BHARATI VIDYAPEETH

DEEMED TO BE UNIVERSITY, PUNE (INDIA)

(Established u/s 3 of the UGC Act, 1956 vide Notification No.F.9-15/95-U-3 of the Govt. of India)

'A+' Grade Accreditation by NAAC

"Social Transformation Through Dynamic Education"

SCHOOL OF DISTANCE EDUCATION

PROGRAMME GUIDE

OF

MASTER OF COMPUTER APPLICATIONS
(MCA)
With effect from 2018-19

BHARATI VIDYAPEETH DEEMED TO BE UNIVERSITY PUNE, INDIA
FACULTY OF MANAGEMENT STUDIES
Board of Studies in Computer Applications
Structure of Master of Computer Applications Programme
(Under Choice Based Credit System)
To be effective from 2018-19 at Part I

1. INTRODUCTION

The MCA Program is a full time 100 Credits programme offered by Bharati Vidyapeeth Deemed to be University, Pune and conducted at its management institutes in Pune, Karad, Kolhapur, Sangli, and Solapur. All the five institutes have excellent faculties, Laboratories, Library, and other facilities to provide proper learning environment. The University is reaccredited by NAAC with an 'A+' grade (3rd cycle). The expectations and requirements of the software industry, immediately and in the near future, are visualized while designing the MCA programme. This effort is reflected in the Vision and Mission statements of the MCA programme. Of course, the statements also embody the spirit of the vision of Dr. Patangraoji Kadam, the Founder of Bharati Vidyapeeth and Chancellor, Bharati Vidyapeeth Deemed to be University which is to usher in "Social Transformation through Dynamic Education."

2. VISION STATEMENT OF MCA PROGRAMME

To create high caliber solution architects and innovators for software development.

3. MISSION STATEMENT OF MCA PROGRAMME

To teach 'things, not just words', 'how to think', and 'how to self-learn'.

4. OBJECTIVES OF THE MCA PROGRAMME

The main objectives of MCA Programme are to prepare the youth to take up positions as system analysts, system engineers, software engineers, programmers and of course as versatile teachers in any area of computer applications. Accordingly the course curriculum aims at developing 'systems thinking' 'abstract thinking', 'skills to analyze and synthesize', and 'skills to apply knowledge', through 'extensive problem solving sessions', 'hands on practice under various hardware/software environments', 'four minor projects and 'one semester full-time internship project'. In addition, 'social interaction skills', 'communication skills', 'life skills', 'entrepreneurial skills', and 'research skills' which are necessary for career growth and for leading quality life are also imparted.

.

5. LEARNING OUTCOMES FROM THE MCA PROGRAMME

At the end of the course the student should be able to:

(a) Analyze problems and design effective and efficient software solutions.

(b) Develop software under latest Application Development Environments.

(c) Learn new technologies with ease and be productive at all times.

(d) Read, write, and contribute to technical literature.

(e) Work in teams.

(f) Be a good citizen in all respects.

.

6. ACADEMIC PLANNER

	For June Admission Session Students	**For January Admission Session Students**
Admission Date	1st July to 31st August	1st January to 28th February
Eligibility Document Submission	1st July to 30th September	1st January to 31st March
Internal Home Assignment Submission	**For Sem - I, III, V -** August to September **For Sem - II, IV, VI -** March to April	**For Sem - I, III, V -** March to April **For Sem - II, IV, VI -** August to September
Examination Form Submission	**For Sem - I, III, V -** August to September **For Sem - II, IV, VI -** March to April	**For Sem - I, III, V -** March to April **For Sem - II, IV, VI -** August to September
University Examinations	**For Sem - I, III, V -** December **For Sem - II, IV, VI -** June	**For Sem - I, III, V –** June **For Sem - II, IV, VI -** December

7. ADMISSION PROCEDURE

The Application Form is available on website of BVDU School of Distance Education i.e. *distance.bharatividyapeeth.edu*. The candidate will have to apply for admission to any academic programme of his / her choice thorough online. The candidate will be admitted provisionally to the programme on verification of the eligibility for admission. He / She will be asked to complete the eligibility requirement by submitting the required Marksheets, Leaving/Transfer Certificate, Educational Gap Certificate (if required), Aadhaar Card etc. After verification of required documents candidate admission will be confirmed.

8. ELIGIBILITY FOR ADMISSION TO THIS PROGRAMME:

Admission to the programme is open to any candidate (Graduate) of any recognized University satisfying the following conditions.

The candidate should have secured at least 50% (45% for SC/ST).

9. DURATION OF THE PROGRAMME

The duration of this programme is three years divided in to six semesters or a minimum of 100 credits whichever is later. The medium of instruction and examination will be only English.

Minimum - 3 Years, Maximum - 6 Years

10. MEDIUM

The medium of instruction and examination is English only.

11. STUDENT SUPPORT SERVICES

a) Student Counseling:-

Full time Student Counseling Desk is available at BVDU School of Distance Education, Pune (Head Quarter). Student can contact to this office and get detail information related to Admission, Programme eligibility, Programme fees, Important Dates related to all Academic Activities, details of Academic Study Centre, Information of Examinations etc. As well as student can contact to this office through email for their queries.

b) Personal Contact Session (PCP):-

Personal Contact Sessions conducted by Academic Study Centre and organized on holidays, normally at time convenient to the student, during which a qualified expert faculty gives explanations and help to clear the doubts and difficulties of the students and also delivering instructions to the students about study material.

c) E-Learning Support:-

The electronic versions of learning resources in mobile-ready formats are available freely on `e-Learning Environmental Portal' of School of Distance Education (econnect.bvuict.in/econnect/) for students. Details programme Syllabus, Videos of Expert Lecturers on various Topics, Self Learning Material, Old Question Papers are also available on this portal. Student can easily access this instructional material.

d) Self Learning Material (SLM):-

SLM will be provided to student on Book form which contents will help them as a reference book. Learner can able to understand the subject matter even in the absence of a teacher.

12. METHODS AND MEDIA USED IN SELF INSTRUCTIONAL MATERIAL DELIVERY

Self Instructional Material is delivered in various media. The printed copies of learning resources in Self Instructional format for this programme is made available to the students through Academic Study Centres. The electronic version of the learning resources including the lectures, instructional material, lectures in mobile-ready formats are available freely on the `e-learning Environmental Portal` of School of Distance Education.

13. FACULTY AND SUPPORT STAFF

As per the requirement of programme faculties (internal and external) are available in adequate number. They are conducting all academic activities related to this programme.

14. EVALUATION OF LEARNER

As a part of evaluation of learner following activities are conducting at every Academic Study Centre.

- Continuation / Internal Assessment of each subject
- Conducting Tutorials
- Conducting Term End Examinations at the end of each session.
- Question Papers Sets with Multiple Choice Questions

GRADING SYSTEM FOR PROGRAMMES UNDER FACULTY OF MANAGEMENT STUDIES:

15. SCHEME OF EXAMINATION:

For some courses there is Internal Assessment (IA) conducted by the respective institutes as well as a University Examination (UE) at the End-of-the Term. UE will be conducted out of 70 marks and IA will be conducted for 30 marks then these are converted to grade points and grades as per the Table I. For courses having only Continuous Assessment (CA) the respective institutes will evaluate the students in varieties of ways, three or four times, during the term for a total of 100 marks. Then the marks will be converted to grade points and grades using the Table I.

16. STANDARDS OF PASSING & RULES OF ATKT:

For all courses, both UE and IA constitute separate heads of passing (HoP). In order to pass in such courses and to earn the assigned credits, the learner must obtain a minimum grade point of 5.0 (40% marks) at UE and also a minimum grade point of 5.0 (40% marks) at IA. . A student who fails at UE in a course has to reappear only at UE as backlog candidate and clear the Head of Passing. Similarly, a student who fails in a course at IA has to reappear only at IA as backlog candidate and clear the Head of Passing to secure the GPA required for passing.

The 10 point Grades and Grade Points according to the following table:

Range of Marks (%)	Grade	Grade Point
80≤Marks≤100	O	10
70≤Marks<80	A+	9

60≤Marks<70	A	8
55≤Marks<60	B+	7
50≤Marks<55	B	6
40≤Marks<50	C	5
Marks < 40	D	0

Table 1

The performance at UE and IA will be combined to obtain GPA (Grade Point Average) for the course. The weights for performance at UE and IA shall be 70% and 30% respectively. GPA is calculated by adding the UE marks out of 70 and IA marks out of 30.The total marks out of 100 are converted to grade point, which will be the GPA.

Formula to calculate Grade Points (GP):

Suppose that „Max" is the maximum marks assigned for an examination or evaluation, based on which GP will be computed. In order to determine the GP, Set x = Max/10 (since we have adopted 10 point system). Then GP is calculated by the following formulas

Range of Marks	**Formula for the Grade Point**
8x ≤ Marks≤10x	10
5.5x ≤ Marks<8x	Truncate (M/x) +2
4x ≤ Marks<5.5x	Truncate (M/x) +1

Table 2

Two kinds of performance indicators, namely the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA) shall be computed at the end of each term. The SGPA measures the cumulative performance of a learner in all the courses in a particular semester, while the CGPA measures the cumulative performance in all the courses since his/her enrollment. The CGPA of learner when he /she completes the programme is the final result of the learner.

The SGPA is calculated by the formula

$$SGPA = \frac{\sum Ck * GPk}{\sum Ck},$$

where, Ck is the Credit value assigned to a course and GPk is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study during the Semester, including those in which he/she might have failed or those for which he/she remained absent. **The SGPA shall be calculated up to two decimal place accuracy.**

The CGPA is calculated by the following formula

$$CGPA = \frac{\Sigma C_k * GP_k}{\Sigma C_k}$$

where, Ck is the Credit value assigned to a course and GPk is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study from the time of his/her enrollment and also during the semester for which CGPA is calculated. **The CGPA shall be calculated up to two decimal place accuracy.**

The formula to compute equivalent percentage marks for specified CGPA:

% marks (CGPA)	(10 * CGPA) - 10	If 5.00 ≤ CGPA < 6.00
	(5 * CGPA) + 20	If 6.00 ≤ CGPA < 8.00
	(10 * CGPA) - 20	If 8.00 ≤ CGPA < 9.00
	(20 * CGPA) - 110	If 9.00 ≤ CGPA < 9.50
	(40 * CGPA) - 300	If 9.50 ≤ CGPA ≤ 10.00

Table 3

Award of Honours:

A student who has completed the minimum credits specified for the programme shall be declared to have passed in the programme. The final result will be in terms of letter grade only and is based on the CGPA of all courses studied and passed. The criteria for the award of honours are given below.

Range of CGPA	**Final Grade**	**Performance Descriptor**	**Equivalent Range of Marks (%)**
9.5≤CGPA ≤10	O	Outstanding	80≤Marks≤100
9.0≤CGPA ≤9.49	A+	Excellent	70≤Marks<80
8.0≤CGPA ≤8.99	A	Very Good	60≤Marks<70
7.0≤CGPA ≤7.99	B+	Good	55≤Marks<60
6.0≤CGPA ≤6.99	B	Average	50≤Marks<55
5.0≤CGPA ≤5.99	C	Satisfactory	40≤Marks<50
CGPA below 5.0	F	Fail	Marks below 40

Table 4

RULES OF ATKT:

1.A student is allowed to carry backlog of any number of subjects for Semester IV.
2.A student must pass Semester I and Semester II to appear for Semester V.

17. STRUCTURE:

SEMESTER - WISE COURSE STRUCTURE FOR MCA

Semester I

Course Number	Course Title	Credits	IA Marks	EoTE Marks
101	C Programming	3	30	70
102	Computer Organization And Architecture	3	30	70
103	Database Management Systems	3	30	70
104	Discrete Structures	2	30	70
105	Management Functions	2	30	70
106	Web Supporting Technologies	3	-	100
107	C Lab	1	-	100
108	Soft Skills	1	50	-
109	Self Learning-I	1	50	-
	Total	**19**	**250**	**550**

Semester II

Course Number	Course Title	Credits	IA Marks	EoTE Marks
201	Data structure and Algorithms	3	30	70
202	Operating Systems	3	30	70
203	Software Engineering	3	30	70
204	Statistical Techniques	2	30	70
205	Financial Accounting	2	30	70
206	Database Management Systems Lab	3	-	100
207	Data Structures Lab	1	-	100
208	Project-I	1	-	50
209	Self-Learning-II	1	50	-
	Total	**19**	**200**	**600**

Semester III

Course Number	Course Title	Credits	IA Marks	EoTE Marks
301	Artificial Intelligence	3	30	70
302	Computer Networks	3	30	70
303	Object Oriented Analysis And Design	3	30	70
304	Probability and Graph Theory	2	30	70
305	Organizational Behavior	2	30	70
306	Object Oriented Programming	3	30	70
307	Object Oriented Programming Lab	1	-	100
308	Project-II	1	-	50
309	Self Learning-III	1	50	-
	Total	**19**	**230**	**570**

Semester IV

Course Number	Course Title	Credits	IA Marks	EoTE Marks
401	Data Warehousing and Data Mining	3	30	70
402	Information Security	3	30	70
403	Design Patterns	3	30	70
404	Elective-I	2	30	70
405	Elective-II	2	30	70
406	Lab Elective-I	3	-	100
407	Linux Lab	1	-	100
408	Project-III	1	-	50
409	Self Learning-IV	1	50	-
	Total	**19**	**200**	**600**

Semester V

Course Number	Course Title	Credits	IA Marks	EoTE Marks
501	Data Science	3	30	70
502	Optimization Techniques	3	30	70
503	Software Project Management	3	30	70
504	Elective-III	2	30	70
505	Elective-IV	2	30	70
506	Lab Elective-II	3	-	100
507	Lab on Current Trends	1	-	100
508	Project-IV	1	-	50
509	Self Learning-V	1	50	-
	Total	**19**	**200**	**600**

List of Elective Groups:

These are the broad Elective groups and a student can select only one group for his specialization. Each group will have 4 subjects, of which a student will study first 2 in Semester IV and other 2 in Semester V.

Elective Group
Mobile Computing
Information Systems

Elective No.	Elective Group	Course No	Course Name
01	Mobile Computing	404-05-A	HTML 5
		405-05-B	Java Script Programming
		504-05-C	Android
		505-05-D	Hybrid Application Development
02	Information Systems	404-08-A	Enterprise Resource Planning
		405-08-B	E Commerce
		504-08-C	Recommender System
		505-08-D	Knowledge Management

SEMESTER VI

Course Number	Course Title	Credits	IA Marks	EoTE Marks
601	Internship Project	5	-	100

Practical Examinations:

For courses Nos. 106,107,206,207,307,406,407,506 and 507 there will be practical examination.

For course No 507 Lab on Current Trends, Every center can decide the Programming Language to be taught depending upon the current industry demand and students interest.

Project Guidelines :

Students are expected choose a problem which will provide software solutions. The topic of a project is decided after discussion with project guide/mentor. A Software platform (language, framework) used by student to develop a project is expected to studied earlier; however students are allowed to work other platform with permission of mentor. The projects can be completed as individual project or if the scope of the project is comprehensive then project can be divided into modules and a group of student can work on it. The number of students in the f group can be decided by project guide/mentor and it should not be more than 3. Every student or group must have meeting about progress of project with their project guide regularly as specified in time table or if required at a communicated by guide.

The project dissertation/document is expected to be created and it should have the following contents.

1. SRS – Problem Statement, BRD- Business Requirement Document
2. General Requirement
3. Requirement as per user Role
4. Functional Decomposition Diagram
5. System Requirement(use case diagram, use case description /BRD)
6. design (ERD/Class Diagrams
7. Database Design
8. Interaction diagrams (DFD/Activity diagrams, Sequence/collaboration)
9. Component and deployment diagrams
10. User interface design /user manual
11. Test cases
12. Scope and limitation
13. Conclusion
14. Bibliography

List of contents are only guidelines and mentor can change the contents of documents depends on the project scope and course contents of previous and current semester.

