DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER APPLICATIONS

Program - MCA

Vision

To emerge as power house of Information Technology and Allied areas developing competent computer professionals to meet the dynamic needs of disruptive technologies.

Mission

- To impart technical knowledge through innovative teaching, research and consultancy.
- Provides state-of-the-art facilities and internationally recognized faculty.
- To adapt to the dynamic needs of industries through curriculum update.
- Promotes partnerships with industry and community.
- To produce competent graduates with professional ethics and life skills

Program Educational Objectives (PEO's)

Consistent with the stated Vision and Mission of the institute and the program, the faculty of the Department of Computer Applications strive to educate and train the students in a technologically sound and challenging environment in order to achieve the following educational objectives:

- **PEO1.** Our graduates will be successful as Computer Application Developers, Algorithm Developers, Computer Programmers.
- **PEO2.** Our graduates will have successful professional careers in industry, government, academia and military as innovative engineers.
- **PEO3.** Our graduates will continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification and seeking higher education.
- **PEO4.** Our graduates will be active members ready to serve the society locally and internationally

DAYANANDA SAGAR UNIVERSITY

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Programme Outcome (PO's)

On successful completion of the program:

- **PO1. Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
- **PO2. Problem analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
- **PO3. Design/development of solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- **PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5. Modern tool usage:** Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
- **PO6. Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
- **PO7. Life-long Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
- **PO8. Project management and finance :** Demonstrate knowledge and understanding of the computing and management principles and apply these to one’s own work, as a

member and leader in a team, to manage projects and in multidisciplinary environments.

- **PO9. Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
- **PO10. Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
- **PO11. Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
- **PO12. Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Program Specific Outcomes (PSO's)

- **PSO1.** Knowledge of Computing Systems: An ability to understand the principles and working of computer systems.
- **PSO2.** Project Development Skills: An ability to understand the structure and development methodologies of software systems.
- **PSO3.** Software Development Skills: Familiarity and practical competence with a broad range of programming language and open-source platforms.

- **PSO4.** Mathematical Skills: An ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.

DAYANANDA SAGAR UNIVERSITY
SCHOOL OF ENGINEERING
DEPARTMENT OF COMPUTER APPLICATIONS

GOVERNING REGULATIONS FOR
MASTER OF COMPUTER APPLICATIONS (MCA) - 2021

PREAMBLE

The Computer Applications Department under the School of Engineering has been established to nurture the fresh talent in the field of Information Computer Applications equipping them with plethora of skills to choose an area of interest at an early stage. The department firmly believes that theoretical knowledge supported by an ample of in-depth practical exposure are required to meet the challenges of this era of changing fields. Courses offered aims at the providing the students key knowledge in the area of computer science and predominantly the applications of the theoretical knowledge. At the PG level, a student undergoes the advanced courses in Computer Science, Mathematics and Humanities. The department ensures that the courses cover both Core and Electives as required.

DEFINITIONS OF KEY WORDS

i. Academic Year: Two consecutive odd and even semesters and a summer term for make up if required.
ii. Course: Usually referred to as a subject, a course may consist of any of Lecture/Tutorials/Laboratory/Practical/Seminar/Mini project/Project work.
iii. Credit: A unit by which the course work is measured. One credit is equivalent to one hour of lecture or one hour of tutorial or two hours of laboratory/practical/workshop practice per week.
iv. Credit Point: It is the product of grade point and number of credits per course.
v. Cumulative Grade Point Average (CGPA): It is the measure of overall cumulative performance over all semesters. It is expressed upto two decimal places.
vi. First Attempt: If a candidate has completed all formalities of academic requirement in a term and become eligible to attend the examinations and attend all the end semester examinations, such attempt shall be considered as first attempt.
vii. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
viii. Letter Grade: It is an index of the performance in a said course. Grades are denoted by alphabets.
ix. Programme: An educational activity leading to award of a Degree or Certificate.
x. Semester Grade Point Average: Is measure of performance during a semester. It shall be expressed up to two decimal places.
xi. Transcript: Based on the grades earned, a grade certificate shall be issued after every semester to the candidate registered

xii. Failure: It is the case of appearing for Semester End examinations, but fails to obtain minimum passing marks in Semester End Examinations.

xiii. Detain: It is the case of not satisfying the eligibility criteria w.r.t Attendance /Internal Assessment in each course to appear for Semester End Examination.

xiv. Audit Course: A course to be taken by the student without benefit of a grade or a credit.

xv. Not Fit For The Program(NFFTP): It is the failure of satisfying the criteria laid down by regulations to continue the program of study, which leads to the termination from the University

RULES AND REGULATIONS

PG 1 All MCA programmes offered by the DSU shall be governed by the DSU MCA Rules and Regulations – 2021.

PG 2 The MCA rules and regulations shall be applicable to any new discipline(s) that may be introduced in future.

PG 3 A candidate shall become eligible for the award of the MCA Degree after fulfilling all the academic requirements as prescribed by the MCA Rules and Regulations of DSU.

PG 4 ELIGIBILITY FOR ADMISSION

PG 4.1 Admission to I year /I semester MCA: A candidate who has passed any recognized under graduate examination or equivalent examination with Mathematics or Statistics or Computer Science or Computer Applications or Computer Programming or Business Mathematics or Business Statistics as one of the optional subjects and obtained an aggregate minimum of 50% marks taken together in all the subjects in all the years of the Degree Examination is eligible for admission to MCA Program and 45% of marks in qualifying examination (QE) in case of SC, ST and Category-I of Karnataka candidates. Provided that in respect of candidate who has studied and passed one of the subjects specified above in Pre-University Course with fifty percent of marks in that subject shall also be considered for admission. 45% of marks in case of SC, ST and Category-I of Karnataka candidates.

