# BHARATI VIDYAPEETH
## (DEEMED TO BE UNIVERSITY)
## PUNE, INDIA

# M.C.A.- II (Sem.III & IV)
## Revised Syllabus(CBCS 2018)
w.e.f. 2019-20

## INSTITUTE OF MANAGEMENT,
## KOLHAPUR

**BHARATI VIDYAPEETH**
**DEEMED TO BE UNIVERSITY**
**PUNE, INDIA**
**FACULTY OF MANAGEMENT STUDIES**

**Board of Studies in Computer Applications**
**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 150 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 Late 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. ELIGIBILITY FOR ADMISSION TO THIS PROGRAMME:

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

1. The candidate should have secured at least 50% (45% for SC/ST).
2. Mathematics as one of the subject at $12^{th}$ or graduation.

## 7 DURATION OF THE PROGRAMME

The duration of this programme is three years divided in to six semesters or a minimum of 150 credits whichever is later. The medium of instruction and examination will be only English.

## 8 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 60 marks and IA will be conducted for 40 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.

## 9 STANDARD OF PASSING:

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 60% and 40% respectively.

GPA is calculated by adding the UE marks out of 60 and IA marks out of 40.The total marks out of 100 are converted to grade point, which will be the GPA.

**10 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 |
|---|---|
| $8x \leq \text{Marks} \leq 10x$ | 10 |
| $5.5x \leq \text{Marks} < 8x$ | Truncate (M/x) +2 |
| $4x \leq \text{Marks} < 5.5x$ | 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

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

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 | If6.00 ≤ 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**

**11 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 upto Semester IV.
2. A student must pass Part I (Semester I and II) to appear for Semester V.

**SEMESTER WISE COURSE STRCTURE FOR MCA**
**(To be effective from July 2018)**

**SEMESTER I**

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 101 | C Programming | 4 | 3 | 1 | - | 40 | 60 |
| 102 | Computer Organization And Architecture | 4 | 3 | 1 | - | 40 | 60 |
| 103 | Database Management Systems | 4 | 3 | 1 | - | 40 | 60 |
| 104 | Discrete Structures | 3 | 2 | 1 | - | 40 | 60 |
| 105 | Management Functions | 3 | 2 | 1 | - | 40 | 60 |
| 106 | Web Supporting Technologies | 4 | 2 | - | 4 | 40 | 60 |
| 107 | C Lab | 2 | 0 | - | 4 | 40 | 60 |
| 108 | Soft Skills | 2 | 2 | - | - | 50 | 0 |
| 109 | Self learning-1 (Societal Related Topic) | 2 | 0 | - | - | 50 | 0 |
| | Total | 28 | 17 | 5 | 8 | 380 | 420 |

**SEMESTER II**

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 201 | Data structure and Algorithms | 4 | 3 | 1 | - | 40 | 60 |
| 202 | Operating Systems | 4 | 3 | 1 | - | 40 | 60 |
| 203 | Software Engineering | 4 | 3 | 1 | - | 40 | 60 |
| 204 | Statistical Techniques | 3 | 2 | 1 | - | 40 | 60 |
| 205 | Financial Accounting | 3 | 2 | 1 | - | 40 | 60 |
| 206 | Database Management Systems Lab | 4 | 2 | - | 4 | 40 | 60 |
| 207 | Data Structures Lab | 2 | 0 | - | 4 | 40 | 60 |
| 208 | Project-I | 2 | 2 | - | - | 0 | 100 |
| 209 | Self-learning-2 (Societal Related Topic) | 2 | 0 | - | - | 50 | 0 |
| | Total | 28 | 17 | 5 | 8 | 330 | 520 |

## SEMESTER III

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 301 | Artificial Intelligence | 4 | 3 | 1 | - | 40 | 60 |
| 302 | Computer Networks | 4 | 3 | 1 | - | 40 | 60 |
| 303 | Object Oriented Analysis And Design | 4 | 3 | 1 | - | 40 | 60 |
| 304 | Probability and Graph theory | 3 | 2 | 1 | - | 40 | 60 |
| 305 | Organizational Behaviour | 3 | 2 | 1 | - | 40 | 60 |
| 306 | Object Oriented Programming | 4 | 3 | 1 | 0 | 40 | 60 |
| 307 | Object Oriented Programming Lab | 2 | 0 | - | 4 | 40 | 60 |
| 308 | Project-II | 2 | 2 | - | - | 0 | 100 |
| 309 | Self learning-3 (Societal Related Topic) | 2 | 0 | - | - | 50 | 0 |
| | Total | 28 | 18 | 6 | 4 | 330 | 520 |

## SEMESTER IV

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 401 | Data Warehousing and Data Mining | 4 | 3 | 1 | - | 40 | 60 |
| 402 | Information Security | 4 | 3 | 1 | - | 40 | 60 |
| 403 | Design Patterns | 4 | 3 | 1 | - | 40 | 60 |
| 404 | Elective-I | 3 | 2 | 1 | - | 100 | - |
| 405 | Elective-II | 3 | 2 | 1 | - | 100 | - |
| 406 | Lab Elective-I | 4 | 2 | - | 4 | 40 | 60 |
| 407 | Linux Lab | 2 | 0 | - | 4 | 40 | 60 |
| 408 | Project-III | 2 | 2 | - | - | 0 | 100 |
| 409 | Self learning-4 (Computer Related Topic) | 2 | 0 | - | - | 50 | - |
| | Total | 28 | 17 | 5 | 8 | 450 | 400 |

## SEMESTER V

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 501 | Data Science | 4 | 3 | 1 | - | 40 | 60 |
| 502 | Optimization Techniques | 4 | 3 | 1 | - | 40 | 60 |
| 503 | Software Project Management | 4 | 3 | 1 | - | 40 | 60 |
| 504 | Elective-III | 3 | 2 | 1 | - | 100 | - |
| 505 | Elective-IV | 3 | 2 | 1 | - | 100 | - |
| 506 | Lab Elective-II | 4 | 2 | - | 4 | 40 | 60 |
| 507 | Lab on Current Trends | 2 | 0 | - | 4 | 40 | 60 |
| 508 | Project-IV | 2 | 2 | - | - | 0 | 100 |
| 509 | Self learning-5 (Computer Related Topic) | 2 | 0 | - | - | 50 | 0 |
| | Total | 28 | 17 | 5 | 8 | 450 | 400 |

**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 |
|---|
| Cloud Computing |
| Data Analytics |
| Linux |
| Open Source Technologies |
| Mobile Computing |
| Dot Net Technologies |
| Net Centric Technologies |
| Information Systems |
| IOT |
| Big Data |
| Cyber Security |

| Elective No. | Elective Group | Course No | Course Name |
|---|---|---|---|
| 01 | Cloud Computing | 404-01-A | Virtualization |
| | | 405-01-B | Cloud Computing Concepts |
| | | 504-01-C | Cloud Solutions |
| | | 505-01-D | Cloud Computing |
| 02 | Data Analytics | 404-02-A | Algorithms for Advanced Analytics |
| | | 405-02-B | Machine Learning Techniques |
| | | 504-02-C | Weka |
| | | 505-02-D | Statistical Computing |
| 03 | Linux | 404-03-A | Linux Desktop Environment and Shell Programming |
| | | 405-03-B | Linux System Administration |
| | | 504-03-C | Linux Network Administration |
| | | 505-03-D | Linux Internals and Network |
| 04 | Open Source Technologies | 404-04-A | Python |
| | | 405-04-B | Perl Scripting |
| | | 504-04-C | PHP |
| | | 505-04-D | Ruby |
| 05 | Mobile Computing | 404-05-A | HTML 5 |
| | | 405-05-B | Java Script Programming |
| | | 504-05-C | Android |
| | | 505-05-D | Hybrid Application Development |
| 06 | Dot Net Technologies | 404-06-A | C# Programming |
| | | 405-06-B | ASP .NET with C# |
| | | 504-06-C | C# Windows Programming |
| | | 505-06-D | MVC |
| 07 | Net Centric Technologies | 404-07-A | HTML 5 |
| | | 405-07-B | Java Script Programming |
| | | 504-07-C | Ajax Programming |
| | | 505-07-D | Web Services |
| 08 | Information Systems | 404-08-A | Enterprise Resource Planning |
| | | 405-08-B | E Commerce |
| | | 504-08-C | Recommender System |
| | | 505-08-D | Knowledge Management |
| 09 | IOT | 404-09-A | IoT Architecture And Protocols |
| | | 405-09-B | Sensors and Fundamentals with Hands-on lab Node.js/Raspberry PI/Python |
| | | 504-09-C | Internet Of Things: Sensing And Actuator Devices |
| | | 505-09-D | Smart city use case, MQTT, Integrating on Cloud |

| | | | |
|---|---|---|---|
| 10 | Big Data | 404-10-A | Business Intelligence Applications |
| | | 405-10-B | Business Intelligence Tools |
| | | 504-10-C | Introduction to Big Data |
| | | 505-10-D | Hadoop |
| 11 | Cyber Security | 404-11-A | Cyber Security |
| | | 405-11-B | Information Security Concepts |
| | | 504-11-C | Information Security Threats |
| | | 505-11-D | Information Security Administration |

## SEMESTER VI

| Course Number | Course Title | Credits | Hours/Week | | | IA Marks | EoTE Marks |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 601 | Internship Project | 10 | - | - | - | | 100 |

**Practical Examinations:**
For course 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 Viva:**
For course Nos. 208,308,408,508 there will be University Project Dissertation Viva carrying 100 marks.

**Self Learning:**
For Self Learning- 1 (109), Self Learning- 2 (209), Self Learning- 3 (309), Self Learning- 4 (409), Self Learning- 5 (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 III

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **301** | **Artificial Intelligence** | 3L+1T+0P = 4C | 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.<br>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:**<br>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:**<br>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,<br>Scripts, CYC |
| 5 | **Game Playing:**<br>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.<br>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 :**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **302** | **Computer Networks** | 3L+1T+ 0P = 4C | 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** ($4^{th}$ 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:**<br>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:**<br>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) :**<br>Domain Names, Authoritative Hosts, Delegating Authority, Resource Records, SOA records, DNS protocol, DHCP & Scope Resolution |
| 6 | **Transport and Application Support Protocols:**<br>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:**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 303 | Object Oriented Analysis And Design | 3L + 1T + 0P= 4C | 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:**<br>**Overview:** Review of SDLC, waterfall, spiral, iterative and incremental models, Iterative development and Rational Unified Process(RUP),<br>**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)<br>**Concept of Modeling:** Importance of Modeling, principles of Modeling, object oriented Modeling, object Modeling techniques. |

| | |
|---|---|
| 2 | **Introduction To UML:**<br>Basics of UML: What is UML? History of UML, Goals of UML,<br>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):**<br>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:**<br>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:**<br>Introduction to Domain Models, Domain modeling guidelines, conceptual class identification , strategies to identify conceptual classes,<br>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<br>**Class Diagram :**<br>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 :**<br>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,<br>System Events and the System Boundary, Example of System Sequence Diagrams.<br>**State Chart Diagram:**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 304 | **Probability and Graph Theory** | 2L + 1T +0P = 3C | 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:**<br>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:**<br>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 :**<br>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:**<br>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:**<br>Introduction, Graphs and Multi graphs, sub graphs, Isomorphic Graphs, Homomorphism Graphs, Paths, Connectivity ,labeled Graphs, Weighted Graphs ,Complete graphs, Planer Graphs,<br>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:**<br>Bridges of Konigsberge, Travelling Salesmen Problem, Seating Arrangement problem ,Crossing of river problem, Sheep cabbage problem, Utilities problem<br>Shortest Algorithms: Warshall's Algorithm, Dijkstra's Algorithm, Travelling Salesman problem, Depth First search, Breadth First Search. |

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **305** | **Organizational Behavior** | 2L+1T+ 0P = 3C | 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:**<br>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:**<br>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:**<br>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:**<br>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 |

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|---|---|
| **5** | **Motivation and Leadership:**<br>Motivation – Definition, Process, Theories – Maslow Hierarchy Theory of Needs, Herzberg's Two Factor Theory, Equity Theory, Vroom's Expectancy Theory |
| **6** | **Leadership:**<br>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:**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 305 | **Object Oriented Programming** | 3L+1T+ 0P = 4C | 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:**<br>Introduction: Need for OOP paradigm, Procedural approach vs. Object-Oriented approach. Object Oriented concepts<br>Java Basics: Features of Java, History of Java, Java features, data types, variables, operators, expressions, control statements, type conversion and casting, Java compiler, JVM,<br>Garbage collection, Data types, concept of class and object, java naming conventions wrapper classes, control structures in java, |

| | |
|---|---|
| 2 | **Class and Object Concepts:**<br>Defining a class, creating objects from class, adding attributes and methods to the class, using constructors,<br>Passing values to the functions – pass by value, pass by reference, Function overloading.<br>Modifiers – public, private, protected, default, static, final |
| 3 | **Arrays and Strings:**<br>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:**<br>Concept and importance of inheritance, is-a relationship, types of inheritance, Polymorphism – function overriding, dynamic method dispatch. Throws keyword and method overriding.<br>Using abstract and final keywords with class declaration, Concept of interface, Compression of Interface and class.<br>Access modifiers and data accessibility in derived classes, method access modifier and method overriding. |
| 5 | **Concurrent Programming**<br>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**<br>Concept of streams, types of streams – byte streams, character streams, The Console: System.out, System.in, and System.err<br>InputStream class, OutputStream class, File class, FileInputStreams, FileOutputStream,<br>Reader class, Writer class, FileReader, FileWriter.<br>Buffered streams – BufferedInputStream, BufferedOutputStream, BufferedReader, BufferedWriter.<br>Object Streams, issue of 'Serialization' |
| 7 | **Java Collections and Utility Classes**<br>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<br>Generics – Basics, class parameters, bounded types, erasures. |

