performance Of Linear Regression Model, Using Regularized Methods For Regression, Polynomial Regression

Module IV (18 hrs): Working With Un-Labelled Data Clustering Analysis- Grouping Objects By Similarity Using K-Means, Organising Clusters As A Hierarchical Tree, Locating Regions Of High Density. Training ANN For Image Recognition- Modelling Complex Function With Artificial Neural Networks, Classifying Handwritten Digits, Training An ANN, Debugging Neural Network With Gradient Checking Convergence In Neural Networks, Other Neural Network Architectures Parallelizing Neural Network Training- Building Compiling And Running Expression, Choosing Activation Function For Feed Forward Neural Networks, Training Neural Network Efficiently Using Keras.

Core Text book:
1.   Raschka, S. (2015). Python Machine Learning. United Kingdom: Packt Publishing.
Additional Reference:
2.   Müller, A. C., Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists. United States: O'Reilly Media.
3.   Madhavan, S. (2015). Mastering Python for Data Science. United Kingdom: Packt Publishing.

SEMESTER IV	COURSE CODE: **IT 1642.1**	CREDITS: 3	HRS/WEEK: 3

MACHINE LEARNING USING PYTHON LAB

PART A
1. Reverse a list of words
2. Count number of words in a sentence using dictionary
3. Write a script to display the distance between two points in XY plane.
4. Modify the above script to contain a function (fruitful) to return the distance and call the same.
5. Write a script to check whether a given number is prime or not.
(You may use input to receive data from user, try while loop with else)
6. Write a Python script to print the total no. of palindrome words in a given sentence.
7. Write a Python script to count words in a given sentence (using dict).
8. Read a csv file and display the data in tabular form
9. Group the data and display in grouped tabular form
10. Apply segmentation using k-means clustering.
11. Apply random forest on Seaborn Dataset
12. Apply PCA and bag-of words from the movie review dataset.

Part B
13. Write a Python program which creates a class named 'Employee' having the following instance Variables: Name, Age, Address, Salary. Include a method named 'print- Salary ()' which prints the salary of the Employee along with the name of employee.
14. Estimate likelihood of events using Housing dataset.
15. Predict the document classification using any document data.

SEMESTER IV	COURSE CODE: **IT 1644**	CREDITS: 3	HRS/WEEK: 3

INDUSTRIAL TRAINING

Students should go to a software firm and undergo training on an emerging tool. Credits will be awarded upon a student presentation at the end of the semester. This presentation should be a self-refection of the industrial training received by the student. This will be internally assessed by the Department.

        Report   : 20 marks
        Presentation   : 10 marks
        Viva Voce   : 20 marks

SEMESTER V	COURSE CODE: **IT 1551**	CREDITS: 4	HRS/WEEK: 4

BIG DATA ANALYTICS

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of big data
CO2	UNDERSTAND when big data analytics can be applied
CO3	APPLY analytics algorithms for big data
CO4	APPLY ML algorithms for a given Big Data context
CO5	ANALYSE various Big data tools
CO6	ANALYSE performance of various ML algorithms in Big Data

COURSE CONTENT

Module I (15 hrs): Introduction – Big data – Hadoop – Silos – HDFS Overview – Hadoop Ecosystem – Machine learning algorithms, evolutionary computing. Intelligent systems – introduction, big data computing. Analytics for Data Science – Data models, Computing Models.

Module II (17 hrs): Big data Tools – Introduction, MapReduce, Pig, Flume, Sqoop, Mahout, GANGLIA, Kafta, Spark, NoSQL Databases. Predictive Modelling for Unstructured Data – Introduction, Application of Predictive Modelling, Feature Engineering, Pattern mining.

Module III (20 hrs): Machine Learning for Big Data; Supervised Learning for Big Data, Unsupervised Learning for Big Data, Semi supervised learning for Big Data, Reinforcement learning basics for Big Data.

Module IV (20 hrs): Applications of Big Data – IoT, Financial Services and Banking, Bio-informatics, Recommender systems, Security in Big Data.

Core Text Book:

1.   Mogadala, A., Livingston, L. J., Chivukula, A. S., Prabhu, C., Ghosh, R. (2019). Big Data Analytics: Systems, Algorithms, Applications. Germany: Springer Singapore.

Additional Reference:

2.   Suthaharan, S. (2015). Machine Learning Models and Algorithms for Big Data Classification: Thinking with Examples for Effective Learning. United States: Springer US.

3.   Raj Kamal, Preeti Saxena (2019). BIG DATA ANALYTICS: Introduction to Hadoop, Spark, and Machine-Learning. McGraw-Hill Education.

SEMESTER V	COURSE CODE: **IT 1552**	CREDITS: 4	HRS/WEEK: 4

CLOUD COMPUTING

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER objectives, advantages and disadvantages of cloud computing
CO2	UNDERSTAND impact of cloud computing
CO3	UNDERSTAND cloud computing architecture and virtualisation
CO4	APPLY design principles of cloud computing
CO5	ANALYSE risks involved in Cloud computing
CO6	EVALUATE security and privacy issues in adopting cloud computing

COURSE CONTENT

Module I (15 hrs): Foundation Of Cloud Computing – Objectives, Introduction, History, Fundamentals Of Cloud Computing Eco System, Cloud Computing Characteristics, Advantages And Disadvantages Of Cloud Computing, Comparison Of Traditional And Cloud Computing Paradigms, Evaluating The Cloud's Business Impact And Economics, Business Drivers Of Cloud Computing Adoption, Future Of Cloud. Cloud services and deployment models – cloud deployment models, cloud service models, could infrastructure mechanisms, cloud service management.