The problems chosen may be any of the problem which can be solved using any of the platform as bellow and it should be finalized with discussion with guide.

Self Learning:

For Self Learning- I (109), Self Learning- II (209), Self Learning- III (309), Self Learning- IV (409), Self Learning- V (509), students should select any one recent/upcoming topic related to Societal Concerns (SEM I to SEM III) and on computer science (SEM IV and V), study it thoroughly and submit a project report at the end of the semester.

SEMESTER I

Course Number	Course Name	Credits	Year of Introduction
101	C Programming	3	2018-19

Course Objective :

This is a first course in programming. The objective of this paper is to teach the Programming Language C. However, the process of learning a computer language will also be emphasized. Emphasis is also on semantics and problem solving.

Expected Outcome :

At the end of the course a student should be able:

- To solve a given problem using C Program C
- Understand and use C libraries,
- Trace the given C program manually
- Effectively use of Arrays and functions
- Write C program for simple applications of real life using structures and Unions.

References (Books, Websites etc) :

1. Let us C - Y.Kanetkar, BPB Publications4. Yashawant Kanetkar, let Us C, BPB Publication
2. Programming in C - Gottfried B.S., TMH 2.
3. The 'C' programming language - B.W.Kernighan, D.M.Ritchie, PHI
4. Programming in ANSI C - Balaguruswami, TMH
5. C- The Complete Reference - H.Sohildt, TMH
6. A Structured Programming Approach using C – B.A. Forouzan & R.F. Gillberg, THOMSON Indian Edition
7. Computer fundamentals and programming in C – Pradip Dey & Manas Ghosh, OXFORD

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan	
Unit	**Contents**
1	**Basics to learn a Programming Language:** Evolution of programming languages, structured programming, the compilation process, object code, source code, executable code, operating systems, interpreters, linkers, loaders, compilers, fundamentals of algorithms, flow charts. Concepts of a Program and subprogram, Procedures and functions, Syntactic, Semantic, and Logical Errors in a program; Program Correctness- Verification and Validation, Concept of Test Data
2	**C Language Fundamentals:** Origins of C, Characters and Character Set of C, Variables and Identifiers, Built-in Data Types,

	Variable Definition, Constants and Literals, Simple Assignment Statement, Operators and operands, Unary and Binary Operators, Concept of Expression, Arithmetic Expressions, Relational Expressions, Assignment Expressions. Evaluation of Expressions, Concepts of Precedence and Associativity, Table of Precedence and Associativity. Basic Input/Output Statement, The function main()
3	**Control Statements:** Control Structures, Decision Making within a Program, Conditions, Relational Operators, Logical Connectives, Decision Making and Branching: If Statement, If-Else Statement, Switch Statement Decision Making & Looping: While Loop, Do While, For Loop. Nested Loops, Infinite Loops, Structured Programming
4	**Arrays:** One Dimensional Arrays: Array Manipulation; Searching, Linear Search, Binary Search; Finding The Largest/Smallest Element in an Array; Two Dimensional Arrays: Addition/Multiplication of Two Matrices, Transpose of a Square Matrix; Strings as Array of Characters
5	**Functions:** User defined and standard functions, Formal and Actual arguments, Functions category, function prototypes, parameter passing, Call-by-value, Call-by-reference, Recursion, Storage Classes. Strings in C and String manipulation functions, Input, output of string statements
6	**Pointers:** Address Operators, Pointer Type Declaration, Pointer Assignment, Pointer Initialization, Pointer Arithmetic, Passing parameters by reference, pointer to pointer, linked list, pointers to functions, Arrays and Pointers, Pointer Arrays, Dynamic memory allocation
7	**Structures, Unions:** Declaration of structures, declaration of unions, pointer to structure & unions. **Additional Features in C**: Command line arguments, bit wise operators, enumerated data types, type casting, macros, the C preprocessor, more about library function

Course Number	Course Name	Credits	Year of Introduction
102	Computer Organization and Architecture	3	2018-19

Course Objectives :

Main objective of this paper is to learn structure and functioning of various hardware components of digital computer. Also study the interactions and communication among these hardware components

Expected Outcome :

At the end of this course, student should be able to understand

- Simple machine architecture and the reduced instruction set computers.
- Memory control, direct memory access, interrupts, and memory organization
- Basic data flow through the CPU (interfacing, bus control logic, and internal communications).
- Number systems, instruction sets, addressing modes, and data/instruction formats.

References (Books, Websites etc) :

1. M Morris Mano Computer systems Architecture third edition Prentice Hall of India Publication
2. Anita Goel : Computer Fundamentals Pearson Publications

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Introduction To Computer Hardware & Computer security:** Computer: Block diagram, Generations, types, Applications, Interconnecting the units of computer, performance of computer. Computer Security: threats and security attack, Malicious software, Hacking, Security services, Firewall.
2	**Introduction To Digital Computer –** Data Representation – Data Types – Complements – Arithmetic Operations – Representations – Fixed –Point, Floating – Point , Decimal Fixed – Point – Binary Codes- Logic Gates, Boolean Algebra, Map Simplification – Combinational Circuits: Half-Adder, Full Adder- Flip Flops - Sequential Circuits
3	**Introduction To Digital Components And Micro Operations** ICs – Decoders – Multiplexers – Registers – Shift Registers – Binary Counters – Memory Unit – Register Transfer Language – Register Transfer – Bus And Memory

	Transfers – Arithmetic, Logic And Shift Micro Operations , Arithmetic Logic Shift Unit.
4	**Computer organization And Programming –** Instruction Codes – Computer Registers – Computer Instructions – Timing And Control – Instruction Cycle – Memory Reference Instructions – I/O And Interrupt – Machine Language – Assembly Language – Assembler - Program Loops – Programming Arithmetic And Logic Operations – Subroutines – I/O Programming.
5	**Memory Organization And CPU –** Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware – CPU: General Register Organization – Control Word – Stack Organization – Instruction Format – Addressing Modes – Data Transfer And Manipulation – Program Control, RISC
6	**Input – Output Organization** Peripheral Devices – Input-Output Interface – Asynchronous Data Transfer – Modes Of Transfer – Priority Interrupt – DMA – IOP – Serial Communication
7	**Pipeline And Vector Processing –** Parallel processing – Pipelining - Arithmetic pipeline - Instruction pipeline - RISC pipeline, - Vector processing - Array processor

Course Number	Course Name	Credits	Year of Introduction
103	Database Management Systems	3	2018-19

Course Objective:

The goal of this course is to teach the fundamentals of the database systems at a master level. A variety of topics will be covered that are important for modern databases in order to prepare the students for real life applications of databases. The course aims to impart knowledge of the concepts related to database and operations on databases. It also gives the idea how database is managed in various environments with emphasis on security measures as implemented in database management systems.

Expected Outcome :

After going through this course a student should be able to:

- Understand the concept of database and techniques for its management.
- Design different data models at conceptual and logical level and translate ER Diagrams to Relational Data Model.
- Normalize the database.
- Write queries using Relational Algebra.
- Describe the file organization schemes for DBMS.
- Describe and use features for Concurrency and Recovery.
- Understand data security standards and methods.
- Understand the fundamentals of Distributed Database Systems.

References :

Books:

1. "Fundamentals of Database Systems" Global Edition By Ramez Elmasri, Shamkant B. Navathe
2. “Database System and Concepts” A Silberschatz, H Korth, S Sudarshan, McGraw-Hill.

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Introduction to DBMS:** Difference between Data, Information, Data Processing & Data Management. File Oriented Approach, Database oriented approach to Data Management, Need for DBMS, Characteristic of Database, Database Architecture: Levels of Abstraction, Database schema and instances, 3 tier architecture of DBMS, Data Independence. Database users, Types of Database System. Database Languages, DBMS interfaces.
2	**Data Modeling in Database :** Data Models, Logical Data Modeling: Hierarchical Data Model, Network Data Model,

	Relational Data Model. Conceptual Data Modeling: Entity Relationship Model, Entities, Attributes, Types of Attributes, Relationships, Relationship set, Degree of relationship Set, Mapping Cardinalities, Keys, ER Diagram Notations, Roles Participation: Total and Partial, Strong and Weak Entity Set. The extended entity relationship (EER) model, Subclass, Superclass, generalization, specialization, Attribute Inheritance. **Relational Data Model** Codd's Rules for RDBMS, Translating ER Diagram to Relational Database.
3	**Normalization and Relational Algebra:** Normalization Vs De-Normalization, Decomposition, Lossy and Lossless Decomposition, Functional Dependencies, Normal forms 1NF, 2NF, 3NF, BCNF, Case Studies on Normalization. **Relational Algebra:** Keys: Composite, Candidate, Primary, Secondary, Foreign, Relational Relational Algebra Operators: Select, Project, Divide, Rename. Set Operations: Union, Intersect, Difference, And Product, Joins: Outer Joins, Inner Joins with example.
4	**File Structures and Data Administration:** File Organization, Overview of Physical Storage Media, Magnetic Disk, RAID, Tertiary Storage, Storage Access, Data Dictionary Storage, Organization of File (Sequential, Clustering), Indexing and Hashing, Basic Concepts, indices, B+ Tree index file, B- tree index file, Static hashing, Dynamic Hashing.
5	**Concurrency Control And Recovery Techniques:** **Concurrency Control:** Single User and Multiuser systems, Multiprogramming and Multiprocessing, Basic Database access operations, Concept of transaction, transaction state, ACID properties, Schedules, Serializability of schedules., Concurrency Control, Need for Concurrency control, lock based protocols, timestamp based protocols, Multiple granularity, Multiple Version Techniques, Deadlock and its handling, Wait-Die and Wound-Wait, Deadlock prevention without using timestamps, Deadlock detection and time outs, Starvation **Recovery Techniques:** Database Recovery, Types of Failures, Storage Structure: Volatile, Non Volatile and stable storage, Data access. Recovery and atomicity, Recovery Techniques / Algorithms: Log Based Recovery, Check points, Shadow Paging
6	**Data Administration And Security:** Data administration, Role and Responsibility of DBA, Creating/Deleting/Updating table space, Database Monitoring, User Management, Basic data security principles – user privileges, data masking, encryption and decryption. Data Security Implementation, revalidation of user, role, privileges. Data Quality Management, Basic quality principles, data quality audit, data quality improvement
7.	**Introduction to Advance Databases:** **Distributed Database:** Heterogeneous and Homogeneous Databases, Distributed database features and needs,

	Advantages and Disadvantages, Distributed Database Architecture. Levels of distribution, transparency, replication. Fragmentation. **Data Warehouse:** Data Warehouse defined, Need for Data Warehouse, Characteristics of Data Warehouse, Multidimensional Data Model, OLTP vs. OLAP, A three tier Data Warehouse Architecture, Data Mart Vs. Data Warehouse.

Course Number	Course Name	Credits	Year of Introduction
104	Discrete Structures	2	2018-19

Course Objective:

1. To learn basic mathematical course ,eg. Sets, Functions, Graph.
2. To be familiar with formal mathematical reasoning eg. Logic proofs.
3. To improve problem solving skills.
4. To see the connections between Discrete structure Computer Science

Expected Outcome :

a)Apply standard Mathematical methods.
b)Write code to implement solution procedures.
c)Search for information in tacking advanced problems.
d)Formulate AI problems mathematically.

Reference Books:

Kenneth H.Rosen,Discrete Mathematics and its Applications Edition 6 th Tata McGraw Hil
Schaum's outlines Discrete Mathematics
Discrete Mathematics N CH S N Lyneger and K.A. Venkatesh

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Propositional logic**: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.
2	**Set and Relation** **Set Theory**: Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and count ability (Countable and Uncountable sets), Partition of set , proofs of some general identities on sets, Fuzzy set ,Fuzzy set operation, rough set concept **Relation**: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation ,Equivalence Relation, Relation Matrices

3	**Function**: Definition and types of function (one to one, onto, Inverse) composition of functions, Graph of Functions, Some Functions in Computer Science, Growth of Functions recursively functions.
4	**Algorithm, the Integers and Matrices**: Algorithm, growth of function, Complexity of algorithm, Primes and Greatest Common Divisors, Integers algorithm
5	**Partial Order and Structure: Partially Ordered,** Sets ,Lexico graphics Order, Hasse Diagram, Maximal and Minimal elements of a Poset, Concept of Lattice, Boolean Functions, Logic Gates, Minimization of Combinational circuit
6	**Combinatories :** Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)
7	**Modelling Computation:** Language and Grammar, Finite State Machine with output**,** , Finite State Machine with no output, Language Recognition

Course Number	Course Name	Credits	Year of Introduction
105	Management Functions	2	2018-19

Course Objective:

1. To orient the students to principles of management
2.To make them comprehend the process of management
3.To internalize the principles through rigorous assignments where they shall observe, analyze and infer the presence of principles transformed into practice.

Expected Outcome :

At the end of the course, the students shall acquire

1. Understanding of functions of management
2. Understand the principle of management woven in to the process of management
3. Understand how they are modified in to practice to suit the requirements
4. How IT influences the process of management

References :

Books:

1. H.Welrcih, Mark Cannice, H. Koontz, Management , A Global and Entrepreneurial Perspective , Mcgraw-Hill Companies, 12th edition.
2. P.C.Tripathi, P.N.Reddy, Principles and Practice of Management , Tata Mcgraw Hill , Third Edition
3. L.M. Prasad, Principles and Practice of Management, Seventh Edition
4. Stephan Robbins, Mary Coutler, Management

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	The need of Management Study , Process of Management , Characteristics of Professional Management , Brief Review of Management Thought Social Responsibility of Management
2	Decision Making Process , Planning and Steps in Planning , Types of Plan Making Planning Effective , Case Study on Planning, MBO
3	Organization, Meaning and Process , Departmentalization,, Organization Structure , Authority and Delegation , Centralization verses Decentralization , Team Work , Case Study
4	Co-ordination – meaning and need , Techniques of establishing Co-ordination Difficulties in establishing co-ordination , Case Study
5	Formal and Informal Organization, Manpower Planning , Recruitment and Performance Appraisal, Compensation and Incentives , issues related to Retention Case study

6	An overview of Communication, Supervision and Direction , Leadership Styles , Control – need and types and control techniques . In addition there shall be tutorials of written examination type, field study and presentation.
7.	**Case Studies**

Course Number	Course Name	Credits	Year of Introduction
106	Web Supporting Technologies	3	2018-19

Course Objectives :

- To understand the basic concepts of the World Wide Web
- To understand and practice HTML as markup language
- To understand and practice embedded dynamic scripting on client side Internet Programming
- To understand and practice web development techniques on client-side
- To understand and practice server-side scripting

Syllabus Outline:

- Understanding of internet and intranet- working of WWW, types Protocols and working of HTTP and types of servers
- UI Design - Markup Language: Introduction to HTML5 - Cascading Style Sheet: Introductionto CSS3.
- Client Side Scripting using JAVASCRIPT - Introduction to JavaScript - Document Object Model -Event Handling - Controlling Windows & Frames and Documents - Browser Management andMedia Management - Object-Oriented Techniques in JavaScript - JQuery.
- Server SideScripting using PHP - Introduction to PHP - Programming basics - Reading Data in WebPages - Embedding PHP within HTML - Establishing connectivity with MySQL database.