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 307 | **Object Oriented Programming Lab** | 0L+0T+4P = 2C | 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 :**<br>- Using Operators : arithmetic, relational, logical and bitwise<br>- Control structures (if, if-else, switch)<br>- Iterative statements (while, do-while, for) |
| 2 | **Programming with Classes :**<br>Wring a class, creating objects and using it<br>Using constructors to initialize object<br>Programs to demonstrate parameter passing<br>Making use of access modifiers |

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

**SEMESTER IV**

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **401** | **Data Warehousing and Data Mining** | 3L+1T+0P=4C | 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:**<br>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:**<br>Steps for Design & Construction of A Data Warehouse, A 3-Tier Data Warehouse Architecture, Data warehouse implementation<br>**Data Pre-processing overview:**<br>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** :<br>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 :**<br>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. |

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|---|---|
| 5 | **Classification & Prediction:**<br>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:**<br>Introduction to Cluster Analysis; Types of Data in Cluster Analysis; A Categorization of major. Unsupervised Learning - K-means Clustering - Hierarchical Clustering –Partially Supervised Learning.<br>**Applications of Cluster Analysis-**Clustering analysis in market research, pattern recognition, data analysis, and image processing.<br>**Requirements of Clustering in Data Mining:**<br>Scalability, Ability to deal with different kinds of attributes, Discovery of clusters with attribute shape, High dimensionality, Ability to deal with noisy data, Interpretability.<br>**Clustering Methods:**<br>Classification of clustering methods-Partitioning Method, Hierarchical Method, Density-based Method, Grid-Based Method, Model-Based Method, Constraint-based Method |
| 7 | **Web Structure Mining:**<br>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<br>**Web Usage Mining:**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 402 | **Information Security** | 3L+1T+0P=4C | 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 interrelationship 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**:<br>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** –<br>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.<br>**Threats** :- Ty p e s of threats: physical threats (accident, disaster, fault, destruction, theft, unauthorized intrusion, etc.), technical threats (unauthorized access, eave<br>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. |

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|---|---|
| 5 | **Information security Management:**<br>management of information based on the information security policy, information, information assets, physical assets, software assets, human assets (people, and their<br>qualifications, skills, and experience), intangible assets, service, risk management (JIS Q 31000), monitoring, information security events, information security incidents.<br>**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:**<br>(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:**<br>Security Incidents management, reducing risk in Information loss and keeping the information safe from unauthorized users and threats.<br>**Information Technology Act:**<br>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 | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 403 | **Design Patterns** | 3L+1T+0P=4C | 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:**<br>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:**<br>**Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences and Implementation of following Creational Patterns :-**<br>Factory Method, Abstract Factory, Builder, Prototype, Singleton**.**<br>**Tutorial:** Tutorials should be conducted in LAB using JAVA for implementing Creational design pattern. |

| | |
|---|---|
| 3 | **Structural Patterns:**<br>Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences, Implementation of Following Structural Patterns<br>**Adapter (class**), **Adapter (object), Bridge, Composite, Decorator. Façade.**<br>**Flyweigh**t, **Proxy.**<br><br>**Tutorial:** Tutorials should be conducted in LAB using JAVA for implementing Structural design patterns. |
| 4 | **Behavioral Patterns:**<br>Intent, Motivation, Applicability, Structure, Participants, Collaborations, Consequences, Implementation of following Behavioral Pattern<br>**Interpreter, Template Method, Chain of Responsibility, Command, Iterator, Mediator, Memento, Observer, State, Strategy, Visitor**<br>**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.<br>**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.<br>**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.<br>**Application to education and social issues:** Future Applications of HCI.<br><br>Tutorials should be conducted in LAB using JAVA for implementing design patterns of Creational, Structural and Behavioral design pattern. |

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 407 | **Lab on Linux Operating System** | 0L+1T+4P=2C | 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:**<br>banner (display a blown-up message),<br>cal (The calendar),<br>date-display the system date,<br>who-Login detail<br>tty-knowing your terminal<br>uname-know your machine name<br>passwd-change your password<br>lock-lock your terminal<br>echo-display message<br>bc-the calculator.<br>who am i,- display login name |

| | |
|---|---|
| **3** | **Navigating the file system:-**<br>pwd-checking your current directory,<br>cd-changing directories,<br>mkdir-Making directories<br>rmdir-moving directories<br>ls-listing files<br>**Handling Ordinary files:**<br>cat-displaying and creating files,<br>touch-creating empty file<br>cp-copying a file<br>rm-deleting files<br>mv-renaming files<br>more-paging output<br>lp-printing a fiile<br>file-know the file type<br>wc-line, word and character counting<br>split-splitting file in to multiple files<br>cmp-comparing two files<br>comm.-finding common<br>chmod-changing file permission<br>files searches using find command,<br>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:**<br>pr- paginating files<br>head-displaying the beginning of a file,<br>tail- displaying the end of file<br>cut- slitting a file vertically<br>paste- pasting file<br>sort- ordering file<br>uniq- locating repeated line<br>nl- line numbering<br>tr-translating characters.<br>regular expressions and grep to find text<br>ps-process status<br>kill-terminate process<br>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 |

## ELECTIVES

## Elective Group:(01) Cloud Computing

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| **404-01-A** | **Virtualization** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
Students will learn an an overview of the field of Cloud Computing Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools. It is our objective that students will develop the skills needed to use cloud computing technique

**Course Outcome:**
student will be able to:

- Study core concept of cloud computing.
- Study virtualization and outline its role in enabling the cloud computing system model.
- Analyze various cloud computing models.

**References:**

- "Virtulization" – A Manager's Guide, By Dan Kusnetzky, O'reilley Publications,
- "Virtulization for Dummies", 1st Edition, Kindle Edition, by Bernard Golden.

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

| Unit | Contents |
|---|---|
| 1 | **Overview Of Virtualization :** Introduction to Virtualization, Virtualization Approaches, Virtualization for Server Consolidation and Containment, Hardware Support for Virtualization, Para-Virtualization, vmWare's Virtualization Solutions |
| 2 | **Understanding Virtualization :** The Roots of Virtualization, Making Better Use of Your Systems with Virtualization, Approaches to Virtualization, Understanding the Virtualization Ecosystem, Reasons to Invest in Virtualization Hardware. |
| 3 | **Hypervisor:** What is Hypervisor, Type 1 Hypervisor, Type 2 Hypervisor, Types of Hardware Virtualization : Full Virtualization, Emulation Virtualization Para virtualization., Installing Hyper-V In Windows Server 2012, |
| 4 | **Types Of Virtualization :** Server Virtualization, Client & Desktop Virtualization Services and Applications Virtualization, Network Virtualization, Storage Virtualization |
| 5 | **Tools For Virtualization:** Virtualization with Xen, Virtualization with Bochs and QEMU, Virtualization with Lguest, Virtualization with KVM |
| 6 | **Virtualization For Businesses:** Need for Virtualization in a Business, Implementation of Virtualization in a Business, Cost-Benefit Analysis of Virtualization, |
| 7 | **Openstack And Its Role In Virtualization :** Understanding Openstack, nine Core key components of openstack. CASE STUDIES OF VIRTULIZATION : Xen Hypervisor, OpenVZ Hypervisor, MS Virtual Server 2005 R2, Oracle VM |

## Elective Group :( 01) Cloud Computing

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| **405-01-B** | **Cloud Computing Concepts** | 2L+1T+0P=4C | 2018 |

**Course Objective:**
Students will learn an an overview of the field of Cloud Computing Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools. It is our objective that students will develop the skills needed to use cloud computing technique.

**Course Outcome**:
student will be able to:

- Study core concept of cloud computing.
- Study cloud application with various service providers services
- Analyze various cloud computing models.

**References:**

- Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
- Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

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

| Unit | Contents |
|---|---|
| 1 | **Cloud Computing Fundamentals:** Definition of Cloud Computing , private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public Vs private clouds |
| 2 | **Virtualization And Cloud Computing:** Role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications, Visualizing Virtualization, Managing Virtualization, Taking Virtualization into the Cloud |
| 3 | **Service Oriented Architecture And The Cloud :** Defining Service Oriented Architecture, Understanding the Coupling, Implementation of Service Oriented Architecture (SOA), Understanding Services in the Cloud, Serving the Business with SOA and Cloud Computing |
| 4 | **Cloud Applications :** Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages |
| 5 | **Management Of Cloud Services:** Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat) |
| 6 | **Application Development:** Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App. |
| 7 | **Cloud It Model:** Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO) |

## Elective Group :( 01) Cloud Computing

| Course Number | Course Name | L-T-P-Credit | Year of Introduction |
|---|---|---|---|
| **504-01-C** | **Cloud Solutions** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
Students will learn different cloud solutions available.

**Course Outcome:**
student will be able

- Design their cloud solution for organization.
- Implement the cloud solutions. And
- Analyze various cloud computing models.

**Reference Books:**

- "AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud" by Mike Ryan , Federico Lucifredi. ,
- "Expert AWS Development: Efficiently develop, deploy, and manage your enterprise apps on the Amazon Web Services platform" Kindle Edition, by Atul Mistry.
- "VMware vSphere 6.5" Cookbook, 3rd Edition Kindle Edition

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

| Unit | Contents |
|---|---|
| 1 | **Coriolis Technologies :** About Coriolis Technologies, storage, virtualization, security,The Colama suite of products, benefits of colama suite, Virtualization of Computer Laboratories, Colama Powered Virtual Computer Laboratory |
| 2 | **vmWare** : what is VmWare, Virtulization with Vmware, VmWare Products,Data Center and Cloud Infrastructure, Networking and Security, SDDC Platform, Storage and Availability, The vmWare Approach to the Cloud, vmWare vSphere 4, Server Consolidation and Containment |
| 3 | **Microsoft :** Exploring Platform as a Service, Putting Platform as a Service Pedestal |
| 4 | **Microsoft :** Integrated Lifecycle Platform, Anchored Lifecycle Platform as a Service Enabling Technologies as a Platform |
| 5 | **Google :** Google App Engine, Details of Google app engine. |
| 6 | **Amazon :** Infrastructure as a Service, Tracing IaaS to ISP, Amazon EC2 |
| 7 | **Other Solutions :** Infrastructure as a Service, Other IaaS Companies, IaaS-Enabling Technology, Issues related to Trust in Cloud, Infrastructure as a Service in a Business Organization |

## Elective Group: Cloud Computing

| Course Number | Course Name | L-T-P-Credit | Year of introduction |
|---|---|---|---|
| 505-01-D | Cloud solutions | 2L+1T+0P=3C | 2018 |

**Course Objective:** Students will learn how to use Amazon web service portal and its services

**Course Outcome:**
Student will be able. Design their cloud solution using AWS. Implement the cloud solutions Using AWS. Practice of AWS applications

**Reference Books:**

- "AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud" by Mike Ryan , Federico Lucifredi. ,
- "Expert AWS Development: Efficiently develop, deploy, and manage your enterprise apps on the Amazon Web Services platform" Kindle Edition, by Atul Mistry.

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

| | |
|---|---|
| 1 | **Getting Started with Amazon Cloud :**<br>Introduction to AWS, AWS history, AWS Infrastructure, AWS ecosystem, Setting up AWS accounts Evaluating Service Level Agreements (SLA) Various AWS Services AWS Management Console The AWS CLI |
| 2 | **Identity Access Management (IAM) :**<br>Introduction to IAM, IAM users and their access, IAM roles and their permission Active Directory Federation Web Identity, Federation IAM Best Practices. Assignment: Configuring IAM users, groups and policies, AWS CLI/SDK access to manage services using Credentials and Roles lab. Programming, management console and storage on AWS Basic Understanding APIs - AWS programming interfaces, Web services, AWS URL naming, Matching interfaces and services, Elastic block store - Simple storage service, Glacier - Content delivery platforms |
| 3 | **Elastic Load Balancing & Auto Scaling :**<br>Components and types of load balancing Auto scaling and its benefits Life cycle of auto scaling Components and policies of auto scaling Assignment - Configure Load Balancer, Auto scaling as per utilization in different situations |
| 4 | **Amazon EC2 :**<br>EC2 Overview Amazon Machine Images(AMI) AMI creation Security groups Key pairs Assigning elastic IP address Elastic IP v/s Public IP Bootstrap Scripts Overview of Amazon EBS , Various login ways from different OS, putty and putty keygen use, Assigning EIP, AMI assignment, Creating and restoring snapshot, snapshot to AMI, EC2 Bootstrapping, Cloudformation & CloudWatch assignments. |
| 5 | **Amazon Simple Storage Service(S3) :**<br>Introduction to S3 Creating an S3 bucket S3 Version Control S3 Lifecycle Management & Glacier S3 Uploading & Downloading S3 durability & redundancy Cloud front overview Create a CDN Security & Encryption Storage Gateway Import & Export using Snowball Cross region replication Static website using S3 Assignment - Creating S3 bucket, S3 ACL, S3 permissions, hosting static website on S3, Cross region replication assignment, S3 lifecycle assignment |
| 6 | **Database Services:**<br>Database overview Amazon Relational Database Service ( RDS) AMI databases Amazon Redshift DynamoDB Amazon ElastiCache AWS Database Migration Service(DMS) Amazon Aurora Assignment - Creating RDS instance, DB backups, RDS Read Replica |
| 7 | **AWS identity services, security and compliance Users, groups,and roles:**<br>Understanding credentials, Security policies, IAM abilities and limitations, AWS physical security - AWS compliance initiatives, Understanding public/private keys, Other AWS security capabilities. |

## Elective Group: (02) Data Analytics

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-02-A** | **Algorithms For Advanced Analytics** | 2L+1T+0P = 3C | 2018 |

**Prerequisite**: Knowledge in basic analytical algorithms

**Course Objective :**

1. Learn concepts and techniques and how to find useful knowledge.
2. Understanding of the topics that can create an ideal analytic environment that is better suited to the challenges of today's analytics demands.
3. Harness the power of high performance computing architectures and data mining, text analytics, and machine learning algorithms.