Module II (17 hrs): Cloud Computing Architecture: Design Principles, CCLC, Reference Architecture, Load Balancing Approach, MCC, Case Study – Oracle Cloud Management. Virtualisation Technology – Understanding Virtualisation, Adopting Virtualisation, Techniques Of Virtualisation, How Virtualisation Works, XEN, KVM, Vmware, Virtualbox, Citirx, Types Of Virtualisation, Virtualisation In Cloud.

Module III (20 hrs): Cloud Security And Privacy: Could Security, Cloud CIA Security Model, Cloud Computing Security Architecture, Service Provider Security Issues, Security Issues In Virtualisation, Cloud Legal Issues, Performance Monitoring And Management Of Cloud Services, Legal Issues In Cloud Computing, Data Security In Cloud, Cloud Risk Management Framework, Risk Management Process For Cloud Consumers, Requirement For Risk Management In ISO/IEC 27001, Data Privacy Risk In The Cloud, Business Continuity And Disaster Recovery, Treats In Cloud, Security Techniques For Threat Protection, Cloud SLA Practices, Components Of Cloud SLA, Types Of Slas, Cloud Vendors, Issues Of Quality Of Cloud Services, Techniques For Providing Qos, Migration Of Local Server To Cloud, Trust Management.

Module IV (20 hrs): Cloud computing applications – Google App Engine, Google Apps, Google Cloud Data Store, DropBox Cloud, Apple iCloud, Microsoft Windows Azure Cloud, AWS. Cloud computing technologies, platforms and services – HPC with cloud technologies, MPI, MapReduce programming model, Dryard and Dryard LINQ, Eucalyptus Cloud platform, Components of Eucalyptus, OpenNebula Cloud Platform – layers and features, OpenStack Cloud platform – Components and benefits, Nimbus Cloud computing platform – features. Apache Hadoop Eco system. Adopting Could Computing – Factors affecting Cloud computing adoption, Cloud computing existing areas of application.

Core Text book:
>   1.   Doshi, R., Fagbola, T., Mahrishi, M. (2019). Cloud Computing: Master the Concepts, Architecture and Applications with Real-world Examples and Case Studies. India: BPB Publications.

Reference Text Books:
>   2.   Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Michael Miller, Que Publications, 2009.
>   3.   Cloud Computing for Dummies, Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper; Wiley Publishing Inc., 2010.

SEMESTER V	COURSE CODE: **IT 1553**	CREDITS: 4	HRS/WEEK: 4

ENTREPRENEURSHIP DEVELOPMENT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER entrepreneur qualities
CO2	UNDERSTAND functions of various departments like DIC, SIDCO etc.,
CO3	UNDERSTAND significance of project reports
CO4	UNDERSTAND various subsidies
CO5	ANALYSE various schemes and eligibility
CO6	CREATE an industrial unit following a project report

COURSE CONTENT

Module I: Concepts of entrepreneur: Entrepreneur- Definitions-Characteristics of entrepreneur-Classification of entrepreneur-Entrepreneurial traits- Entrepreneurial functions role of entrepreneurs in the economic development- Factor effecting entrepreneurial growth- Entrepreneurship - Meaning-definition- Entrepreneur Vs Intrapreneur- Women Entrepreneurs- Recent development-Problems-Entrepreneurial Development Programmes- Objectives of EDP-Methods of training- Phases of EDP

Module II: Institutional support and incentives to entrepreneurs- Functions of Department of Industries and Commerce (DIC) - Activities of Small Industrial Development Corporation (SIDCO)-Functions of National Small Industries Corporation(NSIC)-Functions of Small Industries Development Bank of India (SIDBI)-Khadi Village Industry Commission (KVIC)- Small Industries Service Institute (SISI)- Functions and services of Kerala Industrial Technical Consultancy Organisation (KITCO)-Activities of Science and Technology Entrepreneurship Development Project (STEDP)-Strategies of National entrepreneurship Development Board(NEDB)-Objectives of National Institute for entrepreneurship and small business development (NIESBUD)- Techno park-Functions of techno park Incentives- Importance- Classification of incentives- Subsidy- Types of Subsidy

Module 3: Micro Small and Medium Enterprises- Features- Objectives- Importance- Role of SME in the economic development- MSME Act 2006- Salient features- Credit Guarantee Fund Trust Scheme for MSMEs - Industrial estates-Classification-Benefits-Green channel- Bridge capital- Seed capital assistance-Margin money schemes –Single Window System- Sickness- Causes –Remedies-Registration of SSI

Module 4: Setting up of Industrial unit-(Only Basic study) Environment for Entrepreneurship –Criteria for selecting particular project- Generating project ideas-Market and demand analysis-Feasibility study- Scope of technical feasibility- Financial feasibility- Social cost benefit analysis-Government regulations for project clearance- -Import of capital goods- approval of foreign Collaboration-Pollution control clearances- Setting up of micro small and medium enterprises-Location decision- Significance. Project Report-Meaning-Definition-Purpose of project reports-Requirements of good report-Methods of reporting-General principles of a good reporting system-Performa of a project report-Sample project report.

Core Text Book:
1. Shukla M.B. *Entrepreneurship and small Business Management*, Kitab Mahal Allahabad.