PG 4.2 Admission to II year /III semester MCA (Lateral entry): A candidate who has passed recognized Bachelor's Degree of minimum of 3 years duration in BCA, B.Sc (I.T. / Computer Science) with Mathematics at 10 + 2 level or at Graduate Level and obtained an aggregate minimum of 50% marks taken together in all the subjects in all the years of the Degree Examination is eligible for admission to MCA program (45% of marks in QE in case of SC, ST and Category-I of Karnataka candidates)

PG 5 ACADEMIC SESSION

PG 5.1 Each academic session is divided into two semesters of approximately sixteen weeks duration and a summer term: an odd semester (September -January), an even semester (February - May) and summer term (Make up term) June- August.

PG 5.2 Schedule of academic activities for a session, inclusive of dates for registration, continuous evaluation and end-semester examinations, vacation breaks etc, approved by the Board of Governors shall be laid down in the Academic Calendar for the session.

PG 6 COURSE STRUCTURE

PG 6.1 Medium of instruction, examination and project reports shall be in English except in case of any language audit courses.

PG 6.2 Teaching of the courses shall be reckoned in credits. Credits are assigned to the Courses based on the following general pattern:

- One credit for each lecture period.
- One credit for each tutorial period.
- One credit for two hours of each Activity session
- Credits for Seminar, Dissertation/Project /Project /Project are as indicated in the scheme/curriculum of teaching.

PG 6.3 In order to qualify for the award of MCA degree of the University, a candidate is required to complete the credit requirement as prescribed in the scheme/curriculum for a particular programme.

PG 6.4 The program of a study consists of the following components:

(i) Program Core courses
(ii) Program Elective courses
(iii) Open Elective courses
(iv) Dissertation/Project /Project Work

PG 6.5 Every MCA Programme shall have a curriculum and syllabi for the courses approved by the Board of Governors. Board of Studies will discuss and recommend the syllabi of all the under graduate courses offered by the department from time to time before sending the same to the Academic Council. Academic Council will consider the proposals from the Board of Studies and make recommendations to the Board of Management and Board of Governors for consideration and approval. For all approved courses, the copyright shall be with DSU.

PG 6.6 Faculty Advisor: To help the candidates in planning their courses of study and getting general advice on the academic programme, the concerned department will assign a Faculty Advisor each candidate.

PG 6.7 Dissertation/Project supervisor: Master's Project/Dissertation/Project supervisor (s) for a candidate will be allotted from amongst the faculty members.

- Departments will evolve modalities for appointing of supervisor(s) keeping in view of the candidates' aspirations and faculty interest.
- No candidate will have more than two supervisors.
- No change in Dissertation/Project supervisor(s) will be allowed without the consent of the Dean.
- No change/addition of Supervisor (s) is/are allowed after the Dissertation/Project has been submitted to the academic section.
- In case there has been change/addition in the Supervisor(s), the Dissertation/Project will be submitted not earlier than one month from the date of such change/addition unless condoned by the Vice Chancellor on the recommendation of Dean.
- With prior approval of the Dean and recommendation of Chairman, a candidate may be allowed to have a Co-supervisor from outside the University, in exceptional cases.

PG 7 REGISTRATION

PG 7.1 Every candidate is required to register for approved courses through the assigned Faculty Advisor at the end of previous semester or first week of the current semester, as notified by the Academic Calendar.

PG 7.2 The Dean may cancel the registration of one or more courses if they are found to violate some rules or if there are restrictions imposed due to disciplinary reasons.

PG 7.3 The student is permitted to drop a course/s from the registered courses, within 4 weeks after the start of the Semester/Year as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College and no mention will be made in the grade card for dropped courses.

PG 7.4 The student is permitted to withdraw course/s from the registered courses, within 4 weeks before the start of the Semester/Year End Examinations as notified in the academic calendar, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School / College and Grade "W" will be awarded for course/s that were withdrawn.

PG 7.5 For the courses with "W" grade, the students should re-register, subsequently when offered, either in online mode or in-class or summer term and fulfill the passing criteria to secure a grade in that course for change from "W" grade.

PG 7.6 Only those candidates shall be permitted to register who have:

- The academic eligibility to move to higher semesters
- Cleared all University, Hostel and Library dues and fines (if any) of the previous semesters,
- Paid all required advance payments of University and Hostel dues for the current semester,
- Not been debarred from registering on any specific ground.

PG 8 EXAMINATION: ASSESSMENT CRITERIA & ELIGIBILITY FOR PROGRESSION

Every student shall be assessed for eligibility to higher semester through Continuous Internal Assessment (CIA) and Semester End Examination (SEE) as prescribed.

PG 8.1 The Continuous Internal Assessment (CIA), shall normally be conducted by the assessment components spread through the running semester; the components of CIA may be tests, mid-term exam, quiz, term paper, simulation based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students. The Course instructor shall announce the detailed methodology for conducting the various components of CIA together specifying component-wise weightages right in the commencement of each semester.

PG 8.2 The Semester End Examinations (SEE), shall be conducted at the end of each semester. The SEE components may be a closed or open book examination, project demo, viva-voce, and/or a portfolio presentation.

PG 8.3 CIA and SEE shall respectively have 60:40 percent weightage. The Vice-Chancellor, on the recommendations of the Dean of Faculty and Department Chair, in exceptional cases, may approve the variation in this weightage ratio.

PG 8.4 The performance of a student with respect to a course in a semester shall be the combined score of marks/points, he/she secures in CIA and SEE, put together.

PG 8.4.1 A minimum of securing 40% marks, combining both the CIA with SEE marks secured with respect to a course, shall entail the student a PASS in the course.