**Expected Outcome :**

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

This course gives a comprehensive coverage of algorithms specially meant for analyzing data at an in-depth level. Decision trees, Support Vector machines and Neural networks are considered to be highly effective in analyzing complex data.

**References (Books, Websites etc) :**


1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 3rd ed, 2010.
2. Lior Rokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010.
3. Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press, 2006.
4. Vojislav Kecman, "Learning and Soft Computing", MIT Press, 2010.
5. Jared Dean, "Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners", Wiley India Private Limited, 2014.


**Suggested MOOC:** Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

**Syllabus:**

| Unit | Contents |
|---|---|
| 1 | **Predictive Analytics:** Predictive modeling and Analyisis - Regression Analyisis, Multicollinearity , Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and goodness of fit. |
| 2 | **Classification Algorithms:** Issues regarding classification and prediction, Bayesian Classification, Classification by back propagation, Classification based on concepts from association rule mining, Other Classification Methods, Classification accuracy. |
| 3 | **Decision Trees:** Introduction to Decision trees - Classification by decision tree induction – Various types of pruning methods – Comparison of pruning methods – Issues in decision trees – Decision Tree Inducers – Decision Tree extensions. |
| 4 | **Text Analytics:** Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications. |
| 5 | **Support Vector Machines:** Learning and Soft Computing: Rationale, Motivations, Needs, Basics: Examples of Applications in Diverse Fields, Basic Tools of Soft Computing: Neural Networks, Fuzzy Logic Systems, and Support Vector Machines, |

| | |
|---|---|
| 6 | **Computing:**<br>Basic Mathematics of Soft Computing, Learning and Statistical Approaches to Regression and Classification - Support Vector Machines - Risk Minimization Principles and the Concept of Uniform Convergence, The VC Dimension, Structural Risk Minimization, Support Vector Machine Algorithms. |
| 7 | **Neural Networks:**<br>Single-Layer Networks: The Perception, The Adaptive Linear Neuron (Adaline) and the Least Mean Square Algorithm - Multilayer Perceptions: The Error Back propagation Algorithm – The Generalized Delta Rule, Heuristics or Practical Aspects of the Error Back propagation Algorithm. |

## Elective Group:(02) Data Analytics

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-02-B** | **Machine Learning Techniques** | 2L+1T+0P = 3C | 2018 |

**Prerequisite**:
Knowledge in basic analytical algorithms.

**Course Objective :**

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability based learning techniques.
- To understand graphical models of machine learning algorithms.

**Expected Outcome :** Upon completion of this course, the students will be able to:

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the appropriate machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given
- Problem Design systems that uses the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification efficiency

**References (Books, Websites etc) :**


- Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press.
- Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley.
- Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press.
- Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖ , Second Ed., Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,.
- Tom M Mitchell, ―Machine Learning‖ , First Edition, McGraw Hill Education.


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

**Syllabus:**

| Unit | Contents |
|---|---|
| 1 | **Introduction:** Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression. |
| 2 | **Linear Models :** Multi-layer Perception – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perception in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Spines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines. |
| 3 | **Tree And Probabilistic Models:** Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities. |
| 4 | **Basic Statistics:** Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map |

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|---|---|
| 5 | **Dimensionality Reduction And Evolutionary Models :**<br>Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares |
| 6 | **Optimization:**<br>Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process. |
| 7 | **Graphical Models** :<br>Markov Chain Monte Carlo Methods, Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods |

## Elective Group:(02) Data Analytics

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 504-02-C | Weka | 2L+1T+0P = 3C | 2018 |

**Prerequisite**: Knowledge in basic analytical algorithms

**Course Objective :**

- To introduce the basic concepts and various techniques of machine learning
- To give idea about supervised and unsupervised learning techniques.
- The purpose of machine learning is to discover patterns in your data and then make predictions based on those often, complex patterns to answer business questions, and help solve problems. Machine learning helps analyze your data and identify patterns

**Expected Outcome :**

- After Completion of this course students will be able to understand the difference between supervised, unsupervised and semi supervised learning.
- To apply appropriate machine learning algorithms using weka tool to given problem.
- To as per data result requirement to modify existing algorithms for better result.

**References (Books, Websites etc) :**

- Data Mining Concepts and Techniques By Jiawei Han & Micheline Kamber
- Data Mining: Practical Machine Learning Tools and Techniques (The Morgan Kaufmann Series in Data Management Systems) 3rd Edition, Kindle Edition
- An Introduction to Machine Learning Hardcover by Miroslav Kubat (Author)
- An Introduction to weka: Machine Learning in Java by Giorgio Siron

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

**Syllabus:**

| Unit | Contents |
|---|---|
| 1 | **Machine Learning and Weka basics:** Overview about machine learning concepts, Data Cleaning by weka, Major issues of machine learning, core algorithm type, Overview about weka basics , File type, Experimenter and explorer. Bayesian network, neural network, Trees, Rule concepts |
| 2 | **Creating Dataset for Weka:** Creating ARFF, CSV file format, Data Types, Class enumeration, filtering algorithms based on feature type in weka, Interpreting and refining results |
| 3 | **Linear Model:** Classification concepts, how classification works in data sample, Classifying data in weka using classification rules.Concept of Regression, Choose algorithm for regression. Multilayer perception –forward and backward propagation. Support vector machine classification and regression for predictive analysis |
| 4 | **Decision Tree and model:** Decision tree concepts, Attribute selection measures, visual mining for decision tree, rule based classification, Ensemble methods- Bagging and boosting, Random forest method, cross validation concept. |
| 5 | **Dimensionality Reduction And Evolutionary Models:** Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis ,parametric and nonparametric method |
| 6 | **Cluster Analysis using different methods:** Concept of cluster analysis, methods of clustering with constraints, dimensional reduction methods, biclustering, probabilistic model based clustering. |
| 7 | **Knowledge Data Flow:** Create knowledge data flow on data sample, Analysis data flow, Interpret results with weka , Generate the rules on the basis of result. |

## Elective Group:(02) Data Analytics

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-02-D** | **Statistical Computing** | 2L+1T+0P = 3C | 2018 |

**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.

**Expected Outcome :**

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

**References (Books, Websites etc) :**

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

**Suggested MOOC:**Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

**Syllabus:**

| Unit | Contents |
|---|---|
| 1 | **Random Number:** Concept of random number generator, congruential method of generating uniformvariate, Generation of Binomial, Poisson, Geometric, Negative Binomial& Multinomial variate. Proofs of related results. Generation of continuous random variables covering Exponential, Normal, Gamma, Chi-square, Bivariate exponential, Bivariate Normal distributions, and mixture of distributions. |
| 2 | **R – Language:** Introduction to R, elementary programming, application to data analysis, Descriptive statistics, Fitting of Distributions, Cross Tables, Correlations and Regression, Hypothesis Testing, ANOVA. |
| 3 | **Simulation Technique:** Concept of Simulation, advantage, Disadvantage, Phases of Simulation ,Application of Simulation Models, Types of Simulation Models, Random Numbers, Monte-Carlo(Computer) Simulation Procedure for Monto-Carlo Simulation. |
| 4 | **Queuing and Forecasting:** Concept of Queuing, Queuing models, Forecasting techniques, forecasting methods: Subjective For casting, Structural and Economic Model, Determination Models, Moving Average, Regression Average, Least Square Method of curve fitting. |
| 5 | **Statistical Decision Theory:** Concept, state of Nature or Events, Payoff table, Opportunity Loss, Decision Making Environment, Decision Making Under Certainty, Decision Making Under Uncertainty, Maximax, Minimin, Minimax, Laplace Criterion, Hurwicz ,EMV,EOL, EVIP, Bayes Decision rule |
| 6 | **Statistical Applications:** Regression analysis, Paired test, T-test,F-test, Chi test, Decisions Tree, Probability distributions |
| 7 | **Programming in C++:** Concept of OOP, Data types, Variables, Statements, Expressions, Control structures, Looping, Functions, Pointers. Programming for problems based on all Unit . |

## Elective Group: (03) Linux Environment

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| **404-03-A** | **Linux Desktop Environment and Shell Programming** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
The purpose of this course is to have understanding of Linux operating system and environment

**Expected Outcome :**
At the end of the course a student should be able:
To use Linux operating system for configuring the environment.

**Textbook:**

- Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus
- UNIX Concepts and Applications - by Sumitabha Das

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

| Unit | Contents |
|---|---|
| 1 | **Using Shell Interface:**<br>**12** Introduction to Linux<br>**13** Internal and external commands<br>**14** General purpose utilities<br>**15** Navigating the file system<br>**16** Handling ordinary files<br>**Using GUI Environments:**<br>**17** GNOME desktop environment<br>**18** KDE desktop environment |
| 2 | **Using open source office suite**<br>**19** Word processor application<br>**20** Spreadsheet application<br>**21** Presentation application<br>**22** Desktop database application<br>**Using the Internet**<br>**23** World wide web<br>**24** FTP<br>**25** Telnet |
| 3 | **Using Multimedia**<br>**26** Graphics<br>**27** Audio<br>**28** Video |
| 4 | **Introduction to shell**<br>**29** Introduction to 'bash' shell<br>**30** Redirection<br>**31** Pipes<br>**32** Tees<br>**33** Command substitution<br>**34** Introduction to other shells: Korn shell, C Shell etc.<br>**Shell environment**<br>**35** Shell variables<br>**36** Handling the command line arguments<br>**37** Login scripts<br>**38** Terminal characteristics<br>**39** Aliases |

| | |
|---|---|
| 5 | **Text editors**<br>**40** ‘vi’ editor<br>**41** ‘emacs’ editor |
| 6 | **Shell commands**<br>**42** General purpose utilities<br>**43** File management<br>**44** Process management<br>**45** Communication management<br>**Regular expressions**<br>**46** Pattern matching<br>**47** Wild cards<br>**48** Regular expressions<br>**49** Utilities: grep, egrep, fgrep etc.<br>**Filters**<br>**50** Introduction to filters<br>**51** Utilities: pr, head, tail, cut, paste, sort, uniq, nl, tr etc. |
| 7 | **Shell scripting**<br>**52** Introduction to shell scripting<br>**53** Programming constructs<br>**54** Mathematical operators<br>**55** Logical operators<br>**56** String manipulation<br>**57** Interactive scripts<br>**58** Handling command line arguments |

## Elective Group :( 03) Linux Environment

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| 405-03-B | **Linux System Administration** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
The purpose of this course is to have understanding of Linux operating system and system administration

**Expected Outcome :**
At the end of the course a student should be able:
1.To use Linux administration for user management and security.

**Reference books :**
UNIX Concepts and Applications - by Sumitabha Das

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

| Unit No | Contents |
|---|---|
| 1 | **Linux installation:**<br>**59** Introduction to Linux distributions<br>**60** Normal installation |
| 2 | **Linux installation:**<br>**61** Dual boot installation<br>**62** Virtual installation<br>**63** Troubleshooting an installation |
| 3. | **Understanding system administration:**<br>**64** Introduction to the routine activities in system administration<br>**65** Shell commands for system administration<br>**66** Administrative tools<br>**67** Managing file systems and disk space |
| 4. | **Setting up and supporting users:**<br>**68** Managing user accounts<br>**69** Providing support to the users |
| 5. | **Automating system tasks:**<br>**70** Aut System initialization<br>**71** System startup and shutdown<br>**72** Scheduling system tasks omating system tasks: |
| 6. | **Backing up and restoring files:**<br>**73** Backup and restore strategy<br>**74** Backup and restore tools |
| 7. | **Computer security issues:**<br>**75** Password protection<br>**76** Firewalls |

**Elective Group :( 03) Linux Environment**

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| **504-03-C** | **Linux Network Administration** | 2L+1T+0P=3C | 2018 |

**Course Objective:** The purpose of this course is to have understanding of Linux operating system and Network administration.