Additional Reference:
2. Sangram Keshari Mohanty, *Fundamentals of entrepreneurship, PHI*, New Delhi.
3. Nandan H. *Fundamentals of Entrepreneurship*, PHI, New Delhi.
4. *Small-Scale Industries and Entrepreneurship*, Himalaya Publishing, Delhi
5. Sangam Keshari Mohanty. *Fundamentals of Entrepreneurship*, PHI, New Delhi

SEMESTER V	COURSE CODE: **IT 1651**	CREDITS: 4	HRS/WEEK: 4

COMPUTER GRAPHICS

CO1	REMEMBER Classifications of computer Graphics.
CO2	UNDERSTAND Various terminologies in CG.
CO3	APPLY different transformations
CO4	ANALYSE illumination of an image
CO5	CREATE geometrical shapes using points, lines and curves
CO6	CREATE an animation.

COURSE CONTENT

Module I (18hrs): Introduction – Terminologies – Characteristics – Components – Classification – Advantages And Disadvantages – Applications. Graphics Primitives – Display Devices – Image Processing-Input And Output Devices. Scan Conversion – Vector Generation, Point's Scan Conversion, Line's Scan Conversion, Circle Scan Conversion, Ellipse Scan Conversion, Aliasing And Antialiasing, Character Generation. Polygons – Representation, Entering Polygons, Inside And Outside Test Of Polygons, Polygon Filling. Segments – Segment Table, Creating, Closing, Renaming, Posting And Unposting A Segment, Default Error Conditions, Appending To A Segment, Visibility, Morphing.

Module II (18 hrs): 2-D Transformations – Matrix Representation, Geometric Transformation, Coordinate Transformation, Composite Transformation, Affine Transformation, Windowing And Clipping – Viewing Transformation, Window To View Port Coordinate Transformation, Clipping. 3-D Geometry Primitives, 3-D Transformation, Multiple Transformation, Coordinate, Instance Transformations, 3D Clipping Process (Point And Lines). 3D Projection – Categories Of Projection, Parallel Projection, Perspective Projection.

Module III (18 hrs): Rendering And Illumination – Illumination Methods, Polygon Rendering Methods, Transparency, Shadow, Affine Invariance, Convex Hull, Order Of A Curve, Degrees Of Freedom, End Condition. Order Of Continuity, Control Point. Curve Generation DDA Method, Interpolation, Interpolating Polygons, Spline Representation, Bezier Curves, B-Spline Curves, Hermite Splines, Rational Splines. Octrees, BSP Trees, Fractals, Hilbert's Curve Compare B-Spline And Bezier Curves.

Module IV (18 hrs): CIE Chromaticity Diagram, XYZ Colour Model, Types Of Colour Models. Image And Object Precision, Back Face Detection, Back Face Removal, Z-Buffer Algorithm, A-Buffer Algorithm, Painter's Algorithm, Hidden Line Methods, Warnock's Algorithm, Scanline Method, Floating Horizon Algorithm, Ray Tracing Algorithm. Introduction To Animation – Types Of Animation, Principles Of Animation, Types Of Animation Systems, Design Of Animation Systems, Computer Animated Languages, Animation Tools, GIF Animator, Methods Of Controlling Animation. Animation Application.

Core Text Book:
1. Chopra Rajiv (2017). Computer Graphics with An Introduction to Multimedia, 4th Edition India: S CHAND & Company Limited.

Additional Reference:
2. Kanetkar, Y. (2003). Graphics Under C. India: BPB Publications.

SEMESTER V	COURSE CODE: **IT 1652**	CREDITS: 4	HRS/WEEK: 4

ANDRIOD APP DEVELOPMENT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER basics of Android
CO2	UNDERSTAND Android Studio environment
CO3	APPLY Mobile app development using Android
CO4	ANALYSE Android connections to internet
CO5	EVALUATE Android app database connectivity and querying
CO6	CREATE an Android app using Android Studio

COURSE CONTENT

Module I (17 hrs): Getting Started: Developing For Android, Developing For Mobile And Embedded Devices, Android Development Tools. Components Of An Android Application, Android Application Life Cycle, Priority And Process States, Introducing Android Application Class, Activities And Fragments. Defining Android Manifest, Gradle Build Files And Externalizing Resources. Building A User Interface – Fundamental Android Design, Density Independent Design, Android User Interface Fundamentals, Introducing Layouts, Android Widget Toolbox, Working With Lists And Grids, Introducing To Data Binding, Creating New Views. Intents And Broadcast Receivers: Using Intents And Broadcast Receivers, Using Intents To Launch Activities, Creating Intent Filters To Receive Implicit Intents, Introducing Linkify, Using Intents To Broadcast Events, Introducing The Local Broadcast Manager, Introducing Pending Intents.

Module II (19 hrs): Using Internet Resources – Connecting To Internet, Connecting, Downloading And Parsing Internet Resources, Using The Download Manager, Best Practices For Downloading Data Without Draining Battery, Introduction To Internet Services And Cloud Computing. Files, Saving State And User Preferences: Saving Files, States And Preferences, Saving And Restoring Activity And Fragment Instance State Using Lifecycle Handlers, Retaining Instance State With Headless Fragments And View Models, Creating And Saving Shared Preferences, Retrieving Shared Preferences, Introducing On Shared Preference Change Listeners, Configuring Auto Backup Od Application Files And Shared Preferences, Building A Preference UI, Creating A Settings Activity, Including Static Files As Resources, Working With The File System, Sharing Files Using File Provider, Accessing Files From Other Applications Using The Storage Access Framework, Using URI-Based Permissions.