PG 8.4.2 The Vice-Chancellor, in such cases where the entire class has fared poorly in the course, upon receiving a representation by the students / department, and based on the recommendations of the committee constituted for the purpose, may review the criterion of 40%.

PG 8.5 ATTENDANCE ELIGIBILITY

PG 8.5.1 Candidates are required to attend all the classes (Lectures, Tutorials, Practical, Workshop Practice, etc.) for which they have been registered.

PG 8.5.2 The candidate shall not be allowed to appear for the end semester examination if his/her attendance falls below 85% in each course and shall be awarded a "NE" grade in that course.

PG 8.5.3 A provision for condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the chairman of the department and Dean, showing reasonable cause such as:

- Any medical emergencies/ illness where the candidate requires rest for the specified number of days certified by a Government Doctor only /any death in the family (near and dear ones).
- If the student represents the University in Sports/ Cultural Activities/Extra- curricular activities/Co-curricular activities.
- If a student presents a Paper in National/ International Conferences or attends any recognized Workshops/Seminars.

PG 8.5.4 If the period of leave is for a short duration (less than two weeks), prior application for leave shall have to be submitted to the Chairman of the Department concerned stating fully the reasons for the leave requested for along with supporting document(s). Such leave will be granted by the Chairman of the Department. However the student shall comply with 8.5.2 and 8.5.3.of regulations.

PG 8.5.5 If the period of absence is likely to exceed two weeks, a prior application for grant of leave will have to be submitted through the Chairman of the Department to the Dean with supporting documents in each case. The decision to grant leave shall be taken by the Dean on the recommendation of the Chairman of the Department. However the student shall comply with 8.5.2 and 8.5.3.of regulations.

PG 8.5.6 It shall be the responsibility of the candidate to intimate the concerned course instructor(s) regarding his/her absence before availing the leave.

PG 8.6 CONTINUOUS INTERNAL ASSESSMENT

PG 8.6.1 Candidate shall participate in all components of Continuous Internal Assessment (CIA) to become eligible to take up the Semester End Examination or else 'NE' grade shall be awarded. However, the Vice-Chancellor, under exceptional circumstances on the recommendations of Dean of Faculty and Department Chair, may exempt a student from participation in CIA component/s and permit taking up SEE.

PG 8.6.2 There shall be no marks improvement of Continuous Internal Assessment; however, the withdrawal and re-registering of the course shall be permitted.

PG 8.6.3 Continuous Evaluation consists of:

PG 8.6.3.1 Under normal circumstances for theory courses, total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60% .
The components of CIA may be tests, mid-term exam, quiz, term paper, simulation based problem solving, open-book test, solving open-end problems, mini-projects, seminars, viva-voce, awarding marks for attendance and such activities that enhance original thinking of students.

PG 8.6.3.2 Under normal circumstances for the practical courses (laboratory, workshops, and any such hands-on activity), total CIA weightage shall be a total of 60%, put together all components with varying weightages; Under exceptional circumstances with the approval of the Vice-Chancellor on the recommendation of Dean of the School, the weightage of CIA may be lower/higher than 60% .

CIA may have components such as conduction of an experiment, record writing, viva-voce, tests, simulation, mid-term exam, quiz, demo, term paper, mini-projects, seminars, marks for attendance and activities which enhances original thinking of students.

PG 9 GRADING

PG 9.1 There shall be continuous assessment of a candidate's performance throughout the semester and grades shall be awarded by the concerned course instructor and/or the appropriate committee appointed for this purpose on the following basis.

PG 9.2 The grading will normally be based on CIA and SEE.

PG 9.3 Practical Courses/ Work Shop Practice: The evaluation will be based on instructor's continuous internal assessment, a test and end semester examination.

PG 9.4 The weightage assigned to different components of continuous internal assessment will be announced by the concerned instructor(s) in the beginning of the semester.

PG 9.5 The results of performance of the candidates in the Continuous Internal assessment Test shall be announced by the instructors.

PG 9.6 In case of seminar, evaluation will be as determined by the grade awarding Committee (as per the Program scheme).

PG 9.7 Mini project /projects will be based on Continuous evaluation by Guide(s) and Semester End Examination (as per the Program scheme)

PG 9.8 The results of performance of the candidates shall be announced by the Controller of Examinations.

PG 9.9 METHOD OF AWARDING LETTER GRADES

Relationships among Grades, Grade points and % of marks are listed in Table1.

Table 1: Grade, Points, Grade Description and % of marks

GRADE	GRADE POINTS	DESCRIPTION	% MARKS
O	10	Outstanding	90 to 100
A+	9	Excellent	80 to 89
A	8	Very Good	70 to 79
B+	7	Good	60 to 69
B	6	Above Average	55 to 59
C	5	Average	50 to 54
P	4	Pass	40 to 49
F	0	Fail	< 40
AP	-	Audit Pass	-
AF	-	Audit Fail	-
IC	-	In Complete	-
NE	-	Not Eligible	-
W	-	Withdrawn	-

PG 9.10 DESCRIPTION OF GRADES

PG 9.10.1 Table 1 shows the relationships among the grades, grade points and percentage of marks.

PG 9.10.2 A student will have to ensure a minimum CGPA of 4, to become eligible for the award of the degree.

PG 9.10.3 A candidate shall have to repeat all courses in which he/she obtains 'F' Grades until a passing grade is obtained.

PG 9.10.4 An IC grade denotes incomplete performance in any Theory and/or Practical Assessment. It may be awarded in case of absence on medical grounds or other special circumstances for SEE. Requests for IC grade should be made at the earliest but not later than the last day of SEE.

PG 9.10.5 The student can appear for the course/s with IC grade, when exams are conducted subsequently by the University for those Courses.