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

1. To use Linux administration for creation of server and management.

**Reference books :**

1. Linux Administration : A Beginner's Guide, Shah, TMH
2. LINUX: The Complete Reference, Petersen, TMH
3. LINUX Network Administrator's Guide, Kirch,SPD/O'REILLY

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

| Unit No | Contents |
|---|---|
| 1 | **Setup And Manage a Local Area Network:** Basic Networking, Introduction to networking, OSI Model,IP addressing (IPV4, IPV6) & LAN establishment with Linux , Configuring internet in Linux through broadband, dial-up, data card & through mobile (gprs). |
| 2 | **Setup And Manage Proxy Server :** Basics of proxy services, Configuring proxy services, Creating ACL's for controlling access to internet, SQUID: Proxy server setup, Blocking Websites, content filtering, Bandwidth Management |
| 3. | **Setup And Manage FILE Server:** NFS: network file sharing & resource sharing across Linux environment. YUM server: Setting up local YUM, FTP YUM, HTTP YUM, EPEL, REMI & RPMForge like YUM configuration, DHCP:Dynamic Host Configuration Protocol setting up, Allocating IP, Subnet mask, default gateway and hostname, communication with DNS and other protocols. |
| 4. | **Setup And Manage FTP Server**: Basics of File Transfer Protocol., Configuring vsftpd for anonymous ftp service. FTP:Setting up file transfer protocol,user management for FTP,hands on with ftp clients, FTP security (file,user, host,network based). Remote Services:SSH, Telnet & VNC (remote access services) with security(file,user, host,network based). Network Installation: NFS, HTTP, FTP, Kickstart, TFTP SAMBA: Linux to window data sharing along with security (file,user, host,network based) & managing SAMA graphically. Ticket Server: (OS-Ticket & ORTS) installing, configuring and managing. |
| 5. | **Setup And Manage Web Server :** Basics of Web Services, Introduction to Apache, Configuring Apache for main site, Configuring Apache for multiple sites using IP-based, port based and name-based, Web Server: Apache installation, configuring dedicated server, shared server, user based authentication, load balancing and apache tuning. NIS, LDAP: (user's liberty to sit into remote machine) MAIL Server: knowing MUA,MTA& MDA, setting up and configuring POSTFIX,PO3s v/sIMAPs, Squirrel mail, accessing via Outlook, Thunderbird and evolution. Multi/virtual domain management, email security. Postfix Administration. |
| 6. | **Setup And Manage boot Server :** What is booting and boot process of Linux?, Init Process or Run levels |
| 7. | **Setup And Manage DNS Server :** Basics of Internet, Basics of DNS and BIND 9, Configuring DNS primary server, DNS:master DNS, slave DNS with forward & reverse zone, one DNS resolving multiple domain, dynamic DNS etc |

## Elective Group: (03) Linux Environment

| Course Number | Course Name | L-T-P- Credit | Year of introduction |
|---|---|---|---|
| **505-03-D** | **Linux Internals and Network** | 2L+1T+0P=3C | 2018 |

**Course Objective:**

- To get acquainted with Linux kernel and system calls
- To get knowledge about Process and managing process life.
- Build deeper view IPC and its applications.
- To make able to use Signals and threads and using thread library.
- Make them understanding network communications and using API to write socket programs.
- Make them understand about scheduling and memory management.

**Expected Outcome :**

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

1.To use programming for kernel management and networking.

**Suggested MOOC :**

Please refer these websites for MOOC's:

NPTEL / Swayam

www.edx.com

www.coursera.com

| Unit No | Contents |
|---|---|
| 1 | **Introduction**<br>Architecture of Linux, User and Kernel Space, Introduction to System Calls, System Calls in Detail, trace – Tracing system calls. |
| 2 | **Process management**<br>Introduction to Process and process attributes, process vs. Program, Process States, Creating Process, Process termination, process commands Special case of processes. |
| 3. | **Inter Process Communication**<br>Introduction to IPC, Pipe, FIFO, Shared Memory, Advantages and Disadvantages of various IPC mechanisms, Application of IPC |
| 4. | **Working with Signals and Threads**<br>Introduction to Signals, Default disposition of Signals, Handling the Signals, Signal Related Functions<br>Introduction to Threads, Creating Thread, Data handling with Thread , Types of Threads – Thread Attributes, Thread Cancellation , Threads vs. Process |
| 5. | **Thread and Process Synchronization**<br>Threads and resources management, Race condition in multi-threaded applications,writing thread safe code,Mutex, POSIX Semaphores, Usage of Binary semaphores and Mutex<br>Race condition in multi-process applications, Limitations of shared memory, Semaphore Implementation. |
| 6. | **Linux Networking**<br>OSI and TCP/IP models, Addressing in TCP/IP, IPv4 and IPv6 differences, TCP three-way handshake, Network packet analysis in Linux, Networking commands in Linux, Using socket API to implement client server communication, Working with TCP and UDP sockets, Synchronous I/O |
| 7. | **Process and Memory Management**<br>Need of Process scheduler, scheduling algorithms,<br>Memory Management Unit (MMU) introduction, Concept of Virtual memory, using Paging & Page fault, other MMU concepts: Relocation, Protection, Sharing, Logical and physical organization. |

**Elective Group:(04) Open Source Technologies**

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-04-A** | **Python** | 2L+1T+0P=3C | 2018 |

**Course Objective :**
Main objective of this paper is to learn functioning of various commands of Python language. Also study the practical applications in the field of Software development.

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

- Basic familiarity with Python
- Development tools used for the Python programming
- Implementation of OO concepts.

**References (Books, Websites etc) :**
A Python Book: Beginning Python, Advanced Python, and Python Exercises : Dave Kuhlman

**Suggested MOOC :**
Swayam

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **Introduction to Python:** Etc, Lexical matters : Lines, Comments, Names and tokens, Blocks and indentation, Doc strings, Program structure, Operators, Code evaluation |
| 2 | **Built-in Data types :** Numeric types, Tuples and lists, Strings, 1 The new string. format method, Unicode strings, Dictionaries, Files, Other built-in Types, The None value/type, Boolean values, Sets and frozen sets |
| 3 | **Statements:** Assignment statement, import statement, print statement, if: elif: else: statement, for: statement., while: statement., continue and break statements, try: except: statement., raise statement.., with: statement, del, case statement |
| 4 | **Functions, Modules, Packages, and DebuggingFunctions :** The def statement Returning values, Parameters, Arguments, Local variables, Other things to know about functions, Global variables and the global statement, Doc strings for functions, Decorators for functions, lambda Iterators and generators, Modules, Doc strings for modules, Packages |
| 5 | **Classes:** A simple class, Defining methods, The constructor, Member variables, Calling methods, Adding inheritance, Class variables, Class methods and static methods, Properties, Interfaces, New style Classes, Doc strings for classes, Private members |
| 6 | **Extending and embedding Python:** Introduction and concepts, Extension modules, SWIG, Pyrex, SWIG vs. Pyrex, Cython, Extension types, Extension classes |
| 7 | **GUI Applications:** Introduction PyGtk, EasyGUI, Guidance on Packages and Modules, End Matter, |

**Elective Group:(04) Open Source Technologies**

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-04-B** | **Perl Scripting** | 2L+1T+0P=3C | 2018 |

**Course Objective :**

To introduce the basic concepts of Perl Programming and write, modify, and run simple Perl scripts and study working with files and using perl as an object oriented language

**Expected Outcome :**

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

- The syntax and semantics of the Perl language
- how to develop and implement various types of programs in the Perl language
- various forms of data representation and structures supported by the Perl language
- the appropriate applications of the Perl language

**References (Books, Websites etc) :**

- Mastering Perl : Brian, O'Reilly
- www.tutorialspoint.com/perl/index.htm

**Suggested MOOC :** Swayam

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **Perl ─ Introduction :**<br>What is Perl? Perl features , Perl ─ Syntax Overview, Perl ─ Data Types , Numeric Literals String Literals , Perl ─ Variables , Creating Variables, Perl─ Scalars, Scalar Operations<br>Perl ─ Arrays Perl ─ Hashes |
| 2 | **Control Flow and Looping Statement:**<br>if statement ,if else statement, if elsif else statement, unless statement, switch statement, The ? : Operator<br>**Perl ─ Loops :** while loop , until loop<br>for loop, For each loop do while loop nested loops, next statement, last statement, continue statement, redo statement, go to statement, Infinite Loop |
| 3 | **Perl ─ Operators** :<br>What is an Operator? Perl Arithmetic Operators, Perl Equality Operators, Perl Assignment Operators, Perl Bitwise Operators, Perl Logical Operators, Quote-like Operators<br>Perl ─ Date and Time, GMT Time Format, Date & Time, Epoch time, POSIX Function strftime() |
| 4 | **Perl ─ Subroutines :**<br>Define and Call a Subroutine, Passing Arguments to a Subroutine, Passing Lists to Subroutines, Passing Hashes to Subroutines, Returning Value from a Subroutine, Private Variables in a Subroutine, Temporary Values via local(), State Variables via state() Subroutine, Call Context<br>**Perl ─ References :** Create References Dereferencing Circular References, References to Functions<br>Perl ─ Formats Define a Format Using the Format, Define a Report Header Number of Lines on a Page, Define a Report Footer |
| 5 | **Perl ─ File I/O :**<br>Opening and Closing Files, Open Function, Sysopen Function, Close Function, The Operator getc Function, read Function, print Function, Copying Files Renaming a file, Deleting an Existing File Positioning inside a File<br>**Perl ─ Directories :**Display all the Files, Create new Directory, Remove a directory, Change a Directory |

| | |
|---|---|
| 6 | **Perl – Regular Expressions** :<br>Pattern Matching, Match Operator Match Operator Modifiers Matching Only Once Regular Expression Variables. The Substitution Operator Substitution Operator Modifiers. The Translation Operator Translation Operator Modifiers More Complex Regular Expressions Matching Boundaries Selecting Alternatives Grouping Matching. The \G Assertion Regular-expression Examples |
| 7 | **Introduction to Object Oriented Programming in Perl :**<br>Object Basics, Defining a Class Creating and Using Objects, Defining Methods, Inheritance Method Overriding , Default Auto loading, Destructors and Garbage Collection, Object Oriented Perl Example |

**Elective Group:(04) Open Source Technologies**

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-04-C** | **PHP** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
To make students able to design and develop the web based applications and systems.

**Expected Outcome:**
After completion of this course students will able to develop static and dynamic web applications through Word press, PHP and Joomala.

**References (Books, Websites etc) :**

- PHP and MySQL Web Development- Welling Thomson 4th Ed.( Pearson)
- Teach Yourself PHP, MySQL and Apache by Julie C. Meloni (Pearson)

**Suggested MOOC :**
**SWAYAM**

| Unit | Contents |
|---|---|
| 1 | **Introduction To PHP:**<br>Installing and configuring PHP, **Building blocks of PHP:** PHP tags, variables, data types, operators, expressions, constants, **Control Structures:** conditional statements, loops, switch statement |
| 2 | **Working With Functions And Arrays:**<br>**Working with functions:** What is a function? Function declaration and definition, Calling function, user-defined functions, variable scope,<br>**Working with arrays:** Creating, sorting and reordering arrays, PHP classes.<br>**Working with strings, dates and time:** Formatting, investigating and manipulating strings with PHP, using date and time functions in PHP,<br>**Working with forms:** Creating a simple input form |
| 3 | **Working With Files:**<br>Saving data, storing and retrieving Bob's order, processing files, opening file, writing to a file, closing a file, reading from a file, uses other useful file functions. |
| 4 | **Working With Cookies And Sessions:**<br>**Working with cookies:** Introducing cookies, setting and deleting cookies with PHP<br>**Working with session:** starting a session, working with session variables, passing session IDs in the query string, destroying sessions and unsetting variables, using sessions |
| 5 | **MYSQL:**<br>Creating web database: Using MySQL monitor, logging into MySQL, creating databases and users, setting users and privileges, column data types<br>**Working with MySQL database:** Inserting data into database, retrieving data from the database, retrieving data with specific criteria, retrieving data from multiple tables, retrieving data in particular order, grouping and aggregate data, using sub queries, updating records, deleting records from databases, dropping table and database |
| 6 | **Accessing My-SQL Database From Web With PHP** :<br>Web database architecture<br>**Querying database from the web:** checking and filtering input data, setting up connection, Choosing database to use, querying database, retrieving the query result, disconnecting from the database. |
| 7 | **WORDPRESS AND JOOMLA:**<br>**WORDPRESS -** Word press Theme, Integration Adding Pages and posts Manage Widgets, Plug - In Project in Word press<br>**JOOMLA –** Joomla Installation, Template Integration, Adding content (articles management) Adding content (articles management) Project in Joomla |

## Elective Group:(04) Open Source Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-04-D** | **Ruby** | 2L-1T-0P=3C | 2018 |

**Course Objective:**

Main objective of this paper is to learn, object-oriented programming with Ruby, Rails fundamentals and how to create basic online applications. How to work with HTML controls, use models in Rails applications, and work with sessions. Details on working with databases and creating, editing and deleting database records, Methods for handling cookies and filters and for caching pages.

**Expected Outcome:**

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

- Programming experience in an object-oriented language.
- Basic familiarity with HTML important for Rails project.