Module III (17 hrs): Creating And Using Databases – Using Room Persistent Library. Content Providers And Search: Introducing Content Providers, Creating Content Provider, Accessing Content Providers With Content Resolvers, Using Native Android Content Providers, Adding Search To Your Application. Working In Background: Using Background Threads, Scheduling Background Jobs, Using Notifications, Using Firebase Could Messaging, Using Alarms, Introducing Services. Implementing Modern Android User Experience: Adding Menu And Actions To The APP Bar, App Navigation Patterns, Choosing Right Level Of Interruption.

Module IV: Location, Contextual Awareness And Mapping: Introducing Google Pay Services, Finding Device Location, Creating Map-Based Activities, Adding Contextual Awareness. Audio, Video And Using Camera – Using Camera To Take Pictures, Recording A Video, Audio Playback, Add Media To Media Store. Releasing Distributing And Monitoring Applications – Preparing For Release, Updating Application Metadata, Signing Production Builds, Distributing On Google Play, Introduction To Monetizing Applications, Application Marketing, Promotion And Distribution Strategies, Using Firebase To Monitor Your Application.

Core Text Book:
    1.   Lake, I., Meier, R. (2018). Professional Android. United States: Wiley.
Additional Reference:
    2.   Hagos, T. (2018). Learn Android Studio 3 with Kotlin: Efficient Android App Development. Germany: Apress.
    3.   Montane, R. R., Dawson, L. (2016). Learning Android Application Development. United Kingdom: Packt Publishing.
    4.   DiMarzio, J. (2016). Beginning Android Programming with Android Studio. United States: Wiley.

COMPUTER GRAPHICS LAB

PART A

These experiments are in C.

1. To Study various in build graphics functions in C library.
2. Write a program to draw a line using DDA algorithm.
3. Write a program to draw a circle using midpoint algorithm.
4. Write a program to draw a rectangle using line drawing algorithm.
5. Write a program to perform 2D Transformation on a line.
6. Write a program to perform shear transformation on a rectangle.
7. Write a program to rotate a circle (alternatively inside and outside) around the circumference of another circle.
8. Write a program to draw a car using in build graphics function and translate it from bottom left corner to right bottom corner of screen.
9. Write a program to draw balloons using in build graphics function and translate it from bottom left corner to right top corner of screen.
10. Write a program to draw a cube using in build library function and perform 3D

Part B

11. Write a program to study various in build functions for 2D drawing in MAYA software.
12. Write a program to show animation of a ball moving in a helical path.
13. Write a program to show animation of solar system.

ANDROID APP DEVELOPMENT LAB

PART A

Familiarization with the Android Development Platform
  1. Configure the settings of the Android Studio
  2. Run a short introductory program.
  3. Experiment with XML, activities, manifests and intents in this project.

Expanding the App Capabilities with Lifecycles and more UI options
  4. Use the IDE to create an app that has an activity lifecycle including some of the following: pause, resume, start, stop, destroy and restore.
  5. Experiment with UI fragments, and flexible UIs in this project.

Part B

Demonstrating Inter-App Interaction
  1. Use the IDE to create an app that has inter-application interaction.
  2. Experiment with sending and getting messages to other apps in this project.

Demonstrating Location Awareness
  3. Use the IDE to create an app that is location-aware.
  4. Experiment with the location manager in this project.

Building a program that demonstrates layout hierarchies
  5. Use the IDE to create an app that has multiple layout hierarchies.
  6. Experiment with ListView, List, and ViewStubs in this project.

Building a program that demonstrates network operations
  7. Create an app that has network awareness.
  8. Experiment network and cloud messaging in this project.

Incorporating audio and/or video into app projects
  9. Use the IDE to create an app that has either audio or video (or both) incorporated into its design.
  10. Experiment with volume, playback, photo-capture and/or video control in this project.

MAJOR PROJECT PHASE I

PROJECT GUIDELINES
- Group Size – Maximum 3
- No. of records – No. of group members + 1 (Department copy)
- Certificate should include the names of all members

The minimal phases for the project are:
1. Project search,
2. Finalization and allocation,
3. Investigation of system requirements,
4. Data and process modelling,
5. System Design,
6. Program design,
7. Program coding and unit testing,
8. System integration,
9. System implementation and
10. Acceptance testing.

The **first 6 steps** listed above has to be completed and an analysis and design report should be submitted at the end of this course. This report should be valued internally and marks should be awarded. Up to coding should be finished in 5th semester. Coding should begin in the 6th semester.

1. **Planning the Project:** The Major Project is an involved exercise which has to be planned well in advance. The topic should be chosen in Semester 4 itself; based on the project topic, though on Exceptional cases, for valid reasons, the project guide may waive this condition. Related reading, training and discussions should start from semester 5 itself.
2. **Selection of project work:** Project work could be of 3 types:
   a. **Developing solution for a real-life problem:** In this case, a requirement for developing a computer-based solution already exists and the different stages of system development life cycle is to be implemented successfully. Examples are Accounting Software Package for a particular organization, Computerisation of administrative functions of an organization, Web Based Commerce, etc. The scope for creativity and Exploration in such projects is limited, but if done meticulously, valuable Experience in the industrial context can be gained.
   b. **Innovative Product development:** These are projects where a clear-cut requirement for developing a computer-based solution may not be existing, but a possible utility for the same is conceived by the proposer. An Example is a Malayalam Language Editor with Spell Checker, Computer Music Software for Indian Music, Heat Engines Simulation Software for Learning, Digital Water Marking Software.
   c. **Research level project:** These are projects which involve research and development and may not be as structured and clear cut as in the above case. Examples are Malayalam Character Recognition, Neural Net Based Speech Recogniser, Biometric Systems, Machine Translation System etc. These projects provide more challenging opportunities to students, but at EX level is a difficult choice. If any student identifies proper support in terms of guidance, technology and references from external organizations and also the supervisors are convinced of the ability of the student(s) to take up the project, it shall be permitted. The methodology and reporting of such projects could be markedly different from type (a) and is left to the proposer/external supervisor of the projects.
3. **Selection of Team:** To meet the stated objectives, it is imperative that Major Project is done through a team effort. Though it would be ideal to select the team members at random (drawing lots) and this should be strongly recommended, due to practical considerations, students may also be given the choice of forming themselves into teams with 3 to 5 members (teams less