PG 9.11 EVALUATION OF PERFORMANCE

PG 9.11.1 The performance of a candidate shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester, Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters.

PG 9.11.2 The Earned Credits (EC) are defined as the sum of course credits for courses in which candidates have been awarded grades between O to P. (Table 1).

PG 9.11.3 Points earned in a semester = (Course credits X Grade point) for Grades O to P

PG 9.11.4 The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which F grade or below, registered for in the particular semester.

$$\text{SGPA} = \frac{\text{Points secured in the semester (O to P Grades)}}{\text{Credits registered in the semester, excluding audit}}$$

PG 9.11.5 The CGPA is calculated on the basis of all pass grades, except audit courses.

$$CGPA = \frac{\text{Cumulative points secured in all the passed courses (O to P Grades)}}{\text{Cumulative registered credits, excluding audit}}$$

PG 9.12 WITHHOLDING OF GRADES

Grades shall be withheld when the candidate has not paid his/her dues or when there is a disciplinary action pending against him/her

PG 9.13 CONVERSION OF CGPA INTO PERCENTAGE

Conversion formula for the conversion of CGPA into percentage is
Percentage of Marks Scored = (CGPA Earned − 0.75) × 10

PG 10 PROMOTION CRITERIA AND ENROLLMENTS TO HIGHER SEMESTERS

PG 10.1 During registration to the higher semesters, the following criteria/conditions for promotion, shall be satisfied

PG 10.1.1 A student shall 'Not Eligible' (NE) for writing SEE if he/she does not comply to the minimum prescribed attendance in any course that carry a credit. Students shall register afresh for such course/s, whenever offered next, to meet the attendance requirements and secure a pass grade, subsequently in that course/s.

PG 10.1.2 In a semester (ODD / EVEN), a student is deemed to be Not Eligible (NE) if he/she does not satisfy minimum attendance requirements criteria in a credit course.

If this course happens to be a prerequisite to a connected course in the subsequent semester, then the student shall not be permitted to register for that connected course until he / she secures pass grade in the prerequisite course by complying to the minimum attendance requirement when the prerequisite course is offered next (either during summer term or regular semester).

PG 10.1.3 A student shall be permitted to register for FOUR credited courses or to a total of 16 credits whichever is higher along with pending audit courses, if any, during a summer term by paying the prescribed course registration fee per credit notified by the university from time to time.

PG 10.1.4 The students with NE ('NOT ELIGIBLE' due to shortage in attendance) in any Credit Course/s other than Audit Courses in a semester shall have to secure a pass grade by compliance to minimum attendance requirements in the NE course to register for connected courses if NE course happens to be prerequisite course for those connected courses offered in the subsequent semesters.

PG 10.1.5 Candidates who secure 'F' grade in any courses in regular semester or summer term shall secure PASS grade in such course/s either in the subsequent summer term examination or shall repeat in the next appropriate semester whenever it is/they are offered, i.e. odd semester courses during odd semesters examinations and even semester courses during even semester examinations, respectively.

PG 10.2 In case of failure in Practical/Workshop practice course the candidate in any semester may clear it in the subsequent summer term examination or semester examination.

PG 10.3 In case a candidate fails in Practical/ Workshop practice he/she shall register when it is offered next either in the summer term or subsequent semester, as the case may be.

PG 10.4 Candidates may add and drop course(s) with the concurrence of the Faculty Advisor, and under intimation to the concerned course instructors and the academic section provided this is done within the date mentioned in the Academic Calendar.

PG 10.5 SUMMER TERM

PG 10.5.1 A summer term program may be offered by a department and with the approval of the Dean.

PG 10.5.2 Summer term courses will be announced by the Academic Affairs Office at the end of the even semester and before the commencement of the end semester examination. A candidate will have to register for summer term courses by paying the prescribed fees within the stipulated time in the announcement.

PG 10.5.3 The total number of contact hours in any summer term program will be the same as in the regular semester course. The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.

PG 10.5.4 Candidates granted semester drop by the Board of Governors, on medical ground, shall be allowed to clear the concerned courses in summer term course and subject to conditions as stated under clauses 10.5.1, 10.5.2.and 10.5.3.

PG 10.5.5 The Candidates with "NE" grade shall register for summer term by paying the prescribed fees.

PG 10.5.6 Candidates who are awarded 'F' grades in regular semester examinations have the option to register for the concerned courses in summer term examinations to the conditions as stated under clauses 10.5.1, 10.5.2.and 10.5.3. above, or they can re-sit for subsequent semester/summer term examination only.

PG 10.6 MAKE UP EXAMINATIONS

PG 10.6.1 Provision for make-up exam shall be available to the students who might have missed to attend the Semester End Examinations of one or more courses for exceptional cases arising out of natural calamities / medical emergencies / death of a member in the family, with the permission of Faculty Advisor and Chairperson / Dean / Principal of the respective School/College. All such courses approved for makeup examinations are awarded a transitory grade "IC" (incomplete grade).

PG 10.6.2 The makeup examinations shall be held as notified in the academic calendar or through an exclusive notification duly approved by the Vice-chancellor.

PG 11 DURATION OF THE PROGRAMME

PG 11.1 Normally a candidate should complete all the requirements for Postgraduate programme in Three years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to Six consecutive years (from the first year of registration) to complete all the requirements of the degree.

PG 11.2 Normally a candidate under lateral entry should complete all the requirements for Postgraduate programme in Two years. However, academically weaker candidates who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to Four consecutive years (from the second year registration) to complete all the requirements of the degree.

PG 12 TERMINATION FROM THE PROGRAMME

PG 12.1 A candidate may also be compelled to leave the Program in the University on disciplinary grounds.

PG 12.2 On having been found to have produced false documents or having made false declaration at the time of seeking admission.