**References (Books, Websites etc.):**

- Programming Ruby: The Pragmatic Programmers' Guide, Second Edition
- Agile Web Development with Rails, Third Edition
- www.webtechlearning.com

**Suggested MOOC :**

SWAYAM

| Unit | Contents |
|---|---|
| 1. | **Introduction to Ruby :** Creating a first web application, getting started with Ruby, Checking the ruby documentation, working with numbers in ruby, working with strings in ruby. |
| 2. | **Variables and Constants in Ruby :** Storing data in variables, creating constants, interpolating variables in Double-Quoted strings, reading text on the command line, creating symbols in ruby, working with operators, Handling operator precedence, working with Arrays, using Two Array Indices, working with Hashes, working with ranges. |
| 3. | **Conditional Loops, Methods and Blocks:** If Statement, Using the case statement, using loops, creating and calling a method, making use of Scope, working with Blocks |
| 4. | **Classes:** Encapsulation, creating a class, creating an object, basing one class to another, |
| 5. | **Objects:** Understanding Ruby's object Access, overriding method, creating class variables, creating class methods, creating Modules, creating Mixins |
| 6. | **Rails:** Putting Ruby to Rails, introducing Model View Controller Architecture, giving the view something to do, mixing ruby code and HTML inside the view, passing data from an action to a view, escaping sensitive text, adding a second action. |
| 7. | **Building Simple Rails Applications :** Accessing data the user provides, using rails shortcuts for HTML controls, working with models, tying controls to models, initializing data in controls, storing data in sessions |

## Elective Group: (05) Mobile Computing Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-05-A** | **HTML 5** | 2L+1T+0P= 4C | 2018-19 |

**Objectives:**

**Expected Outcome :**

**References (Books, Websites etc) :**

**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<br>▪ Introduction to HTML5<br>▪ Differences between types of HTML(HTML,XHTML,HTML5) |
| Features of HTML5 | ▪ Detection of HTML5 Support<br>▪ Modernizr: An HTML5 Detection Library<br>▪ Canvas<br>▪ Canvas Text<br>▪ Video<br>▪ Video Formats<br>▪ Local Storage<br>▪ Web Workers<br>▪ Offline Web Applications<br>▪ Geolocation<br>▪ Input Types<br>▪ Placeholder Text<br>▪ Form Autofocus<br>▪ Microdata |
| Elements of HTML5 | ▪ The Doctype<br>▪ The Root Element<br>▪ The <head> Element<br>▪ New Semantic Elements in HTML5<br>▪ Headers<br>▪ Articles<br>▪ Dates and Times<br>▪ Navigation<br>▪ Footers |
| HTML Media | ▪ Adding Media to Web Page<br>▪ Video Tag and its attributes<br>▪ Audio Tag and its attributes |
| HTML Graphics | ▪ Introduction to Canvas<br>▪ Simple Shapes<br>▪ Canvas Coordinates<br>▪ Paths<br>▪ Text<br>▪ Gradients<br>▪ Images |
| Geolocation | ▪ Geolocation API<br>▪ Handling Errors<br>▪ geo.js Library |

| | |
|---|---|
| Local Storage for Web Applications | ▪ Evolution of Local Storage<br>▪ Introduction to HTML5 Storage |
| Offline Web Application | ▪ Introduction to Offline Web application<br>▪ The Cache Manifest |
| Web Forms | ▪ Introduction to Web Forms and its elements<br>▪ Placeholder Text<br>▪ Autofocus Field<br>▪ e-Mail Addresses<br>▪ Web Addresses<br>▪ Numbers as Spinboxes<br>▪ Numbers as Sliders<br>▪ Date Pickers<br>▪ Search Boxes<br>▪ Color Pickers |
| CSS3 | ▪ Introduction<br>▪ Basic designs (Color, Background, Padding, Margin, Height/Width)<br>▪ CSS Box-Model<br>▪ CSS Positions<br>▪ CSS Selectors<br>▪ Advanced CSS<br>• Media queries<br>• Transitions<br>• Animations<br>• Flex-box<br>• Gradients |
| Miscellaneous | Introduction to CSS Preprocessors ,SASS & LESS, CSS framework, Bootstrap, Cross browser compatible CSS |

## Elective Group: (05) Mobile Computing Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-05-B** | **JavaScript Programming** | 2L+1T+0P= 4C | 2018-19 |
| **Objectives:** | | | |
| **Expected Outcome :** | | | |
| **References (Books, Websites etc) :** | | | |
| **Suggested MOOC :** Please refer these websites for MOOC's:<br>NPTEL / Swayam ,www.edx.com ,www.coursera.com | | | |
| **Syllabus:** | | | |
| Introduction to Javascript | ▪ JavaScript Overview<br>▪ JavaScript Programming Basics | | |
| Variables and Operators | ▪ Variables and Data Types<br>▪ Operators<br>▪ Array | | |
| Control Statements | ▪ Controlling the Flow: JavaScript Control Statements | | |
| Functions | ▪ Functions | | |
| The Window Object | ▪ The Window Object<br>▪ Dialog Boxes<br>▪ Window functions | | |
| The Document Object | ▪ The Document Object<br>▪ Writing to Documents<br>▪ Document related functions | | |
| Forms and Forms-based Data | ▪ The Form Object<br>▪ Working With Form Elements and Their Properties<br>▪ Event related with form | | |
| Form Validation | ▪ Form Validation: A Process<br>▪ Testing Data<br>▪ Preparing Data for Validation and Reporting Results<br>▪ Validating Non-text Form Objects | | |
| Frames | ▪ HTML Frames Review<br>▪ Scripting for Frames | | |
| The String and RegExp Objects | ▪ The String Object<br>▪ Properties and methods of String Object<br>▪ Using String Object Methods to Correct Data Entry Errors<br>▪ The RegExp Object | | |
| Dates and Math | ▪ The Date Object<br>▪ Properties and methods of Date Object<br>▪ The Math Object<br>▪ Properties and methods of Math Object | | |
| Animation | ▪ Frequently used Animation function<br>▪ Manual and Automated animation. | | |
| AJAX | ▪ Introduction to AJAX<br>▪ Interacting with the Web Server using XMLHttpRequest Object<br>▪ Need of Web server<br>▪ Need of JSON<br>▪ RESTful API with JSON | | |
| JS Frameworks & Libraries | ▪ jQuery<br>• Intro<br>• Effects and animations<br>• DOM/HTML Updates<br>• jQuery and Ajax | | |

## Elective Group: (05) Mobile Computing Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-05-C** | **Android** | 2L+1T+0P= 4C | 2018-19 |
| **Objectives:** | | | |
| **Expected Outcome :** | | | |
| **References (Books, Websites etc) :** | | | |
| **Suggested MOOC :**<br>Please refer these websites for MOOC's:<br>NPTEL / Swayam<br>www.edx.com<br>www.coursera.com | | | |
| **Syllabus:** | | | |
| Introduction to Android | ▪ Evolution of Android<br>▪ Advantages of Android<br>▪ SDK Tools for Android | | |
| Overview of Android Platform | ▪ Android Development IDE Understand the Working of Android<br>▪ The Android Application Framework<br>▪ Screen Layout Design<br>▪ User Interface Design<br>▪ Introduction to Graphics and Animation Design<br>▪ Interactivity<br>▪ Introduction to Content Providers<br>▪ Intent and Intent Filters | | |
| Setting up the Android Development Environment | ▪ Installing Android Development Environment<br>▪ Updating the Android SDK<br>▪ Setting up AVDs and Smartphone Connections | | |
| Introduction to the Android Software Development Platform | ▪ Understanding Java SE and Dalvik Machine<br>▪ The Directory Structure of an Android Project<br>▪ Android XML<br>▪ Android Application Resources<br>▪ Launching an Android Application<br>▪ Creating first Hello Application | | |
| Overview of Android Framework | ▪ Overview of Object Oriented Programming<br>▪ Overview of XML<br>▪ The Anatomy of an Android Application<br>▪ Components of an Android Application<br>▪ Android Intent Objects<br>▪ Android Manifest XML | | |
| Screen Layout Design | ▪ Android View Hierarchies<br>▪ Activity Lifecycle<br>▪ Defining Screen Layouts ( Screen size, pixel density) | | |
| User Interface Design | ▪ Using Common UI Elements<br>▪ Using Menus in Android<br>▪ Adding Dialogs(Date picker, Time picker, Custom Dialog, Alert Dialog) | | |
| Introduction to Graphics Resources | ▪ Introduction to Drawables<br>▪ Using Bitmap Images<br>▪ Using Transitions<br>▪ Creating 9-Patch Custom Scalable Images<br>▪ Playing Video in Android Apps | | |

| | |
|---|---|
| Handling User Interface Events | ▪ An Overview of UI Events<br>▪ Handling onClick Events for all Views<br>▪ Android Touch-screen Events: onTouch<br>▪ Touch-screen's Right-Click Equivalent: onLongClick<br>▪ Keyboard Event Listeners: onKeyUp, onKeyDown<br>▪ Context Menus: onCreateContextMenu<br>▪ Controlling the Focus |
| Understanding Content Providers | ▪ An Overview of Android Content Providers<br>▪ Defining a Content Provider<br>▪ Working with a Database |
| Intents and Intent Filters | ▪ Understanding the Intents<br>▪ Android Intent Messaging via Intent Objects<br>▪ Intent Resolution<br>▪ Using Intents with Activities<br>▪ Android Services<br>▪ 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

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-05-D** | **Hybrid App Development** | 2L+1T+0P= 4C | 2018-19 |

**Objectives:**

**Expected Outcome :**

**References (Books, Websites etc) :**

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

**Syllabus:**

| | |
|---|---|
| Introduction to Mobile App Development (Warm-up) | ▪ Introduction<br>▪ Introduction Types of mobile apps<br>• Web Apps<br>• Native Apps<br>• Hybrid Apps<br>▪ Intro to Web Apps<br>• Concept<br>• Single Page Apps<br>• Progressive Web Apps<br>• Accelerated Mobile Pages<br>• PWA vs AMP<br>▪ Intro to Native Apps<br>• Concept<br>• Pros and Cons<br>▪ Intro to Hybrid Apps<br>• Concept<br>• Pros and Cons<br>• Native vs Hybrid apps<br>▪ Web Or Native Or Hybrid? |
| Getting Started with React Native (Getting in action) | ▪ Introduction to React Native<br>▪ Installing dependencies<br>▪ Installing Node, Python2, JDK<br>▪ The React Native CLI<br>▪ Android development environment<br>▪ Creating a new application<br>▪ Preparing the Android device<br>▪ Running your React Native application |
| More Details (Diving deep) | ▪ Native modules<br>▪ Components<br>▪ ActivityIndicator, Button, Image, ListView, Modal, ProgressBarAndroid, RefreshControl, ScrollView, Slider, StatusBar, Switch, Text, TextInput, ToolbarAndroid, WebView<br>▪ API's<br>▪ Alert, AppState, CameraRoll, Clipboard, DatePickerAndroid, Keyboard, PermissionsAndroid, Settings, Share, StyleSheet, TimePickerAndroid, ToastAndroid, Vibration |

## Elective Group: (06) Dot Net Technologies

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **404-06-A** | **C# Programming** | 2L+1T+0P=4C | 2018 |

**Course Objective :**
The objectives of the course is to introduce Object Oriented Programming using C#, make student to use C# for implementing object- oriented concepts. Make student to create, compile and run object-oriented C# programs using Visual Studio.

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

- Design classes using inheritance and polymorphism.
- Design interfaces, abstract and concrete classes.
- Design Console Based Applications.
- Design applications using event driven programming.
- Write basic LINQ programs.

**References (Books, Websites etc) :**

- C#: The Complete Reference, McGraw-Hill Osborne Media- Herbert Schildt.
- C # Programming- Wrox publication.
- Programming in C# -A Primer. E. Balaguruswamy.

**Suggested MOOC :** 1) Coursera (www.coursera.org)
2) mymooc (www.my-mooc.com)
3) Class Central (www.class-central.com)
4) edX (www.edx.org)
5) Mooc List (www.mooc-list.com

**Syllabus:**

| Unit No. | Contents |
|---|---|
| 1. | **Introduction to C#**<br>The Dot Net Framework, CLR, CLS, CTS, MSIL, Managed Code, Programming Features of C#,<br>Compile and Execution of C# Program, Keywords in C#, Namespaces, Data Types, Declaration and Initialization of Variables, Operators, Type Conversions,<br>If, If…else, switch, The '?:' Operator, The while Loop, The do….while Loop, The for Loop, 'var' Variable. |
| 2. | **Methods and Arrays:**<br>Define Method, Declaring and Calling a Method, Passing Method Parameters (Pass By Value, Pass by Reference), Method Overloading,<br>Define Array, One Dimensional Array (Declaration, Creation and Initialization), Two Dimensional Array, Multidimensional Array, ArrayList Class, Jagged Array,<br>Manipulating Strings, String Methods, Regular Expressions, foreach Loop. |
| **3.** | **Class and Objects:**<br>Basic Principles of OOP, Define a Class, Member Access Modifiers,<br><br>Constructors, Types of Constructors (Default Constructor, Overloaded Constructor, Static Constructor, Private Constructor and Copy Constructor), Destructors,<br><br>'this' Reference, Constant Members, Properties, Auto Implemented Properties, Object Initializer, Collection Initializer, Anonymous Types, Extension Methods,<br><br>Partial Class, Partial Methods, Indexers. |
| 4. | **Inheritance and Polymorphism**<br>Define Inheritance, Types of Inheritance, Method Overriding, Abstract Class, Abstract Methods, Sealed Class and Methods, |

| | |
|---|---|
| | Define Polymorphism, Static Polymorphism: Function Overloading Operator Overloading, Overloadable and Nonoverloadable Operators, Dynamic Polymorphism, Defining Interface, Extending interface, Interface and Inheritance, Explicit Interface. |
| 5. | **Errors and Exception Handling**<br>Types of Errors, Exceptions, Syntax for Exceptions Handling Code, Multiple catch Statements, finally Statement, Nested try Blocks, Throwing Our Own Exception. |
| 6. | **Delegates, Events and LINQ**<br>Define Delegate, Singlecast Delegate, Multicast Delegate, Events, Declaring Events, Introduction to LINQ, LINQ Query Operators, LINQ-SQL, LINQ-Objects, LINQ-Dataset. |
| 7. | **Professional Techniques for C#**<br>Runtime Type Identification, Reflection, Attributes, Generics, Generic Structure, Unsafe code, Iterators Examples. |

## Elective Group: (06) Dot Net Technologies

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **405-06--B** | **ASP.Net with C#** | 3L+1T+0P=4C | 2018 |

**Course Objective:**
The objective of the course is to introduce web programming using C#, make student to use C# for implementing different controls of ASP.Net. To introduce designing and interacting tools such CSS and JavaScript.