than 3 members may be permitted in Exceptional cases, for valid reasons). A gender mix should also be strongly suggested. A team leader shall be elected through drawing lots. Teams shall maintain team meeting minutes and ensure that every team member has tasks assigned in writing. Team meeting minutes shall form a part of the Project Report. Even if students are doing projects as groups, each one must independently take up different modules of the work and must submit the reports also independently (though, in such cases, some common materials is permissible). Evaluation will also be done independently.

4. **Selection of Tools:** No restrictions shall be placed on the students in the choice of platforms/tools/languages to be utilized for their project work, though open source is strongly recommended, wherever possible. No value shall be placed on the use of tools in the evaluation of the project.

5. **Selection of Organisation & Guide:** No restrictions shall be placed on the students in the choice of organization where project work may be done, in terms of locality, type (public/private) etc. It is the duty of the Head of Institute/Principal of College to ensure that the Aim, Objectives and full project guidelines are communicated to the external organization. The guide should ideally be a post-graduate with minimum 2 years of work experience. Students may also choose to do project in the college/institute (or partially in the college/institute and partially in an external organization), especially product-based work, but in such cases the supervisors must ensure that
   a. industry practices are followed
   b. the students undertake a planned visit to an IT industry with international operations to make up for the loss of experience and
   c. the services of an external guide with industry experience is obtained.

6. **Project Management:** Head of Institute/Principal of College should publish a list of students, projects topics, internal guide and external organization (if any) and teams agreed, before the end of semester 5. Changes in this list may be permitted for valid reasons and shall be considered favourably by Head of Institute/Principal of College any time before commencement of the project. Any request for change after commencement should considered by a committee of 3 teachers and their recommendation shall be accepted by Head of Institute/Principal of College.
   - **Gantt-chart** of proposed activities and a draft statement of project deliverables (which may subsequently be altered if justified) should be prepared before the commencement of the project. The actual completion of each phase should be noted on the chart in the course of the project work. Students should submit a fortnightly report of progress which could be indication of percentage of completion marked on the original Gantt-chart, with any notes attached. Students should ideally keep a daily activity log sheet. Team meetings should be documented in the format given at the end. Changes in the submitted documents are possible, as project development is essentially an evolutionary process. The project guide must ensure that changes are necessary due to the knowledge gained in succeeding phases of the project. The date of completion of a phase should be brought forward if the changes made are deemed to be errors and not due to additional knowledge gained from a succeeding phase.

7. **Documentation:** The following are the major guidelines: The final outer dimensions of the report shall be 21 cm X 30 cm. The colour of the flap cover shall be light green. Only hard binding should be done, with title of the thesis and the words "<BRIEF TITLE> B.Voc (IT) Project Report 200…" displayed on the spine in 20 point, Bold, Times New Roman, as in example below. In case the title is too long, a shorter version of it may be used (Like "Image Pro" instead of "Image Pro – An Interactive Image Processing package"). It is highly recommended that Latex be used for documentation.
   a. The text of the report should be set in 12 pt, Times New Roman, Single Spaced.
   b. Headings should be set as follows: CHAPTER HEADINGS 20 pt, Times New Roman, Bold, All Caps, Centered.

For Example:

WEB BASED BILLING SOFTWARE: B.VOC (IT) PROJECT 2022

1. SECTION HEADINGS 12 pt, Times New Roman, Bold, All Caps, Left Adjusted.

    1.1 Section Sub-headings 12 pt, Times New Roman, Bold, Left Adjusted.

Titles of Figures, Tables etc are done in 12 point, times New Roman, Italics, Centered.

<PROJECT TITLE>
<STUDENT'S NAME>
<COLLEGE NAME>
PROJECT REPORT
Submitted in partial fulfilment of the
Requirements for the award of
B.Voc degree in Information Technology of
University of Kerala
2023

Some general guidelines on documentation stylistics are:

- Double quotes and single quotes (" ", ' ') should be used only when essential. In most cases words put in quotes are better highlighted by setting them in italics.
  - Eg: This process is known as "morphing". This process is known as *morphing.*
- Page numbers shall be set at right hand top corner, paragraph indent shall be set as 3.
- Only single space need be left above a section or sub-section heading and no space may be left after them.
- Certificate should be in the format: "Certified that this report titled......................... is a bonafide record of the project work done by Sri/Kum........................ under our supervision and guidance, towards partial fulfilment of the requirements for the award of the Degree of B.Voc degree in Information Technology of the University of Kerala" with dated signatures of Internal; Guide, external guide and also Head of Institute/College.