PG 12.3 On having been found to be pursuing regular studies and/or correspondence courses (leading to degree or diploma) in any other college, university or an educational institution simultaneously.

PG 12.4 On having been found to be concurrently employed and performing duty or carrying out business in contravention to academic schedules of the University and without seeking approval from the University.

PG 12.5 If a student fails to earn a pass grade even after 4 attempts such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).

PG 12.6 If a student secures a CGPA less than 4.0 , 4 times during entire duration of the program of study, such a student is terminated from the university on the grounds of NOT FIT FOR THE PROGRAM (NFFTP).

PG 12.7 However, if the student appeals for reconsideration of termination from the university under NFFTP rule by providing the guanine reasons to the Vice-Chancellor through the Dean of Faculty, then the Vice-Chancellor may consider constituting a committee for the purpose of review and provide 2 additional attempts on the recommendations of the committee.

PG 13 TEMPORARY WITHDRAWAL FROM THE UNIVERSITY

PG 13.1 Candidate who has been admitted to an undergraduate programme of the University may be permitted to withdraw temporarily from the University on the grounds of prolonged illness or grave calamity in the family for a period of one semester or more, provided:

PG 13.1.1 He/she applies to the University within at least 6 weeks of the commencement of the semester or from the date he last attended his/her classes whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.

PG 13.1.2 The University is satisfied that, counting the period of withdrawal, the candidate is likely to complete his/her requirements of the MCA Degree within the time limits specified in Clause 11.1 or 11.2 above.

PG 13.1.3 There are no outstanding dues or demands in the University/Hostel/Department/ Library.

PG 13.1.4 Normally, a candidate will be permitted only one such temporary withdrawal during his/her tenure as a candidate of the undergraduate programme.

PG 14 TRANSFER OF CANDIDATES

PG 14.1 Transfer of candidates from higher education institutions outside University shall be considered at the beginning of Third and Fifth Semesters but subject to confirmation of equivalence.

PG 14.2 The candidates shall apply for equivalence with the No-objection for admission to DSU from the University where they are perusing their study.

PG 14.3 The candidates must have passed in all courses in the earlier semesters prior to transfer.

PG 15 ELIGIBILITY FOR THE AWARD OF MCA DEGREE

PG 15.1 A candidate shall be declared to be eligible for the award of MCA degree if he/she has:

PG 15.2 Completed all the credit requirements for the degree with a CGPA 4.0 or higher at the end of the programme.

PG 15.3 Satisfactorily completed all the mandatory audit courses.

PG 15.4 No dues to the University, Department, Hostels.

PG 15.5 No disciplinary action pending against him/her.

PG 16 AWARD OF DEGREE

PG 16.1 The award of MCA degree must be recommended by the Academic Council and approved by the Board of Management and Board of Governors of the DSU.

PG 17 CONDUCT AND DISCIPLINE

Candidates shall conduct themselves within and outside the precincts of the University in a manner befitting the candidates of an institution of national importance. The University has a separate ordinance Code and Conduct of Candidates which is applicable to all candidates of the University.

PG 18 REPEAL AND SAVINGS

Notwithstanding anything contained in these Regulations, the provisions of any guidelines, orders, rules or regulations in force at the University shall be inapplicable to the extent of their inconsistency with these Regulations. The Academic Council, Board of Management and Board of Governors of Dayananda Sagar University may revise, amend or change the regulations from time to time.

PG 19 INTERPRETATION

Any questions as to the interpretation of these Regulations shall be decided by the University, whose decision shall be final. The University shall have the powers to issue clarifications to remove any doubt, difficulty or anomaly which may arise during the implementation of the provisions of these regulations.

Dayananda Sagar University
School of Engineering
Kudlu Gate, Hosur Road, Bengaluru 560068

DEPARTMENT OF COMPUTER APPLICATIONS

Code of Conduct

1. Students should pay the required fees , Tuition, Hostel/Bus and Mess Fee as stipulatedby the University on time, failing which Students would not be allowed to register for courses,will not be allowed to stay in the hostel, will not be permitted to attend the classes orwrite examinations.
2. Students should fully aware that possession of cell phone / any electronic devices inside the examination hall is strictly prohibited and if violated, liable to be confiscated and punished as per the rules of the University, Students should also aware that impersonation in anyform will lead to expulsion from the University.
3. Students should fully aware that the Chief Warden, Resident Warden, Mentor, Faculty or any authorized personnel of the University are empowered to check and verify the contents including photos/videos in my Laptop/Mobile phones any time on misuse of electronic gadgets which are against the norms of the University.
4. Students should aware that smoking or consumption or distributing tobacco/alcohol in any formon the campus is punishable and Students will be liable to be suspended / Debarred/Expelledfrom the University.
5. Students should aware that Possessing, consuming or distributing harmful or illegal narcotic drugs and psychotropic substances is a criminal offense as per The Narcotic Drugs and Psychotropic Substances Act ,1985 which will lead to dismissal from the University.
6. Students should not disturb the peace, destroy, damage or deface University property, or injure any person or physically manhandle under the guise of

intimidation, initiation and extortion in any form for any purpose, failing which students shall be liable for thepunishment as per the University code of conduct.

7. Students should fully aware that, while the University encourages healthy interaction between boys and girls, it prohibits eve teasing/sexual harassment, any indecent behavior or any physical contact or public display of affection (PDA) among student. Such conducts are prohibited under the Sexual Harassment of Women in workplace (Prevention, Prohibition & Redressal Act, 2013 and as per UGC Regulations. Those involved in such activities will be summarily expelled from the University and may also be liable for criminal action.
8. My parents and students agree to receive information regarding my studies via all communication modes such as email/post/messages at any time from the University.
9. Students should aware of the refund policy of the University for all the fees paid during the enrollment process

Dayananda Sagar University

School of Engineering

Kudlu Gate, Hosur Road, Bengaluru 560068

DEPARTMENT OF COMPUTER APPLICATIONS

10.

DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BENGALURU – 560 068, KARNATAKA.

SCHOOL OF ENGINEERING

SYLLABUS FOR
MASTER OF COMPUTER APPLICATIONS

(With effect from 2021-22)

SCHEME - MCA - 2021 - 22 ONWARDS

I Semester

#	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	224	21MCA4101	DATA STRUCTURES	CR	3	-	-	-	3	*	***
2	224	21MCA4102	COMPUTER ARCHITECTURE AND MICROCONTROLLER	CR	3	-	2	-	4	*	***
3	224	21MCA4103	ADVANCED OPERATING SYSTEMS	CR	3	-	-	-	3	*	***
4	224	21MCA4104	ADVANCED SOFTWARE ENGINEERING AND TESTING	CR	3	-	2	-	4	*	***
5	224	21MCA4105	PROBABILITY & STATISTICS	CR	3	-	2	-	4	*	***
6	224	21MCA4106	DATA STRUCTURES LAB	CR	-	-	4	-	2	*	***
7	224	21MCA4107	ADVANCED OPERATING SYSTEM LAB	CR	-	-	4	-	2	*	***
					15	-	14	-	22		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

SCHEME - MCA - 2021 - 22 ONWARDS

II Semester

#	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/ AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	224	21MCA4201	ADVANCED ALGORITHMS	CR	3	-	-	-	3	*	***
2	224	21MCA4202	JAVA PROGRAMMING	CR	3	-	-	-	3	*	***
3	224	21MCA4203	COMPUTER COMMUNICATION AND NETWORKS	CR	3	-	-	-	3	*	***
4	224	21MCA4204	DATABASE MANAGEMENT SYSTEMS	CR	3	-	-	-	3	*	***
5	224	21MCA4205	ADVANCED ALGORITHMS LAB	CR	-	-	4	-	2	*	***
6	224	21MCA4206	JAVA PROGRAMMING AND NETWORKS LAB	CR	-	-	4	-	2	*	***
7	224	21MCA4207	DATABASE MANAGEMENT SYSTEMS LAB	CR	-	-	4	-	2	*	***
8	224	21MCA4208	SUMMER INTERNSHIPS	CR	-	-	4	-	2	*	***
9	224	21MCA42XX	DEPARTMENT ELECTIVE - I	CR	3	-	2	-	4	*	***
					15		18	-	24		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

#	COURSE CODE	DEPARTMENT ELECTIVE – I
1	21MCA4209	DATA ANALYTICS & VISUALIZATION
2	21MCA4210	VIRTUALIZATION & CLOUD COMPUTING
3	21MCA4211	FULL STACK DEVELOPMENT

III SEMESTER

#	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	224	21MCA4301	AI AND MACHINE LEARNING	CR	03	-	-	_	03	*	***
2	224	21MCA4302	EMBEDDED SYSTEMS AND INTERNET OF THINGS	CR	03	-	-	_	03	*	***
3	224	21MCAXXXX	DEPARTMENT ELECTIVE –2	CR	03	-	02	_	04	*	***
4	224	21MCAXXXX	DEPARTMENT ELECTIVE –3	CR	03	-	02	_	04	*	***
5	224	21MCA4303	AI AND MACHINE LEARNING LAB USING PYTHON	CR	-	-	04	_	02	*	***
6	224	21MCA4304	EMBEDDED AND INTERNET OF THINGS LABORATORY	CR	--	--	04	_	02	*	***
7	224	21MCA4305	SOCIALLY RELEVANT PROJECT	CR	--	--	08	_	04	*	***
					12	-	20	-	22		

COURSE CODE	DEPARTMENT ELECTIVES II & III
21MCA4306	DISTRIBUTED COMPUTING (HADOOP AND SCALA)
21MCA4307	DATA MINING
21MCA4308	BUSINESS INTELLIGENCE TECHNOLOGY
21MCA4309	BIG DATA WITH R
21MCA4310	DATA SCIENCE
21MCA4311	CLOUD NETWORKING & SECURITY
21MCA4312	CLOUD STORAGE
21MCA4313	MOBILE APPLICATION DEVELOPMENT TECHNIQUES

IV SEMESTER

#	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	224	21MCAXXXX	DEPARTMENT ELECTIVE –4	CR	03	-	02	_	04	*	***
2	224	21MCAXXXX	OPEN ELECTIVE –(MOOC)	CR	03	-	02	_	04	*	***
3	224	21MCAXXXX	OPEN ELECTIVE(MOOC)	CR	03	-	02	_	04	*	***
4	224	21MCA4404	DISSERTATION	CR	-	-	10	_	05	*	***
					09	-	16	-	17		

COURSE CODE	DEPARTMENT ELECTIVES IV
21MCA4401	INFORMATION SECURITY
21MCA4402	INTRODUCTION TO SOCIAL NETWORK ANALYSIS
21MCA4403	DEEP LEARNING
21MCA4405	BLOCK CHAIN TECHNOLOGY

COURSE CODE	LIST OF OPEN ELECTIVES
21MCA4406	BUSINESS DATA ANALYTICS
21MCA4407	INDUSTRIAL SAFETY
21MCA4408	OPERATIONS RESEARCH
21MCA4409	COST MANAGEMENT OF ENGINEERING PROJECTS
21MCA4410	COMPOSITE MATERIALS
21MCA4411	WASTE TO ENERGY

DAYANANDA SAGAR UNIVERSITY

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : I
COURSE CODE : 21MCA4101
TITLE OF THE COURSE : Data Structures
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

- To study the basics and advanced concepts of C programming language.
- To learn the concepts of linear data structures and its applications.
- To understand the concepts of non-linear data structures.
- To learn the usage of sorting techniques.
- To familiarize the concepts of hashing.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Demonstrate basic and advanced concepts of C programming language.
2. Use abstract data types including stacks, queues and lists for any application.
3. Design and implement tree data structures.
4. Analyze and implement hashing techniques that solve in linear time.
5. Apply sorting algorithms for a given problem.
6. Choose appropriate data structure and implement a given application.