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

- Design websites using C# platform
- Work with various controls of ASP.Net
- Work with different states, cookies, themes etc.
- Work with data access controls using different databases.

**References (Books, Websites etc) :**

- ASP.Net: The Complete Reference, Matthew MacDonald
- Professional ASP.Net (4/4.5) in C #- Wrox publication.

**Suggested MOOC:** 1) Coursera (www.coursera.org)
2) mymooc (www.my-mooc.com)
3) Class Central (www.class-central.com)
4) edX *(*www.edx.org*)*
5) Mooc List (www.mooc-list.com

**Syllabus**

| Unit | Contents |
|---|---|
| 1. | **Introduction of ASP.Net:** Introduction to ASP.Net, ASP.Net Architecture, ASP.Net Page Life Cycle, Page Life Cycle Events, ASP.Net Directives. |
| 2. | **Using ASP.Net Rich, Validation, and Navigation Controls:** FileUpload Control, Calendar Control, AdRotator Control, MultiView Control, and Wizard Control Examples. RegularFieldValidator, RegularExpressionValidator, RangeValidator, CompareValidator, CustomValidator, ValidationSummary, Menu, SiteMapPath, TreeView Control. |
| 3. | **Master Pages, CSS, and JavaSricpt:** Working With Master Pages, Nested Master Pages, CSS Overview, Adding Style Sheets into, Web Pages, Editing Styles, Applying Styles to Master Pages, Applying Styles to Web Page, JavaScript Overview, Adding JavaScript files into ASP.Net, Editing JavaScript Files, Applying JavaScripts to Master Pages, Applying JavaScripts to Web Page. |
| **4.** | **State Management:** View State, Hidden Field, Session State, Application State, QueryString, HttpContext, Cookies, Caching, Types of Caching |
| **5.** | **Personalization and Security:** Configuration Overview, Concept of Theme, Applying Themes, Types of Themes- Page Theme and Global Theme, Skins, Security in ASP.Net, Authentication and Authorization Membership and Roles. |
| **6.** | **Data Access in ASP.Net:** Data Source Controls, DataList, DataPager, GridView, DetailsView, FormView, Object Data Sources, ListView, DataPager, Repeater |
| **7.** | **Publishing and Testing Website:** IIS, Configuration of IIS, Setting Application Pool, Publish Website, Testing Website. |

## Elective Group: (06) Dot Net Technologies

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **504-06-C** | **C# Windows Programming** | 3L+1T+0P=4C | 2018 |

**Course Objective:**
The objective of the course is to introduce windows programming using C#, make student to use C# for implementing basic and advanced controls of windows applications. To introduce ADO.Net, XML, and Report Wizards with windows applications.

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

- Design Windows forms applications
- Work with advanced controls of windows forms application
- Work with ADO.Net classes and XML
- Generate reports

**References (Books, Websites etc) :**

- C#: The Complete Reference, McGraw-Hill Osborne Media- Herbert Schildt.
- C # Programming- Wrox publication.
- Programming in C# -A Primer. E. Balaguruswamy.

**Suggested MOOC:**
1) Coursera (www.coursera.org)
2) mymooc (www.my-mooc.com)
3) Class Central (www.class-central.com)
4) edX *(*www.edx.org*)*
5) Mooc List (www.mooc-list.com

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Introduction to Windows Programming:** Overview of Windows Forms, Windows Forms Class Hierarchy, Windows of Visual Studio IDE (Start Page, Menu Bar, Solution Explorer Window, Properties Window, Server Explorer Window, Toolbox, Forms Designer), Dynamic Controls. |
| 2 | **Working with Windows Forms Controls:** Properties, Events and Examples of: Button, Label, LinkLabel, TextBox, RichTextBox, ListBox, ListView, ComboBox, RadioButton, CheckBox, CheckedListBox, DateTimePicker, PictureBox, Timer, ProgressBar, TrackBar, HScrollBar, VScrollBar |
| 3 | **Dialog Controls:** ColorDialog, FolderBrowserDialog, FontDialog, OpenFIleDialog, SaveFileDialog. Examples. |
| 4 | **Menus, MDI and Containers:** ContextMenuStrip, MenuStrip, StatusStrip, ToolStrip, SDI and MDI, Visual Inheritance, GroupBox, Panel, TreeView, SplitContainer, TabControl Examples. |
| 5 | **File Handling using C#:** FileStream, BinaryReader, BinaryWriter, StreamReader, StreamWriter, StringReader, StringWriter, DirectoryInfo, FileInfo Examples. |
| 6 | **Data Access and Data Binding:** ADO.NET Overview, .NET Data Providers, ADO.Net Objects, Connections, Commands, Data Adapters, Data Readers , Data Sets , Data Tables , Data Views , Data Binding, Reports. |
| **7** | **XML with Windows Forms Applications:** XML file, Create XML file, Write data into XML, Read Data from XML file using C#. Update, Filter, and Delete data form XML File. |

## Elective Group: (06) Dot Net Technologies

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **505-06--D** | **Advanced ASP.Net with MVC** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
The objective of the course is to introduce advanced ASP.Net using C#, make student to use C# for implementing advanced features of ASP.Net such JQuery and MVC framework.

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

- Work with web parts and AJAX controls.
- Create and consume web services using C#.
- Work with WPF and WCF.
- Work with JQuery and MVC framework.

**References (Books, Websites etc) :**

- ASP.Net: The Complete Reference, Matthew MacDonald
- Professional ASP.Net (4/4.5) in C #- Wrox publication.
- *Microsoft ASP.NET Step by Step (Microsoft Press)* - G. Andrew Duthrie

**Suggested MOOC:**
1) Coursera (www.coursera.org)
2) mymooc (www.my-mooc.com)
3) Class Central (www.class-central.com)
4) edX *(*www.edx.org*)*
5) Mooc List (www.mooc-list.com

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **ASP.Net Web Parts:** Introduction, Advantages of Web Parts, WebPartsManager, CatalogPart, PageCatalogPart, EditorPart, WebPartZOne, EditorZone, CatalogZone Controls. |
| 2 | **ASP.Net AJAX:** AJAX control toolkit, Building a ASP.NET Page with Ajax ScriptManager Control, UpdatePanel Control, UpdateProgress Control, Timer Control. |
| 3 | **ASP.Net Web Services:** Introduction to Web services, Creating Web Services, Setting the Web Service Attributes, Test and Run Web Services, Consuming Web Services. |
| 4 | **Windows Presentation Foundation:** Overview of WPF, Creating Simple Program in WPF, WPF-Command line, WPF-Data Binding, WPF-Resources, and WPF-Templates. |
| 5 | **Windows Communication Foundation:** Overview of WCF, WCF-architecture, Creating WCF Service, Hosting WCF Service, Types of Hosting WCF Service, Consuming WCF Services. Difference between WCF and Web Services. |
| 6 | **JQuery:** Introduction to JQuery, Features, JQuery Selectors, Working of JQuery, JQuery UI Library, Document Ready Event, Events Handling, Effects Methods. |
| 7 | **Working with MVC:** Introduction to .Net MVC Framework, MVC Framework Features, MVC Architecture, MVC Components, MVC Application Folders, Configuration files- global.asax, packages.config, web.config, Working with Views, Woking with Controls. |

## Elective Group: (07) Net Centric Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-07-A** | **HTML5** | 3L+1T+0P=4C | 2018 |

**Course Objective:**

- Understand the Concepts of HTML 5 & the Applications of HTML 5 to Website Development.
- Design and Develop Websites for various Business Applications.
- Check information inputted into a Database and validate it.

**Pre-requisites:** Basic concepts of Languages and HTML tags with functions.

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

- The Learners will be able to write HTML 5 code for developing website applications.
- The websites developed can be uploaded and implemented for the business areas .

**References (Books, Websites etc.):**


- Bruce Lawson, Remy Sharp –Introducing HTML 5.0 –Google Books 2010.
- Jeffrey Zeldman and Jeremy Keith "HTML 5 for Webdesigners –Google Books-2010.
- Book by Brian Albers, Frank Salim, and Peter Lubbers "Pro HTML 5.0 Programming
- Christopher Murphy,Divya Manian,and Richard Clark:Beginning HTML5 and CSS3.2012


**Suggested MOOC:**

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

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Introduction to HTML:** MIME Types, Standards for the Internet, Evolution of HTML, Introduction to XHTML, Introduction to Working Group, W3C |
| 2 | **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 |
| 3 | **Elements of HTML5:** The Doctype, The Root Element, The <head> Element, New Semantic Elements in HTML5, Handling of Unknown Elements by the Browsers, Headers, Articles, Dates and Times, Navigation, Footers |
| 4 | **Drawing Surface:** Introduction to Canvas, Simple Shapes, Canvas Coordinates, Paths, Text,Gradients, Images |
| 5 | **Video on the web** Video Containers, Video Codecs, Audio Codecs |
| 6 | **Geolocation and Local Storage for Web Applications** Geolocation API, Handling Errors, geo.js Library, Evolution of Local Storage, Introduction to HTML5 Storage |
| 7 | **Web Forms and Offline Web Application** Introduction to Web Forms, Placeholder Text, Autofocus Field, e-Mail, Addresses, Web Addresses, Numbers as Spinboxes, Numbers as Sliders, Date Pickers, Search Boxes, Color Pickers, Introduction to Offline Web application, The Cache Manifest |

## Elective Group: (07) Net Centric Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-07-B** | **JavaScript Programming** | 2L+1T+0P=3C | 2018 |

**Course Objective:**

- Understand the JavaScript language & the Document Object Model.
- Alter, show, hide and move objects on a web page.
- Check information inputted into a form.
- Javascript allows programming to be performed without server interaction.
- Javascript can respond to events, such as button clicks.
- Javascript can validate data before sending out a request.
- Javascript can adjust an HTML document for special effects

**Pre-requisites:**

Computer. Pre-requisite / Target Audience: An intermediate knowledge on Java and Advanced Java Technology.

**Expected Outcome :**

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

- The Learners will be able to write Java Script code for developing website applications.
- The websites developed can be uploaded and implemented for the business areas in java Script Code.

**References (Books, Websites etc.):**

1. Danny Goodman Michael Morrison Paul Novitski Tia GustaffRayl, "Javascript Bible" , 7th Edition Wiley India Pvt Ltd.
2. Kogent Learning Solutions Inc, "Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX , " Dreamtech Press.
3. Fritz Schneider,Thomas Powell ,"JavaScript : The Complete Reference", 2nd Ed.(TM

**Suggested MOOC:**

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

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Introduction to Javascript:** JavaScript Overview , Comparison between Java, JavaScript & VB Script, JavaScript Programming Basics |
| 2 | **Variables and Operators:** Variables and Data Types , Using Variables and Literals , Operators |
| 3 | **Introduction to Objects, Methods and Events** Objects, Methods, and Events, Events and Program Flow, Jumping Right In, Running Scripts. |
| 4 | **Control Statements** Controlling the Flow: JavaScript Control Statements |
| 5 | **Understanding Functions** Built in Functions , Standard Date and Time Functions |

| | |
|---|---|
| 6 | **The Window Object**<br>The Window Object, Dialog Boxes , Status Bar Messages , Window Manipulations<br><br>**The Document Object**<br>The Document Object, Writing to Documents, Dynamic Documents<br><br>**Dates and Math Objects**<br>The Date Object , Using and Manipulating Dates , The Math Object , Doing Math with JavaScript |
| 7 | **Frames , Forms and Forms-based Data and Form Validation .**<br>HTML Frames Review, Scripting for Frames, The Form Object , Working With Form , Elements and Their Properties, Form Validation: A Process , Testing Data , Preparing Data for Validation and Reporting Results , Validating Non-text Form Objects<br>**The String and RegExp Objects**<br>The String Object , Using String Object Methods to Correct Data Entry Errors , Creating Dynamic Effects with Substring Methods , The RegExp Object |

## Elective Group: (07) Net Centric Technologies

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-07-C** | **AJAX Programming** | 2L+1T+0P=3C | 2018 |

**Course Objective:**

- Understand the Concepts of AJAX Programming & the Applications of AJAX to Website Development.
- Design and Develop Websites for various Business Applications using AJAX Programming.
- Check information and handle database in websites.