  If the project is done in an external organization, another certificates on the letterhead of the organization is required: "Certified that his report titled............................. is a bonafide record of the project work done by Sri/Kum............................ under any supervision and guidance, at the ....Department of.................... (Organization) towards partial fulfilment of the requirements for the award of the B.Voc degree in Information Technology of the University of Kerala".
- References shall be IEEE format (see any IEEE magazine or transaction). Take care in use of italics and punctuation. While doing the project, keep note of all books you refer, in the correct format, and include them in alphabetical order in your reference list.
  - Eg: A book is cited as: Kartalopoulos, S V Understanding Neural Networks and Fuzzy Logic, BPB Publishers, 1996, pp. 21-27. (pp.21-27 indicates that pages 21-27 have been referred. If the whole book is being referred, this may be omitted. If a single page is referred, say 7, it may be cited as p.7

Report writing is NOT a hasty activity done after finishing the project. Students must try to develop the report along with the work, so as to give it flesh and blood. Drafts should be read, modified, spell checked and grammar checked at least thrice during the course of the project and before a final printout is taken, the same may be got approved from the internal guide. The students should send two interim reports to internal guides. This will also help the students in their report writing.

- The Gantt chart, fortnightly progress reports, and team meeting should appear as appendix to the project report. Regarding the body of the report, as an indicative
  - *Example, the following is given (though students should not attempt to fit every kind of project report into this format):*
    a. Organizational overview (of the client organization, where applicable)
    b. Description of the present system
    c. Limitations of the present system
    d. The Proposed system- Its advantages and features
    e. Context diagram of the proposed system.
    f. Top level DFD of the proposed system with at least one additional level of Expansion
    g. Structure Chart of the System
    h. System flowchart
    i. Menu Tree

      j. Program List

      k. Files or tables (for DBMS projects) list. Class names to be entered for each file in OO systems.

      l. List of fields or attributes (for DBMS projects) in each file or table.

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

      n. Reports List with column headings and summary information for each report.

      o. System Coding and variable/file/table naming conventions

      p. System controls and standards

      q. Screen layouts for each data entry screen.

      r. Report formats for each report.

- Program documentation is suggested on the following lines:

      i. Program id

      ii. Program level run chart

      iii. Program function Explanation

      iv. Data entry screen (reproduced from system documentation).

      v. Report layout (reproduced from system documentations)

      vi. Program level pseudo code or flowchart.

      vii. Decision tables, decision trees, with English Explanation where necessary.

      viii. Program listing

      ix. Test data

      x. Test results.

8. **Methodology:** Wherever applicable, object oriented approach should be used for software development. The project report should generally contain details of the following steps *(though students should not attempt to fit every kind of project into this format):*

    a. Analysis

      (a) Study of existing systems and its drawbacks (general)

      (b) Understanding the functionalities of the system (detailed)

      (c) Preparation of requirement

      (d) Conduct of Feasibility study

      (e) Identification of relevant Objects

      (f) Abstraction of each object (attributed and methods)

      (g) Relationship between objects

    b. Design:

      (a) Design of each subsystems

      (b) Design of each classes

      (c) Design of communications between objects

      (d) Design of Algorithms for problem solving

      (e) User interface Design

      (f) Any other steps if necessary

    c. Coding and Impletion

    d. Testing

    e. Security, Backup and Recovery Mechanisms

    f. On line help and User Manuals

    g. Upgradability Possibilities

9. **Project IPR & Utilisation:** The intellectual property rights in all project work done by the students shall vest with the University of Kerala, except in cases where some external organizations seek undertaking from students to concede IPR in all work done in their organization or under their guidance. Where possible, students should attempt to obtain at least a joint IPR for the University. In cases where project works are of public utility, students shall be asked to publish their work including source code and documentation, in so far as their rights are clear.

NB:- Evaluation should be performed based on the criteria given **IT 1663**

SEMESTER VI	COURSE CODE: **IT 1561**	CREDITS: 4	HRS/WEEK: 4

PRINCIPLES OF SECURE CODING

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER threats and security issues
CO2	UNDERSTAND the need for secure systems
CO3	UNDERSTAND principles of secure coding
CO4	APPLY principles of secure coding in C
CO5	APPLY principles of secure coding in C++ and JAVA
CO6	APPLY the concept of stored procedures

COURSE CONTENT

Module I – INTRODUCTION: Need for secure systems- Proactive security development process Security principles to live by and threat modelling.

Module II - SECURE CODING IN C: Character strings- String manipulation errors – String Vulnerabilities and exploits – Mitigation strategies for strings- Pointers – Mitigation strategies in pointer based vulnerabilities – Buffer Overflow based vulnerabilities.

Module III - SECURE CODING IN C++ AND JAVA: Dynamic memory management- Common errors in dynamic memory management- Memory managers- Double –free vulnerabilities –Integer Security Mitigation strategies.

Module IV- DATABASE AND WEB SPECIFIC INPUT ISSUES: Quoting the Input – Use of stored procedures- Building SQL statements securely-XSS related attacks and remedies.

Core Text Books:
1. Michael Howard, David LeBlanc, "Writing Secure Code", Microsoft Press, 2nd Edition, 2003.
2. Robert C. Seacord, "Secure Coding in C and C++", Pearson Education, 2nd edition, 2013.

SEMESTER VI	COURSE CODE: **IT 1562**	CREDITS: 4	HRS/WEEK: 4

INFORMATION SECURITY

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER security
CO2	UNDERSTAND access control methods
CO3	APPLY security measures to different scenarios
CO4	ANALYSE security issues
CO5	EVALUATE security strengthening protocols
CO6	CREATE a secure protocol.

COURSE CONTENT

Module 1 (16 Hrs): Models For Security, Attacks, Defence In Depth, Information Security In The Real World. Identification And Authentication- Identification, Authentication, Authorisation And Access Control- Authorisation, Access Control, Access Control Methodologies.