UNIT 1 - LINEAR DATA STRUCTURES **9**

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List Implementation – Doubly-Linked Lists – Circular Linked Lists – Stack ADT: Implementation of Stacks – Queue ADT: Implementation of Queues – Applications.

UNIT 2 - HIERARCHICAL **9**

Trees: Preliminaries – Implementation of Trees – Tree Traversals with an Application – Binary Trees: Implementation – Expression Trees – Search Tree ADT – Binary Search Trees – Applications of Trees.

UNIT 3 - HEAP STRUCTURES **10**

Binary Heaps – Min Max Heaps – Leftist Heaps – Skew Heaps – Binomial Heaps – Fibonacci Heaps – Lazy Merging for Binomial Queues – Fibonacci Heap Operations – Amortized Analysis.

UNIT 4 - HASHING AND SORTING **12**

Fundamentals of Hashing – Hash Function – Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing -Sorting Algorithms: Insertion Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort.

UNIT 5 - GRAPH ALGORITHMS **9**

Graphs: Representation of Graphs – Graph Traversals – Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Graph with Negative Edge Costs – All Pairs Shortest Path -Minimum Spanning Tree: Prim's and Kruskal's Algorithm.

References:

1. Brian W. Kernighan, Dennis Ritchie, "The C Programming Language", Second Edition, Pearson Education, 2015.
2. Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
4. Y. Langsam, M. J. Augenstein, A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2004.
5. V. Alfred, J. E. Hopcroft, J. D. Ullman, "Data Structures and Algorithms", Pearson education Asia, 1983.
6. Robert Kruse & Bruce Leung, "Data Structures & Program Design in C", Pearson Education, 2007.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : I SEM / I YEAR
COURSE CODE : 21MCA4102
TITLE OF THE COURSE : Computer Architecture and Microcontroller
L: T/A: P: C : 3 : 0 : 2 : 4

COURSE OBJECTIVES:

1. This course introduces the principles of the basic computer architecture and microcontroller concepts.
2. The course emphasizes performance and cost analysis, instruction set design, pipelining, memory technology, memory hierarchy, virtual memory management, and I/O systems.

COURSE OUTCOMES:

At the end of the course students will be able:

1. To understand the principles of the basic computer architecture and microcontroller concepts.
2. Design Memory Interfacing circuits.
3. Design and implement 8051 microcontroller based systems.

MODULE 1 - PIPELINING

Basic Concepts – Data Hazards – Instruction Hazards – Influence On Instruction Sets – Data Path And Control Considerations – Performance Considerations – Exception Handling.

MODULE 2 - MEMORY SYSTEM

Basic Concepts – Semiconductor Ram – Rom – Speed – Size And Cost – Cache Memories – Improving Cache Performance – Virtual Memory – Memory Management Requirements – Associative Memories – Secondary Storage Devices.

MODULE 3 - I/O INTERFACING

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller –

Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

MODULE 4 - MICROCONTROLLER

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

MODULE 5 - INTERFACING MICROCONTROLLER

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

Text Books:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata Mcgraw Hill, 2002.

2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson Education, 2011

References Books:

1. David A. Patterson and John L. Hennessy, “Computer Organization And Design: TheHardware/Software Interface”, Third Edition, Elsevier, 2005.

2. William Stallings, “Computer Organization And Architecture – Designing For Performance”, Sixth Edition, Pearson Education, 2003.

3. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware:, TMH, 2012.

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DEPARTMENT OF COMPUTER APPLICATIONS

COURSE CODE:21MCA4103
TITLE: Advanced Operating Systems
L:T:P:C: 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the advanced Operating Systems, their design and implementation.
2. To understand the implementation in UNIX/LINUX, Windows and Embedded OS.

COURSE OUTCOMES:

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

1. Skill of designing OSs
2. Implementations of Design strategies in existing OSs and Distributed Process Management.

MODULE 1 - INTRODUCTION TO OS AND SHELL SCRIPTING

Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

Basics of Shell scripting, writing scripting program, command line arguments, Functions and file manipulators, regular expressions and filters

MODULE 2 - USING THE OPERATING SYSTEMS & OPERATING SYSTEMS ORGANIZATION

The programmer's abstract machine; Resources; Processes and threads; Writing concurrent programs. Basic functions; General implementation considerations; Contemporary OS kernels.

MODULE 3 - DESIGN STRATEGIES

Design considerations; Device Drivers, Monolithic kernels; Modular organization; Microkernel; Layered organizations; Operating Systems for distributed system.

MODULE 4 - DISTRIBUTED SYSTEMS

Networking; The Need for a Protocol Architecture; The TCP/IP Sockets; Linux Networking; Client/Server Computing; Distributed Message Passing; Remote Procedure Calls; Clusters; Windows Vista Cluster Server; Linux Clusters.

MODULE 5 - RTOS (ANDROID)

Basic introduction to Android and Case studies

Text Books:

1. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2004.
2. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2008.
3. John Horton: Android Programming for beginners, 1st Edition, 2015

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007.