Expected Outcome :

Upon successfully completing this course the student will be able to

- Understand concept of internet and how it functions
- Use HTML tag to format contents of web page
- Use Cascading Style Sheets (CSS) to apply user defined look and feel
- Apply Java Script to validate form data and generate dynamic contents
- Make use of PHP to generate server side response using MYSQL as databse

References (Books, Websites etc) :

1. Thomas Powell, Web Design The complete Reference, Tata McGrawHill
2. Thomas Powell, HTML and XHTML The complete Reference, Tata McGrawHill
3. Thomas Powell and Fritz Schneider JavaScript 2.0 : The Complete Reference, Second Edition
4. PHP : The Complete Reference By Steven Holzner, Tata McGrawHil
5. Ivan Bayross (2006) Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI, BPB Publications.
6. Luke Welling, PHP and MySQL Web Development, Pearson Education; Fifth edition

Suggested MOOC :

Please refer these websites for MOOCS:

NPTEL / Swayam www. edx.com www.coursera.com

Syllabus/Course Outline

Unit	Contents
1	Understanding internet and intranet, Introduction to WWW, WWW Architecture, Concept of protocol ant its types: SMTP,POP3,File Transfer, Overview of HTTP, HTTP request and response. Various web server, using Apache as web server, Installation of Apache, Apache Directory Structure, apache configuration, creating application folder, storing and accessing files from server
2	Types of Markup Language and HTML as markup language, basic structure of HTML, Head Section and elements of head section, Meta tags and external link tags HTML body content tags: header tags, Paragraph, span and pre tags, text formatting tags, Ordered and unordered list tag, Table tag, div tag, Frames and framesets, Anchor Links and named anchors, image tag and using image mapping for hotspot, working with forms: Form tag, POST and GET methods, working with Text input, Text Area, Checkbox and radio and other form elements;
3	Introducing CSS, Types of style sheets: inline, embedded and external style sheets, working with CSS properties: text properties, color and background properties, border and shading, box and block properties, positioning with CSS, various types of CSS selectors: universal, class, ID, child, descendent, adjacent sibling, attribute and query.
4	Client Side Scripting: Introduction to JavaScript, data types, Operators, conditional and iterative Statements, Introduction to arrays, arrays with methods, Math, String and Date objects, working with DOM: Window, Navigator, History, Location, Link, Anchor and form elements, functions and objects, methods, handling events and form validations
5	Advanced JavaScript: Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub classes and Super classes – JSON - JQuery and AJAX.
6	Why PHP and MySQL?, Server-side web scripting, Installing PHP, Adding PHP to HTML Syntax and Variables, PHP control structures and loop, Passing informationbetween pages, Strings, Arrays and Array, Functions, Numbers, working with String and Regular Expressions
7	Concept of Cookies and sessions, when and how to use cookies and sessions, Using MySQL to create database and tables, using queries to inset and update data, using PHP to interact with MySQL, Displaying data from tables in tables, using form data to insert, update database, deleting data from table by getting criterion through forms, working with E-Mail

Course Number	Course Name	Credits	Year of Introduction
107	C Lab	1	2018-19

Course Objective :

This is companion course of C Programming

Syllabus Broad Units:

This Companion course of C programming; Practical aspects of C programming towards problem solving is covered.

Expected Outcome :

The students will develop adequate programming skills with respect to following

1. Implement a real world problem using basic constructs of C language.
2. Develop an application using Decision making and looping
3. Make use of proper operators to solve problem.
4. Make use of Arrays and pointers efficiently and handling strings.
5. Comprehend the dynamic memory allocation and pointers in C.
6. Able to define new data types using enum, structures and typedef.

References (Books, Websites etc) :

1. Let us C - Y.Kanetkar, BPB Publications4. YashawantKanetkar, let Us C, BPB Publication
2. Programming in C - Gottfried B.S., TMH 2.
3. The 'C' programming language - B.W.Kernighan, D.M.Ritchie, PHI
4. Programming in ANSI C - Balaguruswami, TMH
5. C- The Complete Reference - H.Sohildt, TMH
6. A Structured Programming Approach using C – B.A. Forouzan& R.F. Gillberg, THOMSON Indian Edition
7. Computer fundamentals and programming in C – PradipDey& Manas Ghosh, OXFORD

C Lab Outline

Sr. No	Programming Exercises
1	Compilation and Executing programs Arithmetic operations Use of Symbolic constants Demonstrating the following gcc options -o, -c, -D, -l, -I, -g, -E Note :***Algorithm of every program should be written. Properly document the programs using comments. Author name and date, purpose of each variable and constructs like loop and functions should be indicated/ documented.*** ***gcc or an equivalent compiler is assumed***.

2	Program to demonstrate the following – Branching – Nested Branching – Looping – Selection
3	Working with functions – Writing function prototype and definition – Using functions to solve problems (Calling a function) – Using recursion – Storage classes - Using register, extern and static
4	Using debugger and Creating Libraries Important Commands - break, run, next, print, display, help Functions Creating Header file for Function Prototype Compiling and storing Function Definition in Library (archive) file
5	Arrays 1D - Linear Search, Sort 2D - Matrix operations Strings, Structure, Union
6	Pointers, Dynamic Memory Allocation Structure Pointer Array of Pointers, Ragged Arrays, Function pointer
7	Structures Making use of structures to define new types(user defined types)

Course Number	Course Name	Credits	Year of Introduction
108	Soft Skills	1	2018-19

Course Objective :

1. To provide Confidence building and soft skills development.
2. To develop decision making and analytical skills.
3. To let students make a transition from the academic mode to the corporate and entrepreneurial mode

Expected Outcome :

- This course would be handy for those who are attending interviews at the company premises, even if it is arranged by the institute. You need to differentiate yourself as a better candidate than others, which is the key to get a job.
- This will go a long way in improving your career prospects by developing skills required by a practicing manager. Thus, you will be able to handle challenging corporate assignments. Being a fresher, you will be closely monitored by your superior. This course will give you confidence to impress them with your professional attitude.
- Industry expects to spot out people for better positions, with the qualities of leadership. This is where this program will help you acquire some of the qualities of leadership.

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Sr. No	
1	**Business Communication Skills – Email correspondence:** E-mail etiquette and Writing Skills, Features of Business Correspondence, Tips for writing Business E-mails, Do's and Don'ts of Business Communication, Examples and Exercises
2	**The Art of Effective Communication:** Communication skills: the importance of removing barriers, Source, Encoding, Channel, Decoding, Receiver, Feedback, Johari's Window, Public Speaking and Presentation tips, Body Language Tips, Listening skills, Common Grammatical mistakes in Written and spoken communication, Negotiation
3	**Time Management:** Importance of setting Tasks, Applying basic principles of Time management; identify productivity cycles, and set goals and priorities, Create a time management plan and a daily plan, Effectively utilize time by using technology and reducing time wastage. Manage interruptions, increase meeting productivity, overcome personal time wasters,

	and prevent personal work overloads, Screen and organize information to reduce information overload
4	**How to create a winning CV:** Designing an Impressive CV, Defining the objective, Customizing the CV for each job, Identifying and Highlighting the right set of strengths, Presentation of academic and professional achievements, Formatting Styles, Do's and Don'ts and common mistakes, Examples and Exercises
5	**How to prepare for Interview:** Introspection: Knowing yourself, your comfortable areas or subjects, Companies, sectors, functions, Employer Research, Skill set and competency mapping, Attire and Etiquette : Greetings, posture, handshakes, manners and actions, Common Interview blunders, Frequently asked questions for Freshers and Experienced professionals, Simulated Interview Situations, Do's and Don'ts before an Interview, Common formats of Company Interview assessments, What to speak?, Latest developments about the specific sector for last 5 years, Study of regulators for sectors.
6	**Preparing for Group discussion and aptitude test:** Structure and Format of a GD, Difference between a Discussion & an Argument, Observing, Reflecting and designing responses within a group, The art of being assertive and persuasive, Defending your turf, Defining the correct Body Language and posture, Deconstructing Topics, Common Do's and Don'ts, Practice and Exercise
7	**Fear Factor: Removing Stage Fear** Presentation Skills, Public Speaking skills, Importance of Eye Contact, Audience engagement, Forms of speech, Content Preparation, Debating, Extempore, Do's and Don'ts, Sample Exercises

SEMESTER II

Course Number	Course Name	Credits	Year of Introduction
201	Data Structures and Algorithms	3	2018-19

Course Objective :

- To make familiar with linear & non linear data structures
- To develop skills to analyze the problem given and to design & develop an efficient solution to given problem
- To develop capability to choose appropriate data structures for given problems
- To imbibe programming skills & thereby making industry ready

Syllabus Broad Units :

Expected Outcome : After undergoing this course, student will

1. Have thorough knowledge about data structures
2. Ability to design& develop program using linear data structures& non linear data structures for solving problems
3. Ability to choose appropriate data structures for problem solving
4. Ability to use combination of these data structures for problem solving.

References (Books, Websites etc) :

1. Behrouz A. Forouzan and Richard F. Gilberg , 2nd Edition, Thomson, 2003, **Computer Science A Structured Programming Approach Using C**
2. Basavraj S Anami, Shanmukhappa Angadi, Sunil Kumar S Manvi, PHI Publications, 2010. A Holistic approach to learning C.
3. Andrew Tenanbaum, Thomson, 2005, Data Structures with C.Robert Kruse & Bruce Leung, Data Structures & Program Design in C, Pearson Education,

Pre-requisites

Any programming language

Suggested MOOC :

Data structures and Algorithms, Prof. Sudarshan Iyengar, IITRopar, 8 weeks, Rerun Feb 05, 2018 https://onlinecourses.nptel.ac.in/noc16_cs06 at NEPTEL

Course Plan	
Unit	**Contents**
1	**Elementary Data Structures** - Basic concepts such as data object, array, and record; Operations and relations on data objects; definition of data structure; Built-in data types as examples of data structures; concept of abstract data type; notation to specify an abstract data type; concepts of pre-conditions and post-conditions; Implementation of an ADT in a language; Specification and implementation of simple data structures such as Integer, Rational, Currency, Date, Temperature, distance, Pay, Marks, Grade_card etc.
2	**Linear Data Structures** (Representation in Memory and operations like insertion, deletion and traversal) – one and multidimensional array, Sparse Matrics, Pointer arrays, single link list,

	circular link list, double link list, applications of Linked list,: Sparse Matrix Manipulation, Polynomial Representation, Dynamic storage Management
3	**Particular Linear Data Structures**(Representation in Memory and operations like insertion, deletion and traversal) **-** Stacks: Applications: Evaluation of Arithmetic Expression, implementation of recursion, factorial calculation, Quick Sort, Tower of Hanoi Problem, queues, circular queue, deques; Application of queues abstract data types; Array and linked list implementations of stacks, queues, and deques;
4	File Handling: Creation, reading writing in a file. Pattern Matching and Extraction of data from a file. Reading and writing from files.
5	**Hierarchical data structures** - General trees and related concepts; depth first and breadth first traversal of trees; n-ary trees and important properties of n-ary trees; binary trees and their properties; binary tree traversal algorithms. Applications of Trees. B Trees : B Tree indexing, Operations on a B Tree, SETS: Representation of Sets, Operations on Sets, Applications of Sets
6	**The problem of search** – linear and binary search algorithms and their efficiency; binary search trees and operations on binary search trees; Improving the efficiency of search through Balanced trees – AVL trees and Red-black trees, concepts of rotation. Hash tables and related concepts in detail.
7	**The problem of sorting** – The standard sort algorithms and their efficiencies; Merge sort and quick sort algorithms and their efficiencies. The binary heaps, their array implementation; Operations on heaps and heap sort algorithm.

Course Number	Course Name	Credits	Year of Introduction
202	Operating Systems	3	2018-19

Course Objective:

The overall aim of this course is to provide a general understanding of how a computer works. This includes aspects of the underlying hardware as well as the structure and key functions of the operating system. Case studies will be used to illustrate and reinforce fundamental concepts.

Syllabus Broad Units : 7

Expected Outcome :

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

- Explain the concepts of process, address space, and file
- Compare and contrast various CPU scheduling algorithms
- Understand the differences between segmented and paged memories, and be able to describe the advantages and disadvantages of each
- Compare and contrast polled, interrupt-driven and DMA-based access to I/O devices
- Understand functioning and working of Windows as well as Unix operating system.

References (Books, Websites etc) :

1. Operating systems design and implementation by Andrew Tanenbaum and Albert Woodhull
2. Operating systems concept and design by Milan Milenkovic

Suggested MOOC :

Please refer these websites for MOOCS:
www. edx.com
www.coursera.com
www.alison.com

Course Plan

Unit	Contents
1	**Unit 1: Introduction to Operating system:** Definition, Importance and functions of operating systems, Types: Batch, Timesharing, Multitasking, multiprogramming, multiprocessing, Online operating system, Real time, distributed operating systems. Various Views: Command language users view, system call users view. Operating system concept: Processes, Files, The shell. Structures: Monolithic system, layered system, Virtual Machine, Client server model. Case Study: Unix History, General Structure of Unix, The shell of Unix operating system, The shell of Unix operating system
2	**Processes:** Process concept, Implicit and explicit tasking, process relationship (cooperation and competitions). Operating systems view of processes OS services for process management. Scheduling and types of Schedulers, Scheduling algorithms: First come first served, shortest remaining time next, Time slice scheduling, Priority based preemptive scheduling, multiple

	level queues, multiple level queues with feedback, Guaranteed scheduling, Lottery scheduling. Performance Evolution. Case Study: Unix processes and scheduling
3	**Memory Management:** Basic Memory Management, monoprogramming without paging or swapping, multiprogramming with fixed partitions. Swapping: Memory Management with bit maps, and linked list. Virtual Memory, Page replacement algorithms: Optimal Page replacement algorithm, Not recently Page replacement algorithm, First in first out Page replacement algorithms, second chance Page replacement algorithms, clock Page replacement algorithms, least recently Page replacement algorithms, simulating LRU in software. Design issues for paging. Segmentation: Implementation of pure segmentation, segmentation with paging with example. Case study: Memory management in Unix.
4	**Interprocess communication and Synchronization:** Need, Mutual Exclusion, Semaphore definition, Busy- wait implementation, characteristics of Semaphore. Queuing implementation of semaphore, Producer consumer problem. Critical region and conditional critical region, what are monitors? Need of it, format of monitor with example. Messages: Basics, issues in message implementation, naming, copying, Synchronous vs asynchronous message exchange, message length, ICS with messages, interrupt signaling via messages. Case study: Unix case study
5	**Deadlocks:** Conditions to occurs the deadlock, Reusable and consumable resources, deadlock prevention, Deadlock Avoidance, resource request, resource release, detection and recovery, Case study: Unix case study
6	**File systems:** Files- naming, structure, types, access, attributes, operation. Directories- system, path and operations. Implementing file and directories, disk space management, file system reliability and performance. Environment, Security flaws, Security attacks, principles for Security, user authentication. Protection domains, access control lists, capabilities. Case Study: Unix file management and security
7	**Input/ output:** Principles of I/O hardware: I/O devices, device controller, DMA, Principles of I/O software : goals, interrupt handler, device drivers, Device independent I/O software. RAM Disk Hardware and software, DISK Hardware and software. Case Study: Input output management in Unix

Course Number	Course Name	Credits	Year of Introduction
203	Software Engineering	3	2018-19

Course Objective:
To introduce the current methodologies involved in the design and development of Software over its entire life cycle.

Expected Outcome :
At the end of this course, student should be able to:

- Understand life cycle models**,** Requirement elicitation techniques, understand the concept of Analysis and Design of software.
- Implement software engineering concepts in software development to develop quality software which can work on any real machine.

References (Books, Websites etc):

- SOFTWARE ENGINEERING A PRACTITIONERS APPROACH seventh edition BY Roger S. Pressman McGraw Hill International Edition.
- Software Engineering by Sommerville, Pearson Education, 7th edition
- Software Engineering by K.K. Aggarwal&Yogesh Singh, New Age International Publishers.

Course Plan

Unit	Contents
1.	**Introduction to Software Engineering** Software, software characteristics, Difference between software engineering and software programming, Members involved in software development. Need of Feasibility study, types of Feasibility study, Cost Benefit Analysis. General software development life cycle with all phases. Overview of software models (Waterfall, Prototyping, Spiral and Rapid Application Development model). Agile Software Development methodologies.
2.	**Requirement Engineering Concepts and Methods** What is Requirement Engineering, Types of requirements, Requirement elicitation techniques- Traditional methods and Modern methods, Verification and validation process. Principles of Requirement Specification, Software Requirement Specification document Outline Characteristics of good SRS: - correct, complete, unambiguous, consistent, modifiable, traceable, Understandable Case study on DFD and ERD mechanism.
3.	**Design Concept and Methods** Software Design and software Engineering. Software Design process and principles, Design concepts: Abstraction, Refinement, Modularity, Architecture, Control hierarchy, Structural partitioning, Data structure, Procedure and Data hiding Modular design: Functional independence, Cohesion and Coupling concepts Architectural design process: Transform flow and Transaction flow User Interface design: - Elements of good design, design issues, Features of modern GUI, Guidelines for interface design Procedural design: - Structured Programming, Program Design Language

	Report Design
4.	**Software Quality Assurance** Quality concept: (quality, quality control, quality assurance, cost of quality), SQA activities, SQA plan. Formal Technical review: Review meeting, review reporting and review guidelines Software Configuration Management: - What is configuration management, Baseline, Software Configuration items. SCM process- Identification of objects, Version control and Change control
5	**Software Testing and Testing Strategies** Software Testing Fundamentals:-Testing Objectives and Testing Principles. White Box Testing, Black Box Testing: - Graph Based Testing Methods, Equivalence Partitioning, Boundary Value Analysis. Testing Strategies for Conventional Software: - Unit Testing, Integration Testing (Top-down and Bottom-up Integration) Validation Testing: - Validation Test Criteria, Configuration Review, Alpha and Beta Testing System Testing: - Recovery Testing, Security Testing, Stress Testing, Performance Testing, Deployment Testing The Art of Debugging – The Debugging Process.
6	**Maintenance and Reengineering** Software maintenance: - Importance and types of maintenance, Concept of Re-engineering, Software reengineering process model Reverse engineering: - to understand process, data and user interfaces Restructuring: Code and Data restructuring Forward engineering: - for client server architecture and user interfaces
7	**Computer Aided Software Engineering** What is CASE? Importance of CASE tools Various Tools: - 1) Information engineering 2) Project planning tools 3) Risk analysis tools 4) Project management and testing tools 5) Tools for Quality assurance 6) Software Configuration Management 7) Analysis and design 8) Database management 9) Interface design and programming tools

Course Number	Course Name	Credits	Year of Introduction
204	Statistical Techniques	2	2018-19

Course Objective:

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.

Syllabus Broad Units :

Expected Outcome :

(i) To compute various measures of central tendency, dispersion, skewness and kurtosis.
(ii) To analyze data pertaining to attributes and to interpret the results.
(iii)Tto compute the correlation coefficient for bivariate data and interpret it.
(iv) To fit linear, quadratic and exponential curves to the bivariate data to investigate relation between two variables.
(v) To fit linear regression model to the bivariate data
(vi)They are able to construct predicate model.

Reference Books:

Fundamentals of Statistics , S.C.Gupta, Seventh Edition ,Himalaya Publishing House

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Introduction to Statistics**: Meaning of Statistics as a Science, Importance of Statistics Scope of Statistics, Statistical organizations in India and their functions: CSO, ISI, NSS, IIPS (Devnar,Mumbai), Bureau of Economics and statistics,Types of data: Primary data, Secondary data , Cross-sectional data, time series data, directional data, Classification: Raw data and its classification, ungrouped frequency distribution,, grouped frequency distribution, cumulative frequency distribution, and relative frequency distribution.
2	**Measures of Central Tendency** Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average. Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean. Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits, Quartiles, Deciles and Percentiles (for ungrouped and grouped data), Geometric Mean (G.M.): Definition, formula, merits and demerits. Harmonic Mean (H.M.): Definition. Formula, merits and demerits. mean Weighted Mean: weighted A.M.,

	G.M. and H.M. Measures of Dispersion :Concept of dispersion, characteristics of good measure of dispersion. Range, Quartile deviation Mean deviation: Definition, merits and demerits, Variance and standard deviation
3	**Moments, Skewness and Kurtosis** Raw moments (m'r) for ungrouped and grouped data. , Central moments (mr) for ungrouped and grouped data, Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution, Karl Pearson's coefficient of skewness, Measures of skewness based on moments ($\beta 1, \gamma 1$) Concepts of kurtosis, Measures of kurtosis based on moments ($\beta 2, \gamma 2$).
4	**Theory of Attributes** Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class- frequency, order of a class, positive class frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to three attributes), and dot operator to find the relation between frequencies, fundamental set of class frequencies. Consistency of data upto 2 attributes. Concepts of independence and association of two attributes. Yule's coefficient of association (Q),
5	**Correlation:** Bivariate data, Scatter diagram and interpretation., Concept of correlation between two variables, positive correlation, negative correlation, no correlation. variance between two variables , Karl Pearson's coefficient of correlation (r) , Spearman's rank correlation coefficient, compute Karl Pearson's correlation coefficient between ranks
6	**Regression:** Meaning of regression, difference between correlation and regression, Concept of error in regression, error modeled as a continuous random variable. Simple linear regression model Estimation of a, b by the method of least squares. Interpretation of parameters.
7	**Times Series** Introduction, Component of a time series, Analysis of time series, Mathematical models for time series, Measurement of Seasonal Variations, Measurement of Cyclical Variations ,Measurement of Irregular Variations.

Course Number	Course Name	Credits	Year of Introduction
205	Financial Accounting	2	2018-19

Course Objective :

1. To impart basic accounting knowledge
2. To enable the students to understand basic accounting principles, practice and its applications in modern business.

Prerequisite :

Students should know the basic principles of accounts and concepts .

Expected Outcome :

1) The knowledge of accounting and its principles at basic level.
2) Practical's in Tally and Excel for Financial Accounting assignments

References (Books, Websites etc) :

1. Anil Chowdhry , Fundamentals of Accounting & Financial Analysis (PearsonEducation)
2. M.E.Thukaram Rao, Accounting for Managers.(New Age International Publishers)
3. M.G.Patkar, Book-Keeping & Accountancy.Std XI(FYJC) Commerce
4. Dr. S. N. Maheshwari , Financial Accounting For Management: (Vikas Publishing House)
5. Robert Anthony, David Hawkins , Business Accounting. (Tata McGraw –Hill)

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Unit 1**: **Introduction:** Need for Accounting, Financial Accounting-definition, Scope and objectives. Accounting v/s Book Keeping. Limitations of Financial Accounting, End users of financial statements. Accounting Concepts and Conventions, Branches of accounting. Accounting Standard-Scope and Functions.
2	**Unit 2: Journal and Ledger:** Journal-importance and utility, classification of accounts, journalizing of transactions. Ledger- meaning and utility, posting and balancing of account, Trial Balance- meaning and purpose, preparation of a trial balance.
3	**Unit 3: Preparation final accounts:** Preparation of Trading and Profit & Loss Account and Balance Sheet of sole proprietary business.
4	**Unit 4: Depreciation:** Meaning, need & importance of depreciation, methods of charging depreciation.(WDV & SLM)

5	**Unit 5: Introduction to International Accounting Standards:** Need for International Financial Reporting Standards (IFRS), Disclosure of Accounting Policies, reporting needs of emerging economies, IFRS for Small and Medium Enterprises(SMEs).
6	**Unit 6: Computerized Accounting:** Computers and Financial application, Accounting Software packages. (Orientation level)
7	**Unit-7: Practical Applications** on Tally package for accounting and its Implementation . Accounting formulas in Excel and its implementation for practical assignments

Course Number	Course Name	Credits	Year of Introduction
206	Database Management Systems Lab	3	2018-19

Course Objective :

- The main objective is to teach the concepts related to database its techniques and Operations.
- SQL (Structured Query Language) is introduced in this subject.
- This helps to create strong foundation for application of database design.

Pre-requisites:

- Concept of Database Management Systems,
- Familiarity with data processing concepts and applications.

Expected Outcome :

At the end of this course, students should be able to:

- Understand the theoretical and physical aspect of a relational database.
- Implementation of RDBMS concepts through Oracle.
- Construct Simple and complex queries on sample datasets
- Writing PL/SQL blocks

References (Books, Websites etc.):1. Ivan Bayross SQL,PL/SQL The Programming Language of Oracle 3rd Revised Edition BPB Publications.

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

Course Plan

Unit	Contents
1	**Introduction to Oracle and SQL:** History, Features, Versions of Oracle, Database Structure: Logical Structure and Physical Structure, Oracle Architecture: System Global Area Processes: Server Processes, Background Processes, Tools of Oracle: SQL * Plus, PL/SQL, Forms, Reports, Pre Compilers: SQL Loader, Import, Export. **Introduction to SQL:** Keywords, Delimiters, Literals, Data Types, Components of SQL: **DDL Commands** – Defining a database in SQL, Creating table, changing table definition, removing table, Creating Tables with constraints on row level and column level, primary key, foreign key, check. Altering Constraints. **DML Commands**- Inserting, updating, deleting data, **DQL Commands**: Select Statement with all options. Renaming table, Describe Command, Distinct Clause, Sorting Data in a Table, Creating table from a table, Inserting data from other table, Table alias, and Column alias. **DCL commands**- Granting and Revoking Permissions

2	**Operators and Functions:** **Operators:** Arithmetic, Logical, Relational, Range Searching, Pattern Matching, IN & NOT IN Predicate, all, % any, exists, not exists clauses, Set Operations: Union, Union All, Minus, Intersect, Grouping data. **Functions:** Aggregate Functions, Numeric Functions, String Functions , Date Functions, Conversion Functions, Miscellaneous Sub queries
3	**Joins:** Relating data through join concept. Simple join, equi join, non equi join, Self join, Outer join
4	**Database Objects:** **Views:** Introduction, Creating a View, Selecting data from a view, Updateable views, Views on multiple tables, Destroying a View. **Sequences:** Introduction, Creating a Sequence, Altering a Sequence, Referencing a Sequence, Dropping a Sequence. **Index:** Introduction, Creating Index, Simple Index, Unique Index, Reverse Key Index, Dropping Index.
5	**Introduction To PL/SQL:** Introduction, Advantages, PL/SQL Block, PL/SQL Execution Environment, PL/SQL Character set, Literals, Data types, PL/SQL Block: Attributes %type, %rowtype,Variables, Constants, Displaying User Message on screen, Conditional Control in PL/SQL, Iterative Control Structure: While Loop, For Loop, Goto Statement, Commit, Rollback, Savepoint
6.	**Cursor Management and Triggers:** **Cursor**: Explicit & Implicit Cursor, Declaring Cursor Variables, Constrained & Unconstrained Cursor Variables, Opening Cursor, Fetching Cursor into Variables, Closing Cursor, Cursor For Loops, Parametric Cursors. **Triggers:** Definition, Syntax, Parts of triggers: statement, body, restricted, Types of triggers: Enabling & disabling triggers.
7	**Stored Procedures / Functions and Exception Handling:** Introduction, How oracle executes procedures/ functions, Advantages, How to create Procedures & Functions, Examples. **Error Handling in PL/SQL:** Exception Handling & Oracle Engine, Oracles Named Exception Handlers, User Named Exception Handlers.

Course Number	Course Name	Credits	Year of Introduction
207	Data Structures Lab	1	2018-19

Course Objective :

This is companion course of Data Structures and Algorithm

Syllabus Broad Units:

This Companion course of Data Structure and algorithm. Algorithms to use different data structures are covered in theory. Students will implement C Programs for these data structures.

Expected Outcome :

The students will develop adequate programming skills with respect to following

1. Implement a real world problem using appropriate data structure.
2. Implement data structures like array, stack, queue, linklist and applications of these data structures.
3. Use files for reading, writing and manipulation.
4. Make use of appropriate searching and sorting techniques appropriately.

References (Books, Websites etc) :

1. Data Structures using C - Y.Kanetkar, BPB Publications4. YashawantKanetkar, BPB Publication
2. Behrouz A. Forouzan and Richard F. Gilberg , 2nd Edition, Thomson, 2003, Computer Science A Structured Programming Approach Using C
3. Basavraj S Anami, Shanmukhappa Angadi, Sunil Kumar S Manvi, PHI Publications, 2010. A Holistic approach to learning C.
4. Andrew Tenanbaum, Thomson, 2005, Data Structures with C.Robert Kruse & Bruce Leung, Data Structures & Program Design in C, Pearson Education,

Suggested MOOC :

Please refer these websites for MOOCS:
NPTEL / Swayam
www. edx.com
www.coursera.com

DS Lab Outline

Sr. No	Programming Exercises
1	Specification and implementation of simple data structures such as Integer, Rational, Currency, Date, Temperature, distance, Pay, Marks, Grade_card etc. Use Linux environment to execute C Programme. Note :***Algorithm of every program should be written. Properly document the programs***

	using comments. Author name and date, purpose of each variable and constructs like loop and functions should be indicated/ documented. ***gcc or an equivalent compiler is assumed***.
2	Program to demonstrate the following: - insertion, deletion and traversal in one and multidimensional array, single link list, circular link list, double link list, Addition of Polynomial using array/ link list
3	insertion, deletion and traversal in Stacks, queues, circular queue, deques, : Programs to demonstrate: - Evaluation of Arithmetic Expression, - implementation of recursion like factorial calculation, Quick Sort, Tower of Hanoi Problem - linked list implementations of stacks, queues, and deques;
4	Programs to demonstrate: - Creation, reading writing in a file. - Pattern Matching and Extraction of data from a file. - Reading and writing from files.
5	Programs to demonstrate: - binary tree traversal - depth first and breadth first traversal of trees
6	Programs to demonstrate: - linear and binary search algorithms and their efficiency; - The standard sort algorithms (bubble,selection,insertion) and their efficiencies; - Merge sort and quick sort algorithms and their efficiencies.

SEMESTER III

Course Number	Course Name	Credits	Year of Introduction
301	Artificial Intelligence	3 Credits	2018

Course Objective :

Students After completion of the course will get the knowledge of area like machine learning, robotics, natural language processing, and multi-agent systems.

Students should be able to:

- Representation an AI problem or domain model, and construct domain models in that representation
- Choose the appropriate algorithm for reasoning within an AI problem domain
- Implement and debug core AI algorithms in a clean and structured manner
- Design and analyze the performance of an AI system or component
- Describe AI algorithms and representations and explain their performance, in writing and orally

Expected Outcome :

At the end of the course a student should be able:

- Understand various search methods
- Use various knowledge representation methods.
- Understand various Game Playing techniques
- Use Prolog Programming language using predicate logic

References (Books, Websites etc) :

- "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata McGraw-Hill
- Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI
- Introduction to Prolog Programming By Carl Townsend.
- "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley)
- "Programming with PROLOG" –By Klocksin and Mellish.

Suggested MOOC:

Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus:

Unit	Contents
1	**Introduction:** What is AI? ,The AI Problems, Background/history, What Is An AI Techniques, The Level Of The Model, Criteria For Success, Some General References, High-level overview of field, State of the art.
2	**Introduction and historical perspective, Hard and Soft AI –** disciplines and applications, Theories of Intelligence, Detecting and Measuring Intelligence, Knowledge based approach, the prepare- deliberate engineering trade-off, Procedural v/s Declarative knowledge, Criticism of symbolic AI, Knowledge representation, desirable properties of KR schemata, Use of predicate calculus in AI.

	Problems, State Space Search & Heuristic SearchTechniques:Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate – And-Test, Hill Climbing, Best-First Search, ProblemReduction, ConstraintSatisfaction, Means-Ends Analysis.
3	**Knowledge Representation Issues:** Representations And Mappings, Approaches To Knowledge Representation.Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning
4	**Symbolic Reasoning under Uncertainty:** Introduction To Non-monotonic Reasoning, Logics For Non monotonic Reasoning.Statistical Reasoning: Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dumpster-Shafer Theory, Fuzzy Logic.Weak Slot – and-Filler Structure. Semantic Nets, Frames. Strong Slot and Filler Structures : Conceptual Dependency, Scripts, CYC
5	**Game Playing:** Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques.Understanding: What is understanding? , What makes it hard?, As constraint satisfaction
6	**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, DiscourseAnd Pragmatic Processing, Spell Checking. Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI AndSymbolic AI.
7	**Introduction to Prolog :** Introduction To Prolog: Syntax and Numeric Function, Basic List Manipulation Functions In Prolog, Functions, Predicates and Conditional, Input, Output and LocalVariables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, LISP and Other AI Programming Languages

Course Number	Course Name	Credits	Year of Introduction
302	Computer Networks	3 Credits	2018

Course Objective:

The key objective is to acquire a foundational understanding of computer network and communication technologies. Networking concepts will be illustrated using TCP/IP networks.

Expected Outcome :

At the end of the course a student should be able:

- Students will acquire a good knowledge of the computer network, its architecture and operation.
- Student will be able to pursue his study in advanced networking courses (This knowledge will help them to create base for the Network Electives to be studied in the next semesters).
- Students will be able to follow trends of computer networks. So, students will get exposer to advanced network technologies like MANET, WSN, and 7G, IoT.

References (Books, Websites etc) :

Text Books:

- A.S. Tanenbaum, **Computer Networks** (4th ed.), Prentice-Hall of India, Latest Edition
- W.Behrouz Forouzan and S.C. Fegan, **Data Communication and Networking,** McGraw Hill, Latest Edition

Reference Books:

- Network Essential Notes GSW MCSE Study Notes
- Internetworking Technology Handbook CISCO System
- Introduction to Networking and Data Communications Eugene Blanchard
- Computer Networks and Internets with Internet Applications Douglas E. Comer

Suggested MOOC :

NPTEL: http://www.nptel.ac.in/courses/106106091/

Syllabus:

Unit	Contents
1	**Introduction to Computer Network:** What is Computer Network? Network Goals and Motivations, Application of Networks, Network Topologies, Classification of Networks, Network software: Network Protocols, Protocol Hierarchies, Design issues for the Layers, Connection Oriented and Connectionless Services, Service Primitives, Relation of services to Protocols, Network Models: The OSI Reference Model, The TCP/IP Reference Model
2	**Basics of Data Transmission / Physical Layer:** Analog and Digital Signals, Data Rate, Transmission Impairment, Signal Measurement: Throughput, Propagation Speed and Time, Wavelength, Frequency, Bandwidth, Spectrum Transmission Media& its Characteristics: Guided and Unguided Media, Synchronous and Asynchronous Transmission, Multiplexing: FDM, WDM, TDM, Switching: Circuit, Message and Packet Switching, Mobile Telephone Systems: 1G to 7G

3	**Network Layer: Network Layer Design Issues; Routing Algorithms:** Static/ Dynamic , Direct/ Indirect, Shortest Path Routing, Flooding, Distance Vector Routing , Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, **Congestion Control Algorithms:** General Principal of Congestion Control, congestion prevention polices, Load shedding, Jitter Control,
4	**IP Addressing:** IP-Protocol, IP-Address Classes (A, B, C, D, E), Broadcast address, Multicast address, Network Mask, Subnetting, Internet control Protocol-ICMP, IGMP, Mobile-IP, IPv6-packet format, addressing scheme, security, applications and limitations of IPv6. IPv4 Vs IPv6
5	**Domain Network Services (DNS) :** Domain Names, Authoritative Hosts, Delegating Authority, Resource Records, SOA records, DNS protocol, DHCP & Scope Resolution
6	**Transport and Application Support Protocols:** Transport Protocols: TCP/UDP, Remote Procedure Calls, RTP, Application Layer: Hyper Text Transfer Protocol (HTTP) HTTP request, Request Headers, Responses, MIME–Multipurpose Internet Mail Extensions, SMTP–Simple Mail Transfer Protocol, POP – Post Office Protocol, IMAP – Internet Message Access Protocol, FTP – File Transfer Protocol, Telnet – Remote Communication Protocol
7	**Advance Networks:** Concept of 7G Networks, Introduction of 802.16, 802.20, Bluetooth, Infrared, MANET, Sensor Networks. Technical Issues of Advanced Networks, Mobile Ad-hoc Networks: Introductory concepts, Destination-Sequenced Distance Vector protocol, Ad Hoc On-Demand Distance Vector protocol, Wireless Sensor Networks: Sensor networks overview: Introduction, applications, design issues, requirements. Introduction to IOT

Course Number	Course Name	Credits	Year of Introduction
303	Object Oriented Analysis And Design	3 Credits	2018

Course Objective :

The course aims at developing skills to analyze and design a software system using Object Oriented Analysis and Design (OOAD) and UML. And use these skills in Unified Process (UP) environment.

Expected Outcome : At the end of the course a student should be able:

- Understand and describe the Object Oriented concepts
- Describe Object Oriented Analysis and Design(OOAD) concepts and apply them to solve problems
- Prepare Object Oriented Analysis and Design documents for a given problem using Unified Modeling Language
- Describe the activity carried out in each and every phase of Rational Unified Process(RUP)

References (Books, Websites etc) :

- Martin Fowler (2003), UML Distilled, 3rd Edition, Pearson Education.
- Applying UML and Patterns
- Roger Pressman(2009), Software Engineering: A Practitioner's Approach, Roger Pressman, ; 7th edition, McGraw-Hill
- Brett D. McLaughlin (2006), Head First Object-Oriented Analysis and Design , 1 edition, O'Reilly

Suggested MOOC :

Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus:

Unit	Contents
1	**Introduction To Object Orientation:** **Overview:** Review of SDLC, waterfall, spiral, iterative and incremental models, Iterative development and Rational Unified Process(RUP), **Object Orientation :** Introduction to Object Orientation, Principles of Object, Orientation: Abstraction, Encapsulation, Modularity, hierarchy, OO Concepts, Object Oriented Analysis (OOA) and Object Oriented Design(OOD) **Concept of Modeling:** Importance of Modeling, principles of Modeling, object oriented Modeling, object Modeling techniques.
2	**Introduction To UML:** Basics of UML: What is UML? History of UML, Goals of UML, Building Blocks of UML: Elements- structural, behavioral, grouping, annotation, relationships- links, dependency, association, aggregation, generalization, realization, Use Case modeling, conceptual modeling, behavioral modeling.

3	**Use Case Model (Requirement Modeling):** Understanding requirements, requirements types, goal and scope of use cases, levels of use cases, identifying use cases, identifying actors, naming use cases, elementary business processes, actors and actor types , Use Case Diagrams, examples, Use case relationships (include, extend and generalize); Concrete, Abstract, Base, and Addition Use Cases
4	**Activity Diagram:** Decomposing an action, partitions, signals, tokens, flow and edges, pins and transformations, expansion regions, flow final, join specification decision, fork, join, swimlanes.
5	**Domain Modeling:** Introduction to Domain Models, Domain modeling guidelines, conceptual class identification , strategies to identify conceptual classes, Adding Associations: Introduction to association, Finding and adding association, Common Associations List, Association Guidelines, Association Roles, Naming Associations, finding attribute and its types, UML Attribute Notation, attributes and foreign Keys, Multiplicity **Class Diagram :** Design Class Diagrams(DCD):When to create Class Diagrams, how to Design Class Diagrams, identify classes, class notations, stereotypes for classes, attribute and operation scope, types of classes, class relations, multiplicities, roles, class diagrams.
6	**System Sequence Diagram :** moving from inception to elaboration, system behavior, introduction to system sequence diagrams, Example of system sequence diagrams, Inter- System Sequence Diagram, system sequence diagrams and Use Cases, System Events and the System Boundary, Example of System Sequence Diagrams. **State Chart Diagram:** Modeling behavior in state chart diagram, events, states, and transitions in state chart Diagrams.
7	Illustration of Collaboration diagram, component diagram, Deployment diagram with suitable examples.

Course Number	Course Name	Credits	Year of Introduction
304	Probability and Graph Theory	2 Credits	2018

Course Objective:

- Learn and become comfortable with a body of results and definitions,
- Practice creative problem solving and improve skills in this area,
- Practice and improve writing skills.
- Understand some applications of graph theory to practical problems and other branches of mathematics.
- Learn about how graph theory developed via a creative organic historical process.
- See that the simplicity of graph theory (a) makes them ubiquitous, and (b) makes it easier to be creative in these fields then in others.

Expected Outcome : At the end of the course a student should be able:

- To perform Simple random experiment.
- Analysis the data from Simulation experiments using appropriate Statistical Methods.
- Aware of some important applications of probability and statistics in the analysis of information systems.

Text/Reference Books:

- Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
- S.C.Gupta ," Fundamentals of Statistics seven Revised Editions"
- Desgin and Analysis of Algorithms, Prentice –Hall of India private Limited New Delhi -2008
- Discrete Mathematics Schaum's outlines
- Discrete Mathematics and its Applications VII Edition Kenneth Rosen
- Discrete Mathematics N Ch SN Iyengar
- Narsing Deo- Graph Theory with Applications to Computer Science and Engineering ; Prentice Hall, India
- Ron Clark and Derek Holton- Graph Theory, Narosa

Suggested MOOC :

NPTEL: http://www.nptel.ac.in/courses/106106091/

Syllabus:

Course Plan	
Unit	**Contents**
1	**Theory of Probability:** Introduction, Permutation and Combination concept, types of probability, Mutually Exclusive and Mutually Exhaustive concept ,Independent event, Conditional probability ,Addition theorem of Probability, Multiplication Theorem, Bayes's Theorem.
2	**Random Variable ,Probability distribution and Mathematical Expectation:** Random Variable, probability distribution of a Discrete Random variable, Probability distribution of a continuous random variable, Distribution function or cumulative probability function moments, Mathematical Expectation, Theorem on Expectation.

3	**Theoretical Distributions:** Introduction, Binomial Distribution, probability functions of Binomial distribution, constant of Binomial distribution, mode of binomial distribution, Fitting of Binomial distribution. Poisson distribution, utilities or Importance, constant of Poisson distributions, mode, fitting of Poisson's distribution. Normal distribution, equation, curve, properties, importance, relation between binomial and normal distribution, relation between Poisson and Normal distribution.
4	**Sampling Theory :** Introduction, Population, Sampling, principles, Limitations, Types of Sampling, Simple random Sampling, Stratified random Sampling System sampling, Cluster sampling, Multistage sampling, Quota sampling.
5	**Testing of Hypothesis:** Introduction, Student's t distribution, properties, critical values of t, application of t – distribution, Fisher's transformation, critical values of F – distribution, Applications of F-distribution, chi square test.
6	**Basic Concept of Graph:** Introduction, Graphs and Multi graphs, sub graphs, Isomorphic Graphs, Homomorphism Graphs, Paths, Connectivity ,labeled Graphs, Weighted Graphs ,Complete graphs, Planer Graphs, Introduction, Directed Graphs, Rooted Trees, Represented of Directed Graphs, Incidence and Adjacency Matrices, Eulerian and Hamiltonian Graphs, Tree Traversing, Prims Algorithm ,Hufmann Algorithm
7	**Graph Applications and Algorithm:** Bridges of Konigsberge, Travelling Salesmen Problem, Seating Arrangement problem ,Crossing of river problem, Sheep cabbage problem, Utilities problem Shortest Algorithms: Warshall's Algorithm, Dijkstra's Algorithm, Travelling Salesman problem, Depth First search, Breadth First Search

Course Number	Course Name	Credits	Year of Introduction
305	Organizational Behavior	2 Credits	2018

Course Objective :

To understand the dynamics of individual and group behaviour in organisational setting to achieve optimum utilization of human resources.

Expected Outcome:

At the end of the course, a learner should be able to

- To understand the implications of different models of Organizational Behavior
- To learn the effect of attitudes, values, group dynamics in organization
- To utilize motivation and leadership theories for delivering best results for organization.

References (Books, Websites etc) :

- Stephen Robbins, Organizational Behaviour
- Ashwathappa, Organizational Behaviour
- Uma Sekaran, Organizational Behaviour
- Ricky W. Griffin, Gregory Moorhead, OB, Cengage Publication

Syllabus:

Unit	Contents
1	**Introduction to OB:** Definition, importance & scope of Organization Behaviour, Multi-disciplinary approach to OB, Models of OB-Autocratic, Custodial, Supportive, Collegial, SOBC, Recent developments and challenges in OB
2	**Individual Behaviour in Organizations:** Attitude - Definition, Components, Sources, Job satisfaction, Perception – Definition, Process, Implications for Management, Perceptual Errors, Values – Definition and meaning, Types of value, Personality – Determinants, Traits theory, BIG FIVE, MBTI
3	**Foundation of Group Behaviour:** Group- Definition, Stages of Group Development, Classification of Groups, Advantages of Group Decision Making, Team – Difference between Group and Team, Creating Effective Team
4	**Conflict and Stress Management:** Conflict – Definition, Conflict Process, Types – Constructive and Destructive Conflicts, Levels of Conflicts and conflict Management, Stress – Definition, Causes or Sources of stress, Symptoms of stress, Management of Stress, Quality of Work-Life
5	**Motivation:** Motivation – Definition, Process, Theories – Maslow Hierarchy Theory of Needs, Herzberg's Two Factor Theory, Equity Theory, Vroom's Expectancy Theory
6	**Leadership:** Leadership- Definition, Traits of good leader, Difference between Leader & Manger, Types of Leadership Style, Likert's 4-M management styles, Managerial Grid and its application
7	**Organization Change Management:** Need for Change, Reasons for Resistance of Change, Building Support for Change, Role of Change Agent, Process of Change Implementation, Learning organization – characteristics, Creating Learning Organization

Course Number	Course Name	Credits	Year of Introduction
306	Object Oriented Programming	3 Credits	2018

Course Objectives :

- To understand the concepts of object-oriented programming paradigms and develop skills in these paradigms using Java.
- To provide an overview of characteristics of Java and make them familiarize to use JDK and Java API for concurrent programming, input/output, Java Collections

Syllabus Outline:

Introduction to Object Oriented concepts - Java Basics - Arrays and Strings -Inheritance – Polymorphism – Interface – Packages - Exception Handling –Multithreaded Programming – Streams and collections

Expected Outcome :

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

- Design interfaces, abstract and concrete classes needed, given a problem specification
- Implement classes designed using object oriented programming language
- Learn how to test, verify, and debug object-oriented programs and create programs using
- Make them comfort to muse Java API for Input/output and Java Collections and utility classes
- Able to achieve object persistence using object serialization and write modules to take advantages of concurrent programming

References (Books, Websites etc) :

- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Osborne Media; Seventh Edition, 2007
- Cay S. Horstmann and Gary Cornell ,Core Java-Volume-I, Sun Core Series, Eighth Edition, 2008
- Bruce Eckel , Thinking In Java – Printice Hall, Fourth Edition

Suggested MOOC :

Please refer these websites for MOOCs:
NPTEL/Swayam
www.edx.com
www.coursera.com

Syllabus/Course Outline

Unit	Contents
1	**Introduction to Java:** Introduction: Need for OOP paradigm, Procedural approach vs. Object-Oriented approach. Object Oriented concepts Java Basics: Features of Java, History of Java, Java features, data types, variables, operators, expressions, control statements, type conversion and casting, Java compiler, JVM,

	Garbage collection, Data types, concept of class and object, java naming conventions wrapper classes, control structures in java,
2	**Class and Object Concepts:** Defining a class, creating objects from class, adding attributes and methods to the class, using constructors, Passing values to the functions – pass by value, pass by reference, Function overloading. Modifiers – public, private, protected, default, static, final
3	**Arrays and Strings:** One dimensional arrays, Multidimensional arrays, exploring String class and methods, String Buffer class. Packages - creating and accessing a package, importing, packages, creating user defined packages, Concept of package, Introduction to Exception Handling.
4	**Inheritance and Polymorphism:** Concept and importance of inheritance, is-a relationship, types of inheritance, Polymorphism – function overriding, dynamic method dispatch. Throws keyword and method overriding. Using abstract and final keywords with class declaration, Concept of interface, Compression of Interface and class. Access modifiers and data accessibility in derived classes, method access modifier and method overriding.
5	**Concurrent Programming** Concept of threads, lifecycle of threads, creating threads, Thread class, Runnable interface, Thread synchronization, inter thread communication – wait(), notify(), notifyAll() methods
6	**Java Input/Output** Concept of streams, types of streams – byte streams, character streams, The Console: System.out, System.in, and System.err InputStream class, OutputStream class, File class, FileInputStreams, FileOutputStream, Reader class, Writer class, FileReader, FileWriter. Buffered streams – BufferedInputStream, BufferedOutputStream, BufferedReader, BufferedWriter. Object Streams, issue of 'Serialization'
7	**Java Collections and Utility Classes** Collection Basics- A Collection Hierarchy, Using ArrayList and Vector, LinkedList, Using a Iterator, Set: HashSet, LinkedHashSet, TreeSet , Comparable and Comparator interfaces, Map, Hashmap, HashTable, TreeMap, LinkedHashMap Generics – Basics, class parameters, bounded types, erasures.

Course Number	Course Name	Credits	Year of Introduction
307	Object Oriented Programming Lab	1 Credit	2018

Course Objective :

This is companion course of Object Oriented Programming

Syllabus Broad Units:

This Companion course of OO programming, Practical aspects of OOP towards problem solving is covered.

Expected Outcome :

The students will develop adequate programming skills with respect to following

- Write simple programs to use basic programming language constructs
- Design interfaces, abstract and concrete classes needed, given a problem specification
- Implement classes designed using object oriented programming language
- Learn how to test, verify, and debug object-oriented programs and create programs using
- Make them comfort to muse Java API for Input/output and Java Collections and utility classes
- Able to achieve object persistence using object serialization and write modules to take advantages of concurrent programming

References (Books, Websites etc) :

- Herbert Schildt, Java: The Complete Reference, McGraw-Hill Osborne Media; Seventh Edition, 2007
- Cay S. Horstmann and Gary Cornell ,Core Java-Volume-I, Sun Core Series, Eighth Edition, 2008
- Bruce Eckel , Thinking In Java – Printice Hall, Fourth Edition

OOP Lab Outline

Sr. No	Programming Exercises
1	**Writing, compiling and Executing Java programs using basic language constructs as bellow :** - Using Operators : arithmetic, relational, logical and bitwise - Control structures (if, if-else, switch) - Iterative statements (while, do-while, for)
2	**Programming with Classes :** Wring a class, creating objects and using it Using constructors to initialize object Programs to demonstrate parameter passing Making use of access modifiers

3	**Working with Arrays and Strings:** – Programs to work with single dimensional and multidimensional arrays – Searching and sorting – Programming with string and operations on it – Programs to understand and study string literal pool
4	**Inheritance and Polymorphism:** – Defining classes as generic types ; using it to write new class/classes – Need and example of method overriding – Writing abstract class and interface – Using abstract classes to write concrete classes – Using interface as base type to write new interface and implementing it to write new concrete class/classes – Anonymous and inner classes
5	**Concurrent Programming :** – Designing and using Thread class and Runnable interface – Thread synchronization – Program to demonstrate Thread priorities, thread join and making use of yield – Programs with classes making use of thread and inter communication between them.
6	**Java Input/Output :** – Programs to make using InputStream and OutStream classes. – Reading and Writing data into files – Making use to console to read data. – Using readers and writers to write data into Files – Making use of Buffered Streams and reader and writer – Programs to take advantages of serialization
7	**Java Collections and Utility Classes:** – Programs to make use collections (ArrayList, Vector, Set and Maps) – Writing user defined data generic types – Programs to illustrate bounded types and erasures

SEMESTER IV

Course Number	Course Name	Credits	Year of Introduction
401	Data Warehousing and Data Mining	3 Credits	2018

Course Objective:
This course will enable to expose the students to Study various design and implementation issues and techniques in data warehousing and data mining including, Basic concepts on knowledge discovery in databases process and tasks, Concepts, model development, schema design for a data warehouse, Data extraction, transformation, loading techniques for data warehousing, Concept description: input characterization and output analysis for data mining, Core data mining algorithms, implementation and applications, Data mining tools and validation techniques.

Pre-requisites:
Thorough understanding of: Relational database normalization techniques , Physical design of a database, Concepts of algorithm design and analysis, Basic understanding of: Software engineering principles and techniques, Probability and statistics – Bayesian theory, regression, hypothesis testing

Expected Outcome : After going through this course a student should be able to understand :

- The Fundamentals concepts of Data warehouse and Data Mining
- Differences between a data warehouses OLAP and operational databases OLTP
- Multidimensional data model design and development
- Techniques for data extraction, transformation, and loading
- Learning schemes in data mining
- Mining association rules (Apriori)
- Classification and prediction (Statistical based: Naïve Bayes, regression trees and model trees; Distance based: KNN, Decision tree based: 1R, ID3, CART; Covering algorithm: Prism)
- Cluster analysis (Hierarchical algorithms: single link, average link, and complete link; Partitional algorithms: MST, K-means; Probability based algorithm: EM)
- Use of data mining tools: C5, Cubist, Weka

References (Books, Websites etc.):

- Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-
- Centric Systems and Applications)", Springer; 2nd Edition 2009
- 2.. Alex Berson, Stephen J. Smith, Data Warehousing, Data Mining and OLAP,McGrawHill, 2004
- D. Hand, H. Mannila, and P. Smyth, Principles of Data Mining, MIT Press, 2011
- Jiawei Han, MichelineKamber, Data Mining: Concepts and Techniques, Harcourt India Pvt., 2011.

Suggested MOOC :
Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus	
Unit	**Contents**
1	**Data Warehousing:** Introduction, Definition, data transformation, ETL (Extract, Transform, Load) processes, OLAP operations, Differences between Operational Database Systems and Data Warehouses; Difference between OLTP & OLAP, Overview of Multi-dimensional Data Model, and the basic differentiation between "Fact" and "Dimension"; Multi-dimensional Cube, Concept Hierarchies of "Dimensions" Parameters: Examples and the advantages, Star, Snowflakes, and Fact Constellations Schemas for Multi-dimensional Databases, Measures: Their Categorization and Computation, Pre-computation of Cubes, Constraint on Storage Space, Possible Solutions, OLAP Operations in Multi-dimensional Data Model: Roll-up, Drill-down, Slice & Dice, Pivot (Rotate), Indexing OLAP Data; Efficient Processing of OLAP Queries, Type of OLAP Servers: ROLAP versus MOLAP versus HOLAP.
2	**Data Warehouse Architecture:** Steps for Design & Construction of A Data Warehouse, A 3-Tier Data Warehouse Architecture, Data warehouse implementation **Data Pre-processing overview:** The need for Pre-processing, Data Cleaning: Missing Values, Noisy Data, Data Cleaning as a Process, Data Integration & Transformation, Data Cube Aggregation; Attribute Subset Selection, Dimensionality Reduction: Basic Concepts only, Numerosity Reduction: Regression & Log-linear Models, Histograms, Clustering, Sampling, Data Discretization & Concept Hierarchy Generation, For Numerical Data, For Categorical Data
3	**Introduction Data Mining** : Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.
4	**Mining Association Rules :** Basic Concepts, Market Basket Analysis, Mining Multi-Level and single , Association Rules From Transaction Mining Multi-Dimensional Association Rules From Relational Databases & Data Warehouses, From Association Mining To Correlation Analysis, Constraint Based Association Mining, Association Rules: Apriori Algorithm, Partition, Pincer search, Incremental, Border, FP-tree growth algorithms, Generalized association rule.
5	**Classification & Prediction:** Introduction to Classification and Prediction; Basics of Supervised & Unsupervised Learning; Preparing the Data for Classification and Prediction; Comparing Classification and Prediction Methods, Classification by Decision Tree Induction, Attribute Selection Measures; Tree Pruning; α –β pruning Scalability and Decision Tree Induction, Rule-based Classification: Using IF-THEN Rules for Classification; Rule Extraction from a Decision Trees; Rule Induction Using a Sequential Covering Algorithm, Bayesian Classification: Bayes' Theorem, Naïve Bayesian Classification; Bayesian Belief Networks.

6	**Cluster Analysis:** Introduction to Cluster Analysis; Types of Data in Cluster Analysis; A Categorization of major. Unsupervised Learning - K-means Clustering -Hierarchical Clustering –Partially Supervised Learning. **Applications of Cluster Analysis-**Clustering analysis in market research, pattern recognition, data analysis, and image processing. **Requirements of Clustering in Data Mining:** Scalability, Ability to deal with different kinds of attributes, Discovery of clusters with attribute shape, High dimensionality, Ability to deal with noisy data, Interpretability. **Clustering Methods:** Classification of clustering methods-Partitioning Method, Hierarchical Method, Density-based Method, Grid-Based Method, Model-Based Method, Constraint-based Method
7	**Web Structure Mining:** Web Link Mining – Hyperlink based Ranking – Introduction -Social Networks Analysis- Co-Citation and Bibliographic Coupling - Page Rank -Authorities and Hubs -Link-Based**,** Similarity Search -Enhanced Techniques for Page Ranking - Community Discovery – Web Crawling -A Basic Crawler Algorithm- Implementation Issues- Universal Crawlers- Focused Crawlers- Topical Crawlers Evaluation- Crawler Ethics and Conflicts - New Developments **Web Usage Mining:** Web Usage Mining – sources of data- Applications -Click stream Analysis -Web Server Log Files - Data Collection and Pre-Processing- Cleaning and Filtering- Data Modeling for Web Usage Mining – Issues- Discovery and Analysis of Web Usage Patterns – Used tools in Web Usage mining.

Course Number	Course Name	Credits	Year of Introduction
402	Information Security	3 Credits	2018

Course Objectives :-

To Create awareness about important issue of Information Security, understand the concept of Information Security in Business Organizations, security measures and procedures at different levels within your IT environment. Procedure to manage the security issues in systematic and scientific way.

Expected Out Come :

- The expected outcome of this course is to understand security policy, Information security management at all functional levels of organization. The basic background of Security and its implementation is required to undertake this course.

- The course will provide the student with an understanding of the principles *of information security for IT Industry and management of important resources of the organization. Students will come to know i*nterrelationship between the various elements of *information security* and its role in protecting organizations information at all level.

Reference Book(s) :

- Information Security Management Handbook, Sixth Edition, Volume 5-2012 Amazon Books Edited by - Micki Krause Nozaki, Harold F. Tipton.
- Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives Nina Godbole and Sunit Belpure, Publication Wiley.
- Information Security: Principles and Practice 1st , Kindle Edition -2005 Amazon Books Author - Mark Stamp
- "Cryptography and information Security" V.K. Pachghare, PHI Learning Private Limited, Delhi India.
- Analyzing Computer Security by Charles P. Pfleeger, Shari Lawerance Pfleeger, Pearson Education India,
- Practical Information Security Management: A Complete Guide to Planning and Implementation-Dec-2016 Amazon Books . Tony Campbell
- Managing Risk and Information Security :- Protect to Enable A-Press Open Access Book (Free) at http://www.freetechbooks.com/managing-risk-and-information-security-protect-to-enable-t1150.html

Suggested MOOC :

Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Unit	Contents
1	**Introduction and Background**: Information, Information Characteristics, sources of Information, Types of Information, and Generating Information in Organizations. Business Application of Information and Information System, What is Information security? Need for Information Security , Types of Organization , Functions of Business organization , Levels of Organization , How Organizations manage the information , flow of information , IT Policy for Information protecting.
2	**Basics of Networking for Security Purpose –** Network Installations , Types of Networks and their security issues , Types of Network of OS. Functions of Information security officer. Different measures to safe guard the important information in the organization . Network policy for protecting important resources of the Network. Basic concept of MIS and Organization flow of Information.
3	**Importance of Information Security** - Improvement in corporate reputation based on the height of the level of information security, threat to business continuity due to accidents related to information systems, cyber space, information assets, threats, vulnerabilities. Information Security Measures. **Threats** :- Ty p e s of threats: physical threats (accident, disaster, fault, destruction, theft, unauthorized intrusion, etc.), technical threats (unauthorized access, eave S dropping , spoofing, alteration, error, cracking, etc.), man-made threats (operational error, loss, damage, peep, unauthorized use, social engineering, etc.), cyber-attack, information leakage, intent, negligence, mistake, fraudulent behavior, sabotage, DoS attack, rumor, flaming, SPAM e-mail, file sharing software [Malware / malicious programs] computer virus, macro virus, worm, bot (botnet, remote operated virus), Trojan horse, spyware, ransom ware, key logger, root kit, backdoor, fake anti-virus software
4	**Information security technology (cryptography)-CRYPTREC** ciphers list, cryptography (encryption key), decryption (decryption key), decoding, symmetric cryptography (common key), public key cryptography (public key, private key)), AES (Advanced Encryption Standard), S/MIME (Secure MIME), PGP (Pretty Good Privacy), hybrid encryption, hash function (SHA-256, etc.), key management, disk encryption, file encryption, compromise. digital signature (signature key, verification key), timestamp (time authentication), message authentication, MAC (Message Authentication Code), challenge-response authentication.
5	**Information security Management:** management of information based on the information security policy, information, information assets, physical assets, software assets, human assets (people, and their qualifications, skills, and experience), intangible assets, service, risk management (JIS Q 31000), monitoring, information security events, information security incidents. **Risk analysis and evaluation (Information asset review / Classification)** information assets review, classification and management by importance of information assets, information assets ledger Risk analysis and evaluation (Risk type)loss of property, loss of responsibility, loss of net earnings, human cost, operational risk, supply chain risk, risk involved in usage of external service, risk involved in distribution of information by SNS, moral hazard, estimated annual loss, scoring method, cost factor .

6	**Information security regulations:** (Company regulations including information security policy)organizational operation according to the information security policy, information security policy, information security purpose, information security measures criteria, information management regulations, security control regulations, documentation control regulations, regulations on measures to be taken against computer virus infection, regulations on measures against accidents, information security education regulations, privacy policy (personal information protection policy), employment agreement, office regulations, penal provisions, outward explanation regulations, regulations for exceptions, regulations for updating rules, procedure for approving regulations.
7	**Management of Information Asset:** Security Incidents management, reducing risk in Information loss and keeping the information safe from unauthorized users and threats. **Information Technology Act:** Cyber Crimes and Cyber Laws. -What are cyber-crimes? Types of cyber-crimes. Categories of Cyber Crime, Online business threats, Online business frauds Safety tips for online business.

Course Number	Course Name	Credits	Year of Introduction
403	Design Patterns	3 Credits	2018

Course Objective:

The objective of the course to emphasize how to use design patterns as general reusable solution to a commonly occurring problem. Understand the Design patterns that are common in software applications and how these patterns are related to Object Oriented design.

Pre-requisites:

This course assumes students should have following knowledge:

- OOAD and UML.
- Software Engineering, Java Programming

Learning Outcomes:

After completing this course, students will be able to:

- Understand meaning and types of design Patterns
- Identify structure and describe structure of Design Pattern
- Given a problem able to decide which design Pattern is used
- Understand the Design patterns that are common in software applications
- Understand how these patterns are related to Object Oriented design.

Text Book(s) :

- Design Patterns Elements of Reusable Object-oriented Software- Erich Gama, Richjard Helm, Ralph Jonson and Jon Vlissides.
- Design Patterns- Vhristopher G. Lasater, BPB Publications, 1st Indian Edition 2007.
- Head First Design Patterns, Eric Freeman, Elisabeth Freeman, Kathy Sierra, Bert Bates,
- Ben Shneiderman, Designing the User Interface, Pearson Education, 1998

Syllabus

Unit	Contents
1	**Introduction to Design Patterns:** Reusable design Patterns: Meaning & Use of Design Patterns, Organizing the Patterns, Describing pattern, how to use the patterns while solving the problem, Applications of different design patterns in various cases. Selection of a Design Pattern
2	**Creational Patterns:** **Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences and Implementation of following Creational Patterns :-** Factory Method, Abstract Factory, Builder, Prototype, Singleton**.** **Tutorial:** Tutorials should be conducted in LAB using JAVA for implementing Creational design pattern.
3	**Structural Patterns:** Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences, Implementation of Following Structural Patterns **Adapter (class**), **Adapter (object), Bridge, Composite, Decorator. Façade.**

	Flyweight, **Proxy.** **Tutorial:** Tutorials should be conducted in LAB using JAVA for implementing Structural design patterns.
4	**Behavioral Patterns:** Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences, Implementation of following Behavioral Pattern **Interpreter, Template Method, Chain of Responsibility, Command, Iterator, Mediator, Memento, Observer, State, Strategy, Visitor** **Tutorial:** Tutorials should be conducted in LAB using JAVA for implementing Behavioral Design Pattern.
5	**Introduction to Human Computer Interface:** Need & Importance of HCI, HCI & human diversity, Goals and Objectives of HCI. **Models of HCI:** Conceptual, semantic, Syntactic and Lexical Model,GMOS Model, Object-Action Interaction model, Action-Object Interaction model.
6	**Principles of Design:** Recognition and Diversity, Eight golden rules of interface design, Error Prevention. **Interaction style of Design:** Guidelines for Data Display and Data Entry**,** Direct and Menu selection, Form filling, Command Language.
7	**Computer Supported co-operation:** Goals of co-operation, Synchronous Interactions, asynchronous and face to face Interactions. **Application to education and social issues:** Future Applications of HCI. Tutorials should be conducted in LAB using JAVA for implementing design patterns of Creational, Structural and Behavioral design pattern.

Course Number	Course Name	Credits	Year of Introduction
407	Linux Lab	1 Credit	2018

Course Objective:

The student would be able

- To obtain knowledge of how to manage files in Linux system.
- To understand Linux commands and write shell programming.
- To grasp the concepts of User Management in Linux.
- To control the system running Ubuntu operating system.

Expected Outcome :

The course is to provide the knowledge of the Linux Operating System. This course intends to teach various features that will help the students to use and learn the working of Ubuntu /Red Hat operating system

Prerequisite:

Students should have basic knowledge of working on an operating system.

- Linux for beginners : An introduction to the linux operating system and command line
- Linux: the complete reference, sixth edition paperback by Richard Petersen, McGraw Hill education
- Unix shell Programming: by yashwant Kanitkar
- UNIX Concepts and Applications - by Sumitabha Das

Course Plan

Unit	Contents
1	Introduction to Linux Operating system, various flavors of Linux O.S., Learning to use and Install Linux, Booting Any one flavor of Linux like ubuntu, red hat etc, Starting up ,Logging in, Exploring the desktop ,Working with virtual desktops, Getting Everything up and running ,Viewing your hardware , Getting online Using an Ethernet Card ,Joining wireless network ,Configuring Email and instant messaging, Adding a Printer , Configuring a local printer, Configuring a network printer, Setting up digital imaging devices, Transferring photos from digital camera, Configuring scanner, Configuring Bluetooth.
2	**General Purpose Utilities:** banner (display a blown-up message), cal (The calendar), date-display the system date, who-Login detail tty-knowing your terminal uname-know your machine name passwd-change your password lock-lock your terminal echo-display message bc-the calculator. who am i,- display login name
3	**Navigating the file system:-** pwd-checking your current directory, cd-changing directories,

	mkdir-Making directories rmdir-moving directories ls-listing files **Handling Ordinary files:** cat-displaying and creating files, touch-creating empty file cp-copying a file rm-deleting files mv-renaming files more-paging output lp-printing a fiile file-know the file type wc-line, word and character counting split-splitting file in to multiple files cmp-comparing two files comm.-finding common chmod-changing file permission files searches using find command, locate command, mount and unmount command. Understanding vi modes, Using vi to edit the file, Creating a new text file using vi, Searching through files.
4	**Filters:** pr- paginating files head-displaying the beginning of a file, tail- displaying the end of file cut- slitting a file vertically paste- pasting file sort- ordering file uniq- locating repeated line nl- line numbering tr-translating characters. regular expressions and grep to find text ps-process status kill-terminate process Other process related commands
5	sh command, pattern matching- the wild cards, escaping-the backslash(\), quoting, redirection, pipes, tees
6	What is Shell, Different types of shells, Shell as command processor, shell variables, creating command substitution, various shell scripts using functions, conditionals, loops, customizing environment

SEMESTER V

Course Number	Course Name	Credits	Year of Introduction
501	Data Science	3 Credits	2018-19

Course Objective :

You will learn data science basics, statistics, R programming fundamentals of big data, hadoop and mapreduce, and Machine Learning Basics. By the end of this students should be able to handle and program on machine learning techniques using R-tool

Learning Outcomes:

- Students will develop relevant **programming** abilities.
- Students will demonstrate proficiency with statistical **analysis of data**.
- Students will develop the ability to build and assess data-based **models**.
- Students will execute statistical analyses with professional statistical **software**.
- Students will demonstrate skill in **data management**.
- Students will apply data science concepts and methods to **solve** problems in real-world contexts and will **communicate** these solutions effectively

References (Books, Websites etc) :

Refer web sources

Suggested MOOC :

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

Syllabus:

Unit	Contents
1	**Introduction To Data Science:** What is data science, relation to data mining, machine learning, big data and statistics, Several data science settings, Introduction to the WEKA tool
2	**Data analysis:** **From data to features:** Interactive group discussion, Representing problems with matrices, Representing problem with relations, Examples **Computing simple statistics:** Means, variances, standard deviations, weighted averaging, modes, quartiles, Examples **Simple visualizations:** Histograms, Boxplots, Scatterplots, Time series, Spatial data **Case studies:** X & Y examples, Medical data ,Hands-on R-Tool
3	**Exploratory Data Mining:** Introduction to Exploratory Data Mining, **Association discovery**

	What is association discovery?, What are the challenges? , In detail: Apriori **Clustering** What is clustering? , What are the challenges? ,In detail: agglomerative clustering Hands-on: clustering in WEKA
4	**Evaluation And Methodology Of Data Science:** **Experimental setup** Training, tuning, test data, Holdout method, cross-validation, bootstrap method **Measuring performance of a model** Accuracy, ROC curves, precision-recall curves, Loss functions for regression **Interpretation of results** Confidence interval for accuracy Hypothesis tests for comparing models, algorithms
5	**Data Engineering:** **Attribute selection** Filter methods, Wrapper methods **Data discretization** Unsupervised discretization, Supervised discretization **Data transformations** PCA and variants Exercises
6	**Introduction To Machine Learning:** **Linear Regression** Learn to implement linear regression and predict continuous data values **Classification** Understand and implement algorithms like K-NN*, Naive Bayes and Logistic Regression **Clustering** Learn how to create segments based on similarities using K-Means and Hierarchical clustering
7	**Big Data Analytics:** **Introduction to Big Data And Hadoop:** Understand the basic concepts of Big Data and Hadoop as processing platforms for Big Data **Managing Big Data:** Learn and Use Hadoop Ecosystem tools for data ingestion, extraction and management. Hadoop ecosystem tools namely Sqoop, Hive will be covered in this Module

Course Number	Course Name	Credits	Year of Introduction
502	Optimization Techniques	3 Credits	2018

Course Objective:

Operations Research is a method of mathematically based analysis for providing a quantitative basis for analytical decisions in management. It provides different techniques based on logic and mathematics, and hence form the backbone of computer science.

Expected Outcome :

This module helps to introduce students to use quantitative methods and techniques for effective decisions–making model formulation and applications that are used in solving business decision problems.

References (Books, Websites) :

Books:

Operations Research Theory and Applications by J. K. Sharma

Operations Research: An Introduction (Pearson Publication, 8th edition) by H. A. Taha

Web Resources :

For video lectures refer to site – http://mech19.blogspot.in/2015/08/operation-research-video-lectures.html

Suggested MOOC :

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

Syllabus

Unit	Contents
1.	**Introduction to OR and Linear Programming Problem:** **Operation Research** – Introduction, Models, Areas of Application, Basic terminologies in OR. **Introduction to LPP** Mathematical Formulation of L.P.P. **Solution to LPP using** – Graphical Method (Minimization and Maximization). Simplex Method – Concept of slack, surplus & artificial variables. Manual solutions of L.P.P. (up to 3 iterations). Solution using Big M method Duality and sensitivity Analysis in LPP **Variations of LPP –** Alternative optimal, Unbounded solutions & Infeasible solutions to be shown graphically & also by simplex method.

2.	**Transportation** Definition and mathematical formulation of the transportation model. **Finding initial basic feasible solution using –** North-West Corner Rule Least cost method Vogel's approximation method Checking for Optimality & obtaining of optimal solution using MODI method. **Variations of Transportation Problem-** Unbalanced problems Maximization. Degenerate Solutions
3.	**Assignment Model** Definition and mathematical formulation of Assignment Problem. Finding BFS and optimal solution for Assignment Problem using Hungarian method. **Variations of Assignment Problem –** Unbalanced problems Maximization Travelling Salesman Problem
4.	**Network Analysis** Introduction to project management and significance of PERT/CPM in project management. Components of network. Construction rules and precautions Network of phases of project. Critical Path Analysis (CPM): Calculating Earliest Time and Latest Time for events, finding critical path for project, Calculating floats (Total, free and independent float), Calculating probability for completion of projects.
5.	**Simulation** Introduction to simulation, types of simulation, advantages and disadvantages of simulation Steps in solving problem using simulation **Monte Carlo Method for Simulation for –** Inventory, Queuing, PERT, Investment Applications of Simulation
6.	**Decision Theory and Decision Tree** Introduction to terminologies in Decision Making (Decision alternatives, States of alternatives, payoff table) and steps in Decision Making. Types of Decision Environments – Decision making under Uncertainty & Decision making under Risk. Criteria for Decision making under uncertainty- Minimin or Maximax criteria, Miximin or Minimax Regret criterion, Laplace criterion, Hurwicz criterion. Criteria for Decision making under Risk- Expected Monetary Value criterion, Expected Opportunity Loss (E.O.L.)

	Expected Value of Perfect Information (E.V.P.I.) Decision Tree introduction and building decision tree for Simple problems.
7.	**Queuing Theory** Introduction, structure of queuing System, Performance measures of a Queuing System, Probability Distributions in Queuing Systems of – Arrivals, Interarrival Times, Departures, Service times, Single Server Queuing Models, Multi Server Queuing Models

Course Number	Course Name	Credits	Year of Introduction
503	**Software Project Management**	3 Credits	2018

Course Objective :

To provide basic project management skills with a strong emphasis on issues and problems associated with delivering successful high quality IT projects.

Expected Outcome :

- Evaluate project to develop scope of work, provide accurate cost estimation and to plan the various activities.
- Identify resources required for a project and to produce a work plan and resources schedule

References (Books, Websites etc) :

- Software Project Management – Bob and Huges
- Software Project Management in Practice, Pankaj Jalote, Pearson Education,2002
- Software Engineering by Pressman
- Basic of Software Management ,NIIT, Prentice-Hall India ,2004
- S0FTWARE REQUIREMENTS - MS project 2007 onward , CoStar 7 Onwards

Syllabus:

Unit	Contents
1	**Introduction to project management -** Project, project management, software project management, characteristics of project, how software projects are diff. Than other projects, Problems with software projects, All parties (stakeholders) involved in project. Role of Project Manager. Phases of project management life Cycle.
2	**Project Management Body of Knowledge** – Project management institute, PMBOK. Role of PMBOK , Knowledge area's identified by PMBOK, Various certifications provided by PMBOK with their importance, Association for project management , project planning, importance.
3	**Project planning –** Various plans to be prepared in SPM , Stepwise project planning , Importance of Project scheduling, project and activities, sequencing and scheduling activities , Importance of resource allocation, nature of resources , Identifying resource requirement , Scheduling resources , Work breakdown structure , Gantt chart, Network Planning models, formulating network model , Critical path analysis , PERT, Hands on experience with Microsoft Project.
4	**Cost and effort estimation –** Where estimation done?, problem with over and under estimation , Cost to be considered during estimation, factors affecting cost estimation , cost estimation methods-non algorithmic , COCOMO model, Function point analysis model , Hands on experience with Costar or other estimation software's.
5	**Project risk management -** The importance, top risk in projects , Classic mistakes, Elements of risk management – Risk identification, risk analysis , Elements of risk management – Risk prioritization, risk control.

6	**Managing Contract –** Types of contract, Contract management and Acceptance Managing people and organizing teams - Organizational behavior, understanding behavior, Selecting Right person for right job, Motivation, Becoming a team and decision Making, Leadership styles, Organizational structures **.**
7	**Software quality –** Place of software quality in planning, Defining software quality and importance of it, Software quality measures, ISO standards, CMM standards, Quality Assurance document.

ELECTIVES

Elective Group: (01) Mobile Computing Technologies

Course Number	Course Name	Credit	Year of Introduction
404-05-A	HTML 5	2 Credits	2018-19

Objectives:

To Acquire knowledge and Skills for creation of Web Site considering both client-and server-side Programming. To create Web application using tools and techniques used in industry.

Expected Outcome :

Design a basic web site using HTML5 and CSS3 to demonstrate responsive web design.
Implement dynamic web pages with validation using JavaScript objects by applying different event handling mechanism.

Suggested MOOC :
Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus:

Introduction to HTML	▪ History and Evolution of HTML Types ▪ Introduction to HTML5 ▪ Differences between types of HTML(HTML,XHTML,HTML5)
Features of HTML5	▪ Detection of HTML5 Support ▪ Modernizr: An HTML5 Detection Library ▪ Canvas ▪ Canvas Text ▪ Video ▪ Video Formats ▪ Local Storage ▪ Web Workers ▪ Offline Web Applications ▪ Geolocation ▪ Input Types ▪ Placeholder Text ▪ Form Autofocus ▪ Microdata
Elements of HTML5	▪ The Doctype ▪ The Root Element ▪ The <head> Element ▪ New Semantic Elements in HTML5 ▪ Headers ▪ Articles

	▪ Dates and Times ▪ Navigation ▪ Footers
HTML Media	▪ Adding Media to Web Page ▪ Video Tag and its attributes ▪ Audio Tag and its attributes
HTML Graphics	▪ Introduction to Canvas ▪ Simple Shapes ▪ Canvas Coordinates ▪ Paths ▪ Text ▪ Gradients ▪ Images
Geolocation	▪ Geolocation API ▪ Handling Errors ▪ geo.js Library
Local Storage for Web Applications	▪ Evolution of Local Storage ▪ Introduction to HTML5 Storage
Offline Web Application	▪ Introduction to Offline Web application ▪ The Cache Manifest
Web Forms	▪ Introduction to Web Forms and its elements ▪ Placeholder Text ▪ Autofocus Field ▪ e-Mail Addresses ▪ Web Addresses ▪ Numbers as Spinboxes ▪ Numbers as Sliders ▪ Date Pickers ▪ Search Boxes ▪ Color Pickers
CSS3	▪ Introduction ▪ Basic designs (Color, Background, Padding, Margin, Height/Width) ▪ CSS Box-Model ▪ CSS Positions ▪ CSS Selectors ▪ Advanced CSS • Media queries • Transitions • Animations • Flex-box • Gradients
Miscellaneous	Introduction to CSS Preprocessors ,SASS & LESS, CSS framework, Bootstrap, Cross browser compatible CSS

Elective Group: (01) Mobile Computing Technologies

Course Number	Course Name	Credit	Year of Introduction
405-05-B	**JavaScript Programming**	2 Credits	2018-19

Objectives:

To Acquire knowledge and Skills for creation of Web Site considering both client-and server-side Programming. To create Web application using tools and techniques used in industry.

Expected Outcome :

Compose programs for the web and other contexts using the JavaScript programming language

Suggested MOOC :

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

Syllabus:

Introduction to Javascript	▪ JavaScript Overview ▪ JavaScript Programming Basics
Variables and Operators	▪ Variables and Data Types ▪ Operators ▪ Array
Control Statements	▪ Controlling the Flow: JavaScript Control Statements
Functions	▪ Functions
The Window Object	▪ The Window Object ▪ Dialog Boxes ▪ Window functions
The Document Object	▪ The Document Object ▪ Writing to Documents ▪ Document related functions
Forms and Forms-based Data	▪ The Form Object ▪ Working With Form Elements and Their Properties ▪ Event related with form
Form Validation	▪ Form Validation: A Process ▪ Testing Data ▪ Preparing Data for Validation and Reporting Results ▪ Validating Non-text Form Objects

Frames	▪ HTML Frames Review ▪ Scripting for Frames
The String and RegExp Objects	▪ The String Object ▪ Properties and methods of String Object ▪ Using String Object Methods to Correct Data Entry Errors ▪ The RegExp Object
Dates and Math	▪ The Date Object ▪ Properties and methods of Date Object ▪ The Math Object ▪ Properties and methods of Math Object
Animation	▪ Frequently used Animation function ▪ Manual and Automated animation.
AJAX	▪ Introduction to AJAX ▪ Interacting with the Web Server using XMLHttpRequest Object ▪ Need of Web server ▪ Need of JSON ▪ RESTful API with JSON
JS Frameworks & Libraries	▪ jQuery • Intro • Effects and animations • DOM/HTML Updates • jQuery and Ajax

Elective Group: (05) Mobile Computing Technologies

Course Number	Course Name	Credit	Year of Introduction
504-05-C	**Android**	2 Credits	2018-19

Objectives:

Android Application Development cours e is des igned to quickly get you up to s peed with writing apps for Android devices . The s tudent will learn the bas ics of Android platform and get to unders tand the application lifecycle

Expected Outcome :

- Gain a thorough understanding of Android architecture
- Build and publish own Android apps
- Achieve expertise in app development for Android wearable devices

Suggested MOOC :

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

Syllabus:

Introduction to Android	▪ Evolution of Android ▪ Advantages of Android ▪ SDK Tools for Android
Overview of Android Platform	▪ Android Development IDE Understand the Working of Android ▪ The Android Application Framework ▪ Screen Layout Design ▪ User Interface Design ▪ Introduction to Graphics and Animation Design ▪ Interactivity ▪ Introduction to Content Providers ▪ Intent and Intent Filters
Setting up the Android Development Environment	▪ Installing Android Development Environment ▪ Updating the Android SDK ▪ Setting up AVDs and Smartphone Connections
Introduction to the Android Software Development Platform	▪ Understanding Java SE and Dalvik Machine ▪ The Directory Structure of an Android Project ▪ Android XML ▪ Android Application Resources ▪ Launching an Android Application

	▪ Creating first Hello Application
Overview of Android Framework	▪ Overview of Object Oriented Programming ▪ Overview of XML ▪ The Anatomy of an Android Application ▪ Components of an Android Application ▪ Android Intent Objects ▪ Android Manifest XML
Screen Layout Design	▪ Android View Hierarchies ▪ Activity Lifecycle ▪ Defining Screen Layouts (Screen size, pixel density)
User Interface Design	▪ Using Common UI Elements ▪ Using Menus in Android ▪ Adding Dialogs(Date picker, Time picker, Custom Dialog, Alert Dialog)
Introduction to Graphics Resources	▪ Introduction to Drawables ▪ Using Bitmap Images ▪ Using Transitions ▪ Creating 9-Patch Custom Scalable Images ▪ Playing Video in Android Apps
Handling User Interface Events	▪ An Overview of UI Events ▪ Handling onClick Events for all Views ▪ Android Touch-screen Events: onTouch ▪ Touch-screen's Right-Click Equivalent: onLongClick ▪ Keyboard Event Listeners: onKeyUp, onKeyDown ▪ Context Menus: onCreateContextMenu ▪ Controlling the Focus
Understanding Content Providers	▪ An Overview of Android Content Providers ▪ Defining a Content Provider ▪ Working with a Database
Intents and Intent Filters	▪ Understanding the Intents ▪ Android Intent Messaging via Intent Objects ▪ Intent Resolution ▪ Using Intents with Activities ▪ Android Services ▪ Using Intents with Broadcast Receivers
Bars and Views	▪ Action Bar, Toolbar, Navigation Drawer, TextView, EditView, Button, WebView, ImageView ,ListView etc

Elective Group: (05) Mobile Computing Technologies

<table>
<tr><th>Course Number</th><th>Course Name</th><th>Credit</th><th>Year of Introduction</th></tr>
<tr><td>505-05-D</td><td>Hybrid Application Development</td><td>2 Credits</td><td>2018-19</td></tr>
<tr><td colspan="4">Objectives:</td></tr>
<tr><td colspan="4">Expected Outcome :</td></tr>
<tr><td colspan="4">Suggested MOOC :

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com</td></tr>
<tr><td colspan="4">Syllabus:</td></tr>
<tr><td colspan="2">Introduction to Mobile App Development

(Warm-up)</td><td colspan="2">▪ Introduction
▪ Introduction Types of mobile apps
• Web Apps
• Native Apps
• Hybrid Apps
▪ Intro to Web Apps
• Concept
• Single Page Apps
• Progressive Web Apps
• Accelerated Mobile Pages
• PWA vs AMP
▪ Intro to Native Apps
• Concept
• Pros and Cons
▪ Intro to Hybrid Apps
• Concept
• Pros and Cons
• Native vs Hybrid apps
▪ Web Or Native Or Hybrid?</td></tr>
<tr><td colspan="2">Getting Started with React Native

(Getting in action)</td><td colspan="2">■ Introduction to React Native
■ Installing dependencies
■ Installing Node, Python2, JDK
■ The React Native CLI</td></tr>
</table>

	▪ Android development environment ▪ Creating a new application ▪ Preparing the Android device ▪ Running your React Native application
More Details (Diving deep)	▪ Native modules ▪ Components ▪ ActivityIndicator, Button, Image, ListView, Modal, ProgressBarAndroid, RefreshControl, ScrollView, Slider, StatusBar, Switch, Text, TextInput, ToolbarAndroid, WebView ▪ API's ▪ Alert, AppState, CameraRoll, Clipboard, DatePickerAndroid, Keyboard, PermissionsAndroid, Settings, Share, StyleSheet, TimePickerAndroid, ToastAndroid, Vibration

Elective Group:(02) Information Systems

Course Number	Course Name	Credit	Year of Introduction
404-08-A	Enterprise Resource Planning	2 Credits	2018

Course Objective:
The objective of the course is to enable students in learning basic concepts of Enterprise Resource Planning so that they can understand how to use the organizational resources effectively.

Pre-requisites:
Knowledge of Business Process , Business Functions and MIS

Expected Outcome :
After going through this course a student should be able to understand :

- Will be able to understand the concepts of ERP.
- Can be able to design and develop ERP systems for Business applications .
- Implementation of ERP for various areas of Interest in Business Organizations .

References (Books, Websites etc.):
1. Alexis Leon, ERP (Demystified Hrs), 5/E, Tata McGraw-Hill, 2006.
2. David L Olson, Managerial Issues of Enterprise Resource Planning Systems, McGraw Hill, International Edition-2006.
3 Sinha; Enterprise Resource Planning , Cengage Learning, New Delhi,

Suggested MOOC:
Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus

Unit	Contents
1	**Introduction to ERP:** Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP , Business Modeling , Integrated Data Model , ERP Market.
2	**ERP Technologies:** Business Process Re-engineering (BPR), BPR Process, Clean Slate Re-engineering Technology Enabled Re-engineering , Myths regarding BPR , Business Intelligence Systems-Data Mining, Data Warehousing, On-Line Analytical Processing (OLAP), Supply Chain Management, Best Practices in ERP.
3	**ERP Modules :** **(a)** Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System

	(b) ERP System Options and Selection **(c)** ERP proposal Evaluation.
4	**ERP Implementation:** Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success
5	**Maintenance and Benefits of ERP:** Improvement opportunities , IT Maintenance, Business Needs , Business Priority , Maintenance Cost , User Training, ERP Solutions
6	**ERP & Information System:** Reduction of Lead Time, On-Time Shipment , Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance , Increased Flexibility , Reduced Quality Costs, Improved Information Accuracy and Decision Making Capabilities.
7	**Case Studies on ERP :** ERP for Finance , Manufacturing , Supply Chin and Quality Management for any Business Organization

Elective Group:(02) Information Systems

Course Number	Course Name	Credit	Year of Introduction
405-08-B	E-Commerce	2 Credits	2018

Course Objective:

This course explores the basics of working with internet including WWW, Email, Browsing, Chatting etc., and understands the potential of secured electronic transactions, E-mail security and electronic publishing.

Pre-requisites:

Knowledge of Internet and Internet Technologies , Programming knowledge and Network Technology basics.

Expected Outcome :

- Will be able to understand the concepts of E-Commerce.
- Can be able to design and develop E-Commerce facilities for Business applications . Implementation of E-Commerce Websites for Business firms.

References (Books, Websites etc.):

1. Web Commerce Technology Handbook, byDanielMinoli, EmmaMinoli, McGraw-Hill.
2. Frontiers of electroni commerece by Galgotia.
3. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
4. E-Commerce, S.Jaiswal – Galgotia.
5. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
6. Electronic Commerce – Gary P.Schneider – Thomson.
7. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.

Suggested MOOC:

Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus

Unit	Contents
1	**Introduction and Concept** What is E-Commerce? Types of E-Commerce and Applications of E-Commerce, E-Commerce Basic Requirements, Internet and Concepts of Internet.
2	**Approaches to Safe Electronic Commerce:** Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET), Certificates for authentication Security on web Servers and Enterprise Networks, Electronic Cash and Electronic Payment Schemes: Internet

	Monetary, Payment & Security Requirements. Payment and Purchase Order Process,On-line Electronic cash.
3	**Internet/Intranet Security Issues and Solutions:** The need for Computer Security, Specific Intruder Approaches, Security Strategies, Security Tools, Encryption, Enterprise Networking and Access to the Internet, Antivirus Programs, Security Teams.
4	**Master Card/Visa Secure Electronic Transaction:** Introduction, Business Requirements Concepts, payment Processing, E-Mail and Secure E-mail , Technologies for Electronic Commerce: Introduction, The Means of Distribution, A model for Message Handling, E-mail working, Multipurpose Internet Mail Extensions, Message Object Security Services, Comparisons of Security Methods, MIME and Related Facilities for EDI over the Internet.
5	**Internet Resources for E-Commerce** Introduction, Technologies for web, Servers, Internet Tools Relevant to Commerce, Internet Applications for Commerce, Internet Charges, Internet Access and Architecture, Searching the Internet, Advertising on Internet: Issues and Technologies, Advertising on the Web, Marketing creating web site, Electronic Publishing Issues, Approaches and Technologies: EP and web based EP.
6	**E-Commerce Website Development** Website Development , Online Transactions and Payments , Security Issues in E-Commerce website
7	**Case Studies on E-Commerce :-** Amazon , Flip kart , Myantra

Elective Group:(02) Information Systems

Course Number	Course Name	Credit	Year of Introduction
504-08-C	Recommender System	2 Credits	2018

Course Objective:

Pre-requisites:

Knowledge about Business Organizations and its functions , Theory of Recommender Systems and Decision Making process .

Expected Outcome :

After going through this course a student should be able to understand :

- Will be able to understand the concepts of Decision Making Process.
- Can be able to design and develop Recommender for Business applications.
- Implementation of Recommender System for various areas of Interest in Business Organizations .

References (Books, Websites etc.):

1. "Recommender systems An Introduction" by Dietmar Jannach, Markus Zanker, Alexzander Felfering, Gerhard friedrich by Cambridge university press 2011
2. **recommender systems handbook [book] by francesco ricci, lior rokach, paul b. kantor in books**

Suggested MOOC:

Please refer these websites for MOOC's:
NPTEL / Swayam
www.edx.com
www.coursera.com

Syllabus

Unit	Contents
1	**Introduction to Basic Concepts:** Collaborative Recommendation: User Based Nearest Neighbor recommendation, Item Based Nearest Neighbor recommendation, model based and pre-processing based approaches. Recent practical approaches and systems. Content based Recommendation: content representation and content similarity, similarity based retrieval, other text classification methods, Knowledge Based Recommendation: Knowledge representation and reasoning, interacting with constraint based recommenders, interacting with case based recommenders,
2	**Hybrid recommendation approaches:** Opportunities for hybridization, Monolithic hybridization design, parallelized hybridization design, pipelined hybridization design,
3	**Evaluating recommender systems :** General properties of Evaluation research, popular evaluation designs, evaluation on historical datasets, alternate evaluation design

4	**Recent developments:** Attacks on collaborative recommender systems, Online consumer decision making
5	**Recommender systems and the next-generation web** Recommendations in ubiquitous environments.
6	**Explanations in recommender systems** Explanations in constraint-based recommenders, explanation in case based recommenders, explanation in collaborative filtering recommenders.
7	**Case studies on Recommender System.**

Elective Group:(02) Information Systems

Course Number	Course Name	Credit	Year of Introduction
505-08-D	Knowledge Management	2 Credits	2018

Course Objective:

The objective of the course is to provide the basic skills of managing knowledge in organizations. Knowledge is an asset for retaining the competitive advantage of the organization. This course develops the capabilities of towards managing students to manage knowledge in organizations.

Pre-requisites:

Knowledge about Information System and MIS with Implementation of MIS

Expected Outcome :

After going through this course a student should be able to understand :

- Will be able to understand the concepts of Knowledge and knowledge management .
- Can be able to design and develop Knowledge management systems for Business applications .
- Implementation of KM to various areas of Interest in Business Organizations .

References (Books, Websites etc.):

1. Madhukar Shukla:Competing Through Knowledge-Building a learning Organisation(Responsce Books, New Delhi.
2. Tiwana, The Knowledge Management Toolkit: Practical Techniques for building a Knowledge Management Systmes, 2/e, Pearson Edu.
3. Honey Cutt : “Knowledge Management Strategies”, PHI, New Delhi.
4. A wad, KM, Pearson Edn, 2007.
5. Barnes, Knowledge Management Systems, 1/e, Thomson 2006.
6. Ikudiro Nonka & Hirotaka Takeuchi, “ The Knowledge – Creating Company”, Oxford University Press, London.

Suggested MOOC:

Please refer these websites for MOOC’s:

NPTEL / Swayam

www.edx.com

www.coursera.com

Syllabus

Unit	Contents
1	**Introduction:** Definition, Scope and Significance of Knowledge Management , Difficulties of Knowledge Management, Techniques of KM – Implementation of KM, Organizational knowledge, Characteristics and Components of Organizational Knowledge
2	**Drivers of knowledge Management:** Pillars of knowledge Management, KM framework , Supply Chain of KM , Formulation of KM strategy.

3	**Technology and KM:** Technology components of KM – IT & KM , Ecommerce and KM
4	**Total Quality Management and KM:** TQM and KM , Bench marking and KM.
5	**Implementation of KM:** Discussion on Roadblocks to success, Implementing a KM programme , Critical Success Factors in KM , Implementation of KM
6	**KM and Organizational Restructuring:** The Mystique of Learning, Organization:- Outcomes of learning, Learning and Change – Innovation, continuous Improvements, Corporate Transformation.
7	**Case studies in Knowledge Management** Knowledge management in Health Care, Knowledge Management in Human Resource Management