Module II (18 Hrs): Auditing And Accountability- Accountability, Auditing. Cryptography- History, Additional Resources, Modern Cryptography Tools, Protecting Data At Rest, In Motion And The Use. Laws And Regulations- Compliance, Privacy.

Module III (18 Hrs): Operations Security Origins Of Operation Security, Additional Resources, The Operations Security Process, Haas Law Of Operation Security. Human Element Security- Awareness, The Security Awareness And Training Program. Physical Security- Physical Security Controls, Protecting People, Protecting Data, Protecting Equipment, Physical Security In Real World.

Module IV (20 Hrs): Network Security- Protecting Networks, Protecting Network Traffic, Mobile Device Security, Network Security Tools, Firewall Tools. Operating System Security- Operating System Hardening, Protecting Against Malware, Software Firewalls And Host Intrusion Detection, Operating System Security Tools, Vulnerability Assessment Tools. Application Security- The Tix Breach, Software Development Vulnerabilities, Additional Sources, Web Security, Server Side Attacks, Database Security, Application Security Tools.

Core Text Book:
1.   Andress, J. (2014). The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice. Netherlands: Elsevier Science.

Additional Reference:
2.   I.A. Dhotre, V.S. Bagad (2009). Information Security. India: Technical Publications.

3.   Merkow (2007) Information Security: Principles And Practices. India: Pearson Education.

SEMESTER VI	COURSE CODE: **IT 1563**	CREDITS: 4	HRS/WEEK: 4

BLOCKCHAIN MANAGEMENT

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER bitcoins
CO2	UNDERSTAND bitcoins and block chain
CO3	UNDERSTAND various block chain tools
CO4	ANALYSE scenarios where blockchain can be applied
CO5	ANALYSE how to use cryptocurrency
CO6	ANALYSE various alternative blockchains

COURSE CONTENT

Module 1 (16 hrs): Introduction- The Growth Of Blockchain Technology, Distributed System, History Of Blockchain And Bitcoin, Types Of Block chain, Consensus, CAP Theorem And Block chain. Decentralization- Decentralization Using Blockchain, Methods Of Decentralization, Routes To Decentralization, Blockchain And Full Ecosystem Decentralization, Smart Contracts, Decentralized Organisation, Platform For Decentralization.

Module II (18 hrs): Symmetric Cryptography- Cryptography, Confidentiality, Integrity, Authentication, Non Repudiation, Accountability. Cryptographic Primitives-Symmetric Cryptography, Data Encryption Standard, Advanced Encryption Standard. Introducing Bitcoin - Bitcoin, Digital Keys And Addresses, Transaction, Blockchain, Mining. Bitcoin Network And Payments- Wallets- Bitcoin Payment, Innovation In Bitcoin, Bitcoin Installation.

Module III (18 hrs): Alternative Coins, Bitcoin Limitations. Name Coin, Litecoin, Primecoin, Zcash. Smart Contracts- Definition, Ricardian Contracts. Ethereum 101- Introduction, Ethereum Bird Eye View, The Ethereal Network, Components Of The Ethereum Ecosystem. Hyperledger - Projects Under Hyperledger, Hyperledger As A Protocol, The Reference Architecture, Fabric.

Module IV (20 hrs): Alternative Block chain- Kadena, Ripple, Stellar, Rootstock, Quorum Block chain DB, Multi-chain, Tendermint. Scalability And Other Challenges Scalability, Network Plane, Consent Plane, Storage Block Size Increase, Block Interval Reduction, Invertible Bloom Lookup Tables, Sharding, State Channel, Private Blockchain, Proof Of Stake, Side Chain. Privacy- Indistinguishability Obfuscation, Homomorphic Encryption, Zero Knowledge Proof, State Channel, Secure Multiparty Computation, Usage Of Hardware To Provide Confidentiality, Coin join, Confidential Transaction, Mimblewimble, Security.

Core Text Book:
1. Bashir, I. (2017). Mastering Blockchain. India: Packet Publishing.

Additional Reference:
2. Laurence, T. (2019). Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century. Netherlands: Van Haren Publishing.

FREE AND OPEN SOURCE SOFTWARE (FOSS)

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of FOSS
CO2	UNDERSTAND features of PHP and linux
CO3	APPLY PHP programming
CO4	ANALYSE benefits of using FOSS
CO5	EVALUATE PHP implementation
CO6	CREATE a MySQL database and query using PHP.

COURSE CONTENT

Module I (18 hrs): Open source software: Features, advantages over proprietary software, examples, Free software: concepts, features, Free software Vs Open Source software, Free software movements. Policies, GPL, Free OS, History and Features of Linux, Various flavours of Linux, Linux Kernel and Shell, Graphical Desktops- GNOME, KDE, Linux File System and Directories.

Module II(18 hrs): The Building Blocks Of PHP: Variables, Globals & Super Globals Data Types: SetType, Type Casting, Test Type, Operators & Expressions, Flow Control Functions In PHP, Functions: Defining A Function Variable Scope, Calling A Function, Returning Values ,Setting Default Values For Arguments, Passing Variable Reference Arrays: Creating Arrays(Associative & Multidimensional), Array Related Functions Working With Strings: Formatting Strings, Indexing, *strlen*() Functions

Module III (18 hrs): Forms In PHP: Creating A Simple Input Form, Combining HTML & PHP Code On A Single Page, Redirecting The User, Creating A Send Mail Form, File Upload Form Cookies: Introduction, Setting A Cookie With PHP, Deleting A Cookie, Session Function Overview: Starting A Session, Working With Session Variables, Passing Session IDs In The Query String, Destroying Sessions & Unsetting Variables.