DAYANANDA SAGAR UNIVERSITY

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DEPARTMENT OF COMPUTER APPLICATIONS

COURSE CODE: 21MCA4104
TITLE OF THE COURSE: Advanced Software Engineering and Testing
L:T:P:C: 3 : 0 : 2 : 4

COURSE OBJECTIVES:

1. Understand agile software development practices
2. Demonstrate Agile development and testing techniques 3. Know the benefits and pitfalls of working in an Agile team 4. Understand agile development and testing.

COURSE OUTCOMES:

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

1. At the end the student will be able to
2. The know importance of interacting with business stakeholders in determining the requirements for a software system.
3. Apply iterative software development process
4. Apply the impact of social aspects on software development success.

MODULE 1 - AGILE METHODOLOGY **9**

Theories for Agile management – agile software development – traditional model vs. agile model - classification of agile methods – agile manifesto and principles – agile project management – agile team interactions – ethics in agile teams - agility in design, testing – agile documentations – agile drivers, capabilities and values.

MODULE 2 - AGILE PROCESSES **9**

Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, and Extreme Programming: Method overview – lifecycle – work products, roles and practices.

MODULE 3 - AGILITY AND KNOWLEDGE MANAGEMENT **9**

Agile information systems – agile decision making – Earl's schools of KM – institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment , leveraging – KM in software engineering – managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story-cards – Story-card Maturity Model (SMM).

MODULE 4 - AGILITY AND REQUIREMENTS ENGINEERING 9

Impact of agile processes in RE – current agile practices – variance – overview of RE using agile – managing unstable requirements – requirements elicitation – agile requirements abstraction model – requirements management in agile environment, agile requirements prioritization – agile requirements modeling and generation – concurrency in agile requirements generation.

MODULE 5 - SOFTWARE TESTING 9

Testing as an Engineering Activity – Testing Fundamentals – Defects – Strategies and Methods for Black Box Test Case Design – Strategies and Methods for White-Box Test Case design – Test Adequacy Criteria – Evaluating Test Adequacy Criteria – Levels of Testing and different types of testing – OO Testing- Agile testing- methodologies

Text Books:

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), —Agile Software Development, Current Research and Future Directions||, Springer-Verlag Berlin Heidelberg, 2010
2. David J. Anderson; Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results||, Prentice Hall, 2003
3. Hazza& Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science||, Springer, VIII edition, 2009
4. Craig Larman, —Agile and Iterative Development: A manager_s Guide||, Addison-Wesley, 2004
5. Kevin C. Desouza, —Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.
6. M G Limaye, "Software Testing – Principles, Techniques and Tools", McGraw Hill, 2011.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : I SEM / I YEAR
COURSE CODE : 21MCA4105
TITLE OF THE COURSE : Probability & Statistics
L: T/A: P: C : 3 : 0 : 2 : 4

COURSE OBJECTIVES:

This course aims at providing the required skill to apply the statistical tools in engineering problems.

COURSE OUTCOMES:

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

1. The students will have a fundamental knowledge of the concepts of probability.
2. Have knowledge of standard distributions which can describe real life phenomenon.
3. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

MODULE 1 - RANDOM VARIABLES 9

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

MODULE 2 - TWO – DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

MODULE 3 - TESTING OF HYPOTHESIS 9

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chisquare and F distributions for mean, variance and proportion – Contingency table (test for independent) – Goodness of fit.

MODULE 4 - DESIGN OF EXPERIMENTS 9

Impact of agile One way and Two way classifications – Completely randomized design – Randomized block design – Latin square design – 22 factorial design.

MODULE 5 - RANDOM PROCESS AND STATISTICAL QUALITY CONTROL **9**

Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

Text Books:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4 th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund‟s Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes" McGraw Hill Education India, 4th Edition, New Delhi, 2010.

Reference Books:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum‟s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : I SEM / I YEAR

COURSE CODE : 21MCA4106

TITLE OF THE COURSE : Data Structures Lab

L: T/A: P: C 0 : 0 : 4 : 2

COURSE OBJECTIVES:

1. Be familiarized with good programming design methods, particularly Top- Down design.
2. Getting exposure in implementing the different data structures using C Appreciate recursive algorithms.

COURSE OUTCOMES:

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

1. Design and implement C programs for manipulating stacks, queues, linked lists, trees, and graphs.
2. Apply good programming design methods for program development.
3. Apply the different data structures for implementing solutions to practical problems. 4. Develop recursive programs using trees and graphs.

Lab experiments and mini projects will include C programming concepts and implementation of ADT data structures using C.

SEMESTER/YEAR : I SEM / I YEAR
COURSE CODE : 21MCA4107
TITLE OF THE COURSE : Advanced Operating Systems Lab
L: T/A: P: C : 0 : 0 : 4 : 2

COURSE OBJECTIVES:

1. To have practical implementation of OS

2. To implement design strategies for Operating System.
3. To design Distributed systems and give implementation aspects of distributed Process management.

COURSE OUTCOMES:

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

1. Understanding the design and implementation aspects OS
2. Understand and develop skills to design distributed systems and process Management

Lab experiments and mini projects will include Shell scripting, concurrent programming, process management, socket programming, client server computing, Parallel programming, distributed message passing, remote procedure calls, and distributed process management.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER: II SEM / I YEAR
COURSE CODE: 21MCA4201
TITLE OF THE COURSE: Advanced Algorithms
L:T:P:C: 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the design of advanced algorithms and data structures.
2. To understand the applications of algorithms in different fields such as geometry, number theory, signal processing and linear algebra.

COURSE OUTCOMES:

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

1. Skill of advanced algorithm design. 2.

Knowledge of advanced data structures.

MODULE 1 - MULTI-THREADED ALGORITHMS AND MATRIX OPERATIONS

The basics of dynamic multi-threading; multi-threaded versions of matrix multiplication, solution of