**Pre-requisites:** Computer. Pre-requisite / Target Audience: An intermediate knowledge on Programming Languages and its structure for developing professional websites.

**Expected Outcome :**

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

- Concepts of AJAX Programming and its Applications to website Development.
- Design and develop professional web applications in the business domain.

**References (Books, Websites etc.):**

- Ajax: The Definitive Guide: Interactive Applications by Anthony T. Holdener -2014.
- Kris Hadlock "Ajax for Web Developers Amazon Books 2012.
- Ajax: The Complete Reference by Thomas A. Powell-Amazon Books 2013
- Website :- https://www.amazon.com/Learn-JavaScript-Ajax-w3Schools-W3Schools/dp/0470611944/

**Suggested MOOC:**

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

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Introduction to AJAX:** Introduction to Web Architecture, Traditional Web Communication Processes and Technologies , Introduction to AJAX |
| 2 | **Interacting with the Web Server using XMLHttpRequest Object:** Introduction to Interaction with Web Server, Create an XMLHttpRequest Object, Interact with the Web Server |
| 3 | **Working with PHP and AJAX:** Introduction to PHP , Process Client Requests , Accessing Files Using PHP |
| 4 | **Manipulating XML Data:** Basics of XML , Create an XML Document Using DOM , Retrieve Data from XML |
| 5 | **Working with XSLT and AJAX:** Basics of XSLT , Transform Responses Using XSLT |
| 6 | **Working with JSON:** Introduction to JSON Format, Create Data in JSON Format , Implement JSON on the Server Side |
| 7 | **Using Frameworks in AJAX:** Understand AJAX Frameworks , Use Prototype and Script.aculo.us , Use jQuery **Applying Basic AJAX Techniques** Download Images Using AJAX, Auto-Populate Select Boxes **Implementing Security and Accessibility in AJAX Applications** Create Secure AJAX Applications , Create Accessible Rich Internet Applications |

## Elective Group: (07) Net Centric Technologies

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **505-07-D** | **Web Services** | 2L+1T+0P=4C | 2018 |

**Course Objective:**

- Understand the Concepts of Web services the Applications for Website Development.
- Design and Develop Websites for various Business Applications using XML
- Check and Validate information inputted into a Database and validate it.

**Pre-requisites:** Computer. Pre-requisite / Target Audience: An intermediate knowledge on XML

**Expected Outcome :**

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

- Learners will be able to write code in XML and Understand the basic concepts of web services .
- The programmes written can be implemented for business applications using XML and apply web services in different areas of business .

**References (Books, Websites etc.):**


- Book by Ethan Cerami Web Services Essentials Amazon Books 2014.
- Book by Eric Newcomer Understanding Web Services: XML, WSDL, SOAP, and UDDI-Amazon Books 2013.
- Erik T. Ray "Learning XML Google Books 2015.
- **Website :-** https://www.w3schools.com/xml/default.asp


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

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **XML Technology Family:**Introduction to XML, Advantages of XML, EDI, Databases for Web, XML Based Standards, Structuring with Schemas: DTD, XMLSchemas , XML Processing: DOM, SAX , Presentation Technologies: XSL, XFORMS, XHTML Transformation: XSLT, XLINK, XPATH, XQuery |
| 2 | **Architecting Web Services:**Business Motivations for Web Services , Technical Motivations for Web Services, Limitations of CORBA and DCOM, Service Oriented Architecture (SOA), Architecting Web Services, Implementation View: Web Services Technology Stack, Logical view: Composition of Web Services, Deployment View: From Application Server to Peer to Peer, Process View: Web Service Lifecycle |
| 3 | **Building Blocks of Web Services:** Transport Protocols for Web Services, Messaging with Web Services, Protocols for Web Services, SOAP, WSDL, UDDI |
| 4 | **Creation of Web Services:** Web Services using .Net, Web Services using J2EE |
| 5 | **Implementing XML in e-Business:** B2B Applications, B2C Applications, Different types of B2B Interactions, Components of e-Business XML Systems, ebXML, RosettaNet, Applied XML in Vertical Industry: Web Services for Mobile Devices |
| 6 | **XML Content Management:**Semantic Web, Role of Metadata in Web Content, Resource Description Framework: RDF Schema, Architecture of Semantic Web, Content Management Workflow: XLANG, WSFL |
| 7 | **Security in Web Services:**Meeting Security Requirements, XML Encryption, Client / Server Security Issues |

## Elective Group:(08) Information Systems

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-08-A** | **Enterprise Resource Planning** | 2L+1T+0P=3C | 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,(MGH) Int.Ed.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 :**<br>**(a)** Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System<br>**(b)** ERP System Options and Selection<br>**(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:**<br>Improvement opportunities , IT Maintenance, Business Needs , Business Priority , Maintenance Cost , User Training, ERP Solutions |
| 6 | **ERP & Information System:**<br>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 :**<br>ERP for Finance , Manufacturing , Supply Chin and Quality Management for any Business Organization |

## Elective Group:(08) Information Systems

| Course Number | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| **405-08-B** | **E-Commerce** | 2L+1T+0P=3C | 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,( MGH)
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**<br>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:**<br>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:**<br>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:**<br>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**<br>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**<br>Website Development , Online Transactions and Payments , Security Issues in E-Commerce website |
| 7 | **Case Studies on E-Commerce :-**<br>Amazon , Flip kart , Myantra |

## Elective Group:(08) Information Systems

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-08-C** | **Recommender System** | 2L+1T+0P=3C | 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:**<br>Collaborative Recommendation: User Based Nearest Neighbor recommendation, Item Based Nearest Neighbor recommendation, model based and pre-processing based approaches. Recent practical approaches and systems.<br>Content based Recommendation: content representation and content similarity, similarity based retrieval, other text classification methods,<br>Knowledge Based Recommendation: Knowledge representation and reasoning, interacting with constraint based recommenders, interacting with case based recommenders, |
| 2 | **Hybrid recommendation approaches:**<br>Opportunities for hybridization, Monolithic hybridization design, parallelized hybridization design, pipelined hybridization design, |
| 3 | **Evaluating recommender systems :**<br>General properties of Evaluation research, popular evaluation designs, evaluation on historical datasets, alternate evaluation design |
| 4 | **Recent developments:**<br>Attacks on collaborative recommender systems, Online consumer decision making |
| 5 | **Recommender systems and the next-generation web**<br>Recommendations in ubiquitous environments. |
| 6 | **Explanations in recommender systems**<br>Explanations in constraint-based recommenders, explanation in case based recommenders, explanation in collaborative filtering recommenders. |
| 7 | **Case studies on Recommender System.** |

## Elective Group:(08) Information Systems

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-08-D** | **Knowledge Management** | 2L+1T+0P=3C | 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,


**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 |

## Elective Group:(09) Internet Of Things

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-09-A** | **IoT Architecture And Protocols** | 2L+1T+0P=3C | 2018 |

**Course Objective:** The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations

**Expected Outcome :** At the end of the course a student should be able:
1.To Understand the Architectural Overview of IoT
2. To Understand the IoT Reference Architecture and Real World Design Constraints
3. To Understand the various IoT Protocols ( Datalink, Network, Transport, Session, Service)

**References:**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer 46.
http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm

**Text Books:**

- Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014.

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

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management |
| 2 | Architecture of IoT<br>1. Hardware<br>2. Software<br>Reference Model and architecture, IoT reference Model - IoT Reference ArchitectureIntroduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. |
| 3 | IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS (12 hours) PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), |
| 4 | WirelessHART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP |
| 5 | Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) |
| 6 | Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT |
| 7 | SERVICE LAYER PROTOCOLS & SECURITY - Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer |

## Elective Group: (09) Internet Of Things

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-09-B** | **Sensors and Fundamentals with Hands-on lab Node.js/Raspberry PI/Python** | 2L+1T+0P=3C | 2018 |

**Course Objective:** The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations

**Expected Outcome :** At the end of the course a student should be able:
1.To Understand the basics of Python and node js to interface with sensors

**REFERENCES:**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm

**Text Books:**

- Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications

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

### Course Plan

| Unit | Contents |
|---|---|
| 1 | Sensing and Measurements<br>0-5 Voltage<br>Analog I/O<br>Pulse Width Mode<br>I2C Communication |
| 2 | Sensor Types, Classification<br>Visual, Fleet Tracking sensors<br>Wiring Basics |
| 3 | Practical :Working with Temperature,Humidity, Light & Motion Detector,Promity Sensor |
| 4 | Edge Devices & Gateway Devices With hands-on using Raspberry PI using Node.js/Python<br>Introduction to Edge Devices<br>Wired, Wireless Communications<br>Serial Port/UART<br>BLE/WIFI<br>Introduction to Arduino [Serial port communication]<br>Introduction to ESP32 [WIFI/BLE Device] (Micro Controller for Edge Devices)<br>Hands-on using C [Arduino], Embedded JavaScript [ESP] |
| 5 | Actuators and Controllers with Hands-on using Raspberry PI with Node.js/Python<br>Actuators and Controllers<br>Controllers Introduction<br>Buzzer<br>Relay Switches<br>Servo Motors |
| 6 | Gateway with Raspberry PI<br>Gateway Introduction<br>Needs for Gateway, Roles of Gateway<br>Edge/Gateway Connectivity |
| 7 | Raspberry PI, Single Board Linux Computer<br>WIFI/BLE Communication with Edge Devices<br>Hands on using Node.js/Java/C#/Python based on training needs |

## Elective Group:(09) Internet Of Things

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| 504-09-C | **Internet Of Things: Sensing And Actuator Devices** | 2L+1T+0P=3C | 2018 |

**Course Objective:**

The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics

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

1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved
2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
3. Market forecast for IoT devices with a focus on sensors
4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

**References:**


1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights ,2014
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market
4. Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm


**Text Books:**


- Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014.


**Suggested MOOC :**

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

| Course Plan | |
|---|---|
| **Unit** | **Contents** |
| 1 | Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device |

| | |
|---|---|
| 2 | SEVEN GENERATIONS OF IOT SENSORS TO APPEAR Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics– Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics– Polytronics Systems – Description & Characteristics– Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap |
| 3 | TECHNOLOGICAL ANALYSIS - Wireless Sensor Structure–Energy Storage Module– Power Management Module–RF Module–Sensing Module |
| 4 | IOT DEVELOPMENT EXAMPLES:ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks - Focus on Wearable Electronics |
| 5 | - PREPARING IOT PROJECTS (9 hours) Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - |
| 6 | External representation of sensor values - Exporting sensor data - Creating the actuator projectHardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states |
| 7 | - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera |

## Elective Group: (09) Internet Of Things

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-09-D** | **Smart city use case, MQTT, Integrating on Cloud** | 2L+1T+0P=3C | 2018 |

**Course Objective:** The purpose of this course is to impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics.

**Expected Outcome :**
At the end of the course a student should be able to upload IoT application on cloud.

**REFERENCES:**


1.Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors OvidiuVermesan Peter Friess,'Internet of Things -From Research and Innovation to Market
4. Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm

**Text Books:** Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014.


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

### Course Plan

| Unit | Contents |
|---|---|
| 1 | LoRA, LoRAWAN - Smart City Use Cases<br>Working with Smart City Solutions<br>Problem understanding<br>Introduction to LoRA |
| 2 | LoRA Hardware and bandwidth<br>Communication between Lora Devices, |
| 3 | LoRA Gateway, LoRAWAN<br>WIFI vs BLE vs ZigBee vs LoRA |
| 4 | IoT and Cloud<br>IoT and Cloud introduction |
| 5 | Data ingestion using MQTT |
| 6 | Understanding Device Management<br>Device Security |
| 7 | Device Connectivity<br>MQTT<br>MQTT Introduction<br>Brokers<br>Publish/Service<br>Topics<br>QOS [0, 1, 2 levels]<br>MQTT Message Format<br>Messaging, Ack format<br>Payload<br>Security [TLS, User Authentication]<br>MQTT Authorization |

## Elective Group:(10) Big Data

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-10-A** | **Business Intelligence Applications** | 2L-1T-0P= 3C | 2018 |

**Course Objective :**
To introduce learner with Business Intelligence Concept, decision making by Business Intelligence Tools on Applications such as Finance, Marketing, Education etc.

**Pre-requisites:** Preliminary knowledge of computer, Big Data Analysis and Business Intelligence.

**Expected Outcome :**

- Good knowledge of Business Intelligence Tools.
- Knowledge of Decision making using analysis on the Big Data using Excel Tools.
- Case Studies: Knowledge about different applications used in industries.