Module IV (18 hrs): Database Concepts: Open Source Database Software: MySQL Features MySQL Data Types: Numeric, Date & Time, String Table Creation In MySQL: Insert, Select, Where Clause, Ordering The Result, Like Operator Selecting Multiple Tables: Using Join, Using Queries Modifying Records: Update Command, Replace Command, Delete Command Date & Time Functions In MySQL Interacting With MySQL Using PHP: Connecting To MYSQL ,Executing Queries, Retrieving Error Messages, Inserting Data With PHP, Retrieving Data With PHP.

Core Text Book:

1. Meloni, J. C., Kyrnin, J. (2018). HTML, CSS, and JavaScript All in One: Covering HTML5, CSS3, and ES6, Sams Teach Yourself. (n.p.): Pearson Education.

Additional Reference:

2. Batross, I. (2005). Web Enabled Commercial Application Development Using Html, Dhtml, Javascript, Perl Cgi - 3Rd Edn.. India: BPB Publications.

SEMESTER VI	COURSE CODE: **IT 1662**	CREDITS: 4	HRS/WEEK: 4

PROGRAMMING IN R

COURSE OUTCOME: At the end of the course, the student will be able to

CO1	REMEMBER fundamentals of data visualisation
CO2	UNDERSTAND R and R packages
CO3	APPLY visualisation techniques using R
CO4	ANALYSE data using R
CO5	EVALUATE various data types in R
CO6	CREATE R program to access, visualise and manipulate data.

COURSE CONTENT

Module I (15 Hrs): Data Visualization With Ggplot2-Aesthetic Mappings, Common Problems, Facets, Geometric Objects, Statistical Transformations, Position Adjustments. Coding Basics. Data Transformation Using Dplyr-Filter(), Arrange(), Select(), Mutate(), Summerize() Grouped Mutates And Filters. Rstudio Diagnostic Scripts, Exploratory Data Analysis-Questions, Variations, Missing Values, Covariation, Patterns And Models, Ggplot2 Calls. R Projects In R Studio.

Module II(18 Hrs): Tibbles With Tibble.- Creating Tibbles, Tibbles Vs DataFrames. Data Import With *readr*-Parsing A Vector, Parsing A File, Writing To A File. Other Types Of Data. Tidy With *tidyr*-Tidy Data, Spreading And Gathering, Separating And Pull, Missing Values, Case Study, Nontidy Data. Relational Data With *dplyr – nycflights13*, Keys, Mutating Joins, Filtering Joins, Join Problem, Set Operations. Strings With *stringr*- String Basics-, Matching Patterns With Regular Expressions, Tools, *stringi*. Factors With *forcats*,- Creating Factors, General Social Survey, Modifying Factor Order And Factor Levels. Dates And Times With *lubridate* – Creating Date/Times, Components, Time Spans, Time Zones.

Module III (18 Hrs): Program- Pipes With *magittr* Piping Alternatives. Functions- Conditional Execution, Function Arguments, Return Values, Environment. Vectors- Vector Basics, Types To Atomic Vectors, Using Atomic Vectors, Recursive Attributes, Augment Vectors. Iteration With *purr* - For Loops, Variations In For Loop For Loop Vs Functional The Map Function, Dealing With Failure, Mapping Over Multiple Arguments, Walk, Other Patterns Of For Loop.

Module IV (18 Hrs): Model Basics With *modelr*- A Simple Model, Visualising Model, Formula And Model Family, Missing Value, Other Model Family. Model Building, Many Models *gapminder*, List Columns, Creating, Simplifying List and Columns, Tidy Data With *broom*. Model-Model Basics With *modelr*, Model Building, Models With *purr* And *broom*.

Core Text Book:
1. Grolemund, G., Wickham, H. (2016). R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. United States: O'Reilly Media.

Additional Reference:
2. Raykov, T., Marcoulides, G. A. (2013). Basic Statistics: An Introduction with R. United States: Rowman & Littlefield Publishers, Incorporated.

PROGRAMMING IN R LAB

PART A

These experiments are in R on RStudio.

1. Write a simple R program to add two vectors.
2. Generate a random number from standard distribution.
3. Sample from a population.
4. Load csv files and use
   a. summerise(),
   b. filter(),
   c. map().
5. Display each row using for loop and variations of For loop
6. Visualise data using ggplot2 for
   a. Iris dataset
   b. Seaborn dataset
   c. Housing dataset
   d. Custom data
7. Create function that take a vector as input and return
   a. The last value,
   b. Elements at even numbered positions,
   c. Every element except last value.
8. RStudio for debugging R script.

Part B

9. Sum of natural numbers using recursion.
10. Fibonacci sequence using recursion.
11. Build an R model that load iris data set and display various classifications of data.
12. Implement piping using magittr package, and use functions to display the output from pipelines.
(use custom data).

SEMESTER VI	COURSE CODE: **IT 1663**	CREDITS: 4	HRS/WEEK: 7

MAJOR PROJECT PHASE II

This is a continuation of Major Project Phase I. Students should start coding at the start of this semester. Guidelines given in IT 1653 has to followed. End of the semester projects will be evaluated.

Evaluation of Project

Documentation	: 20 marks
Content & Methodology	: 20 marks
Presentation	: 20 marks
Viva Voce	: 20 marks
TOTAL	: 80 marks

SEMESTER VI	COURSE CODE: **IT 1664**	CREDITS: 3	HRS/WEEK:

INDUSTRIAL VISIT

Students should be taken for at least 3-5 day visit to any of the software industry and the marks should be awarded based on the study tour report submitted.