**Reference Books :**
1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo
2. Business Intelligence Strategy-John Boyer, Bill Frank, Brain Green, Tracy Harris

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **Introduction To Business Intelligence Applications:** Introduction to Big Data, Business Intelligence Data Mining, and Data Warehousing, What are Business Intelligence Applications (BIA). Features of BIA. |
| 2 | **Sales, Finance And Marketing:** Introduction to Sales, Finance and Marketing Concept, features of Sales, features of Finance, features of Marketing, Use of Business Intelligence in Sales, Finance and Marketing in any Organization, Case Study. |
| 3 | **Education And Learning:** Introduction to Education System, Learning Concept, Difficulties in Education Systems, Use of Business Intelligence for Education and Learning, Case Study. |
| 4 | **Vertical Ai Applications:** Overview of AI, What is Vertical AI, Features of Vertical AI, Use of Business Intelligence in Vertical AI, Case Study. |
| 5 | **Security:** Define Security, Security in Big Data, Problems with Security, Business Intelligence for Security, Case Study. |
| 6 | **Lifescience:** Introduction to Life Science, Life Science Intelligence, Features of Life Science Intelligence, Use of Life Science Intelligence in Decision Making, Case Study. |
| 7 | **Ad Optimisation:** Define Optimization, Introduction to Ad Optimization, Uses of Ad Optimization for Industry, Use if Business Intelligence in Ad Optimization, Case Study. |

## Elective Group: (10) Big Data

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-10-B** | **Business Intelligence Tools** | 2L-1T-0P= 3C | 2018-2019 |

**Course Objective :**

To introduce learner with Big Data Concept. Using different Advance Excel Functions (like Optimization) and implementing it on Big Data for decision making. By solving Case Studies the students will get real example of using BI Tools in industry. To introduce learner with Business Intelligence Concept, decision making by Business Intelligence Tools on Applications such as Finance, Marketing, Education etc.

**Pre-requisites:** Preliminary knowledge of computer, Big Data Analysis and Business Intelligence.

**Expected Outcome :**

***** Good knowledge of Business Intelligence Tools.
***** Knowledge of Decision making using analysis on the Big Data using Excel Tools.
***** Case Studies: Knowledge about different applications used in industries.

**Reference Books :**

- Tutorials Point for advance Excel Tools.
- Excel 2010 Bible by John Walkenbach, John Wiley & Sons, 2010 Edition.
- https://office.live.com/start/Excel.aspx
- https://www.talend.com/

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **Introduction To Big Data:**<br>**Overview of** - Data Mining, Data Warehousing, Big Data, How Business Intelligence is useful for Big Data, Big Data Problems. |
| 2 | **Introduction To Business Intelligence:**<br>Introduction to BI, **Data Cleaning-** Editing a Workbook, Data Cleaning Using Text Function Using Validation To Keep Data Clean, **Working with Multidimensional Data-** Pivot Table Pivot Charts. |
| 3 | **Applications Of Business Intelligence:**<br>CRM Domain, Banking Domain, Health Care Domain, Mobile Industry Domain, Creation of a New Product, Providing Personalized Services |
| 4 | **Optimization Modeling With Solver:**<br>Introduction to MS-Excel and MS-Excel Formulas, Understanding Optimization Modeling, Setting Up a Solver Worksheet, Solving an Optimization Modeling Problem, Reviewing the Solver Reports |
| 5 | **Working With Solver:**<br>Working With the Solver Options, Setting a Limit on Solver, Understanding the Solver Error Messages, Case Studies (Solver Problems). |
| 6 | **Advance Excel Tools:**<br>**Using Shared Work Books-** Sharing a workbook, Opening and editing a shared workbook, Tracking changes, Resolving conflict in a shared workbook, Multiple workbooks- Linking workbooks, Editing the Link, Consolidating the workbook. |
| 7 | **Working With Macros:**<br>Introduction to Macros? Where are Macros, Features of Macros, **Working with Macros-** Display the developer Tab, Changing Macro security Settings, Recording and running a Macro. |

## Elective Group: (10) Big Data

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-10-C** | **Introduction to Big Data** | 2L-1T-0P= 3C | 2018 |

**Course Objective :**
To introduce learner with Big Data Concept, decision making by doing analysis on the data and managing the data using Big Data Tools like Apache Hadoop, Pig and Hive. What are the problems of Big Data and how it can be solved by different tools.

**Pre-requisites:** Preliminary knowledge of computer, Data Mining, Data Warehousing Concepts.

**Expected Outcome :**

- Good knowledge of Big Data Concepts
- Knowledge of Decision making using analysis on the Big Data
- Introduction to Big data Tools like Hadoop and Weka.

**Reference Books :**
1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo
2. Edureka lectures **Link:-** https://www.youtube.com/watch?v=A02SRdyoshM

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **Introduction:**<br>Big Data History, The Big Data Business Opportunity- Business Transformation Imperative, Big Data Business Model, Business Impact of Big Data |
| 2 | **Big Data In Organization:**<br>Data Analytics Lifecycle, **Data Scientist Roles and Responsibilities** – Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, New Organizational Roles, Liberating Organizational Creativity. |
| 3 | **Decision Theory And Strategy:**<br>Business Intelligence Challenge, Big Data User Interface Ramifications, Human Challenge of Decision Making, **Strategy for Decision Making**- Big Data Strategy Document, Case Study. |
| 4 | **Value Creation Process:**<br>Understanding Big Data Value Creation, Value Creation Drivers, **Michael Porter's Value Creation Models**- Michael Porter's Five Forces Analysis, Michael Porter's Value Chain Analysis, Case Study. |
| 5 | **Big Data User Experience:**<br>The Unintelligent User Experience, Understanding the Key Decisions to Build a Relevant User Experience, Using Big Data Analytics to Improve Customer Engagement, Uncovering and Leveraging Customer Insights, Big Data can Power a New Customer Experience. |
| 6 | **Big Data Use Cases:**<br>**The Big Data Envisioning Process** –1. Research Business Intiatives, 2. Acquire and Analyze your Data, 3. Brainstorm New Ideas , 4. Prioritize Big Data Use Cases, 5. Document Next Steps, The Prioritization Process. |
| 7 | **Big Data Architecture:**<br>New Big Data Architecture, **Introducing Big Data Technologies** – Apache Hadoop, MapReduce, R, WEKA etc. |

## Elective Group: (10) Big Data

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-10-D** | **HADOOP** | 2L-1T-0P= 3C | 2018 |

**Course Objective :**

To introduce learner with HADOOP Tool for Business Intelligence, decision making by doing analysis on the data using HADOOP Tool and also managing the Big Data using HADOOP.

**Pre-requisites:** Preliminary knowledge of computer, Big Data Analysis and Business Intelligence. Also students must know Core Java, C Programming and Data Structure Languages.

**Expected Outcome :**

- Good knowledge of HADOOP Tool.
- Knowledge of Decision making using HADOOP analysis on the Big Data
- Hands-on Big Data tools- Hadoop, Pig, Hive, HBase

**Reference Books :**

1. Big Data- Understanding How Big Data Power Big Business –By Bill Schmarzo
2. www.tutorialspoint.com

**Course Plan**

| Unit | Contents |
|---|---|
| 1 | **BIG DATA Overview** :<br>What is Big Data?, What Comes Under Big Data?, Benefits of Big Data, Big Data Technologies Operational vs. Analytical Systems, Big Data Challenges. |
| 2 | **Introduction To HADOOP**:<br>Hadoop Architecture, MapReduce, Hadoop Distributed File System, How Does Hadoop Work?, Advantages of Hadoop. |
| 3 | **HDFS Overview:**<br>Features of HDFS, HDFS Architecture, Starting HDFS, Listing Files in HDFS, Inserting Data into HDFS, Retrieving Data from HDFS, Shutting Down the HDFS. |
| 4 | **MAPREDUCE:**<br>What is MapReduce?, The Algorithm for MapReduce, Inputs and Outputs (Java a Perspective), Analyze different use-cases where MapReduce is used, Differentiate betwee traditional way and MapReduce way. |
| 5 | **Introduction To Hadoop Features:**<br>New Big Data Architecture, Introducing HADOOP Features – Apache Hive, Apache HBase, Pig. |
| 6 | **Multi Node Cluster:**<br>Multi Node Cluster, Install Java, Creating User Account, Mapping the Nodes, Installing Hadoop, Configuring Hadoop, Start Hadoop Services, Adding New Data Node in the Hadoop Cluster, Removing New Data Node from the Hadoop Cluster. |
| 7 | **Environment Setup:**<br>Pre-installation Setup, Installing Java Downloading Hadoop Hadoop Operation Modes Installing Hadoop in Standalone Mode Installing Hadoop in Pseudo Distributed Mode Verifying Hadoop Installation, Implement basic Hadoop commands on terminal. |

## Elective Group: (11) Cyber Security

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **404-11-A** | **Introduction to Linux** | 2L+1T+0P=4C | 2018 |

**Course Objective:**
Introduce the learner to Linux environment

**Expected Outcome :**
Practical understanding of Linux environment

**References (Books, Websites etc) :**
Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus

**Suggested MOOC :**
SWAYAM

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | Installation of Kali-Linux, Understanding Kali Linux |
| 2 | **Using Shell Interface**<br>Introduction to Linux, Internal and external commands, General purpose utilities, Navigating the file system, Handling ordinary files |
| 3 | **Using GUI Environments**<br>GNOME desktop environment, KDE desktop environment |
| 4 | **Using open source office suite:**<br>Word processor application , Spreadsheet application, Presentation application, Desktop database application |
| 5 | **Using the Internet**<br>World wide web, FTP, Telnet |
| 6 | **Using Multimedia**<br>Graphics, Audio, Video |
| 7 | **Shell commands**<br>General purpose utilities, File management , Process management, Communication management |

## Elective Group: (11) Cyber Security

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **405-11-B** | **Information Security Concepts** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
Introduce the learner to concepts involved in Information Security domain

**Expected Outcome :**
Theoretical understanding of Information Security Concepts

**References (Books, Websites etc) :**
CEH Study Guide - Sybex

**Suggested MOOC :**
SWAYAM

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Information Security Concepts:** Confidentiality, Integrity and Availability of Information, Identification, Authentication and Authorization, Security Principles and Models |
| 2 | **Physical Security:** Facility Requirement, Perimeter Security, Fire Protection, Fire Suppression, Power Protection, General Environmental Protection, Equipment Failure Protection |
| 3 | **Network Security:** Secure Network design, Firewalls, WLAN Security, VPNs, Types and Sources of Network Threats |
| 4 | **Operating System Security:** Windows, Linux/UNIX |
| 5 | **Database Security:** MS SQL |
| 6 | **Web Application Security:** Web Application Vulnerabilities, Secure Coding Techniques, Continuous Security Testing and Assessments |
| 7 | **Compliance Standards :** IT Act, ISO 27001, ITIL Framework |

## Elective Group: (11) Cyber Security

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **504-11-C** | **Information Security Threats** | 2L+1T+0P=4C | 2018 |

**Course Objective:**
Introduce the learner to threats involving Information Systems

**Expected Outcome :**
Practical understanding of threats involving Information Systems

**References (Books, Websites etc) :**
CEH Study Guide - Sybex

**Suggested MOOC :**
SWAYAM

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Introduction to Information Security Threats**<br>TCP/IP Fundamentals , Operating System Fundamentals , Web Application and Database Fundamentals , Introduction to Ethical Hacking, Advanced Persistent Threats |
| 2 | **Information Gathering:**<br>Footprinting, Advanced Google Hacking, Nmapping the network, Fingerprinting |
| 3 | **Exploitation:**<br>Hacking Networks, Hacking Servers, Hacking Databases, Password Cracking |
| 4 | **Advanced Exploitation:**<br>Hacking WLANs, Evading IDS, Firewalls, Web Application Hacking, Advanced Web Hacking, Hacking Web Browsers |
| 5 | **Social Engineering:**<br>Introduction to Social Engineering, Common Types of Attacks, Online Social Engineering |
| 6 | **Cryptography:**<br>Introduction to Cryptography, Encryption and Decryption, Cryptographic Algorithms, Digital Signature, Cryptography Tools, Cryptography Attacks |
| 7 | **Malware Attacks:**<br>Viruses, Worms, Trojans |

## Elective Group: (11) Cyber Security

| Course Number | Course Name | L-T-P- Credits | Year of Introduction |
|---|---|---|---|
| **505-11-D** | **Information Security Administration** | 2L+1T+0P=3C | 2018 |

**Course Objective:**
Introduce the learner to concepts involving security administration

**Expected Outcome :**
Practical understanding of setting, managing and securing Information Systems

**References (Books, Websites etc) :**
Red Hat Linux Bible: Fedora and Enterprise Edition - by Christopher Negus

**Suggested MOOC :**
SWAYAM

**Syllabus**

| Unit | Contents |
|---|---|
| 1 | **Setup a Client:**<br>Introduction to client-side devices, Setup, Manage and Secure a Desktop PC<br>Setup, Manage and Secure a Mobile Device |
| 2 | **Setup a LAN:**<br>Introduction to LAN devices, Simulate a LAN, Setup, Manage and Secure a Local Area Network |
| 3 | **Connect a LAN to the Internet:**<br>Introduction to WAN devices, Setup, Manage and Secure a Connection to the Internet |
| 4 | **Share an Internet Connection across a LAN:**<br>Introduction to Internet Connection sharing, Introduction to NAT and PAT Setup, Manage and Secure a Proxy Server |
| 5 | **Share resources over a LAN:**<br>Setup, Manage and Secure a Print Server, Setup, Manage and Secure a File server |
| 6 | **Host a Website:**<br>Introduction to website hosting, Setup, Manage and Secure a Web Server |
| 7 | **Setup support servers:**<br>Setup, Manage and Secure a Mail Server, Setup, Manage and Secure a FTP Server, Setup, Manage and Secure a Boot Server, Setup, Manage and Secure a DNS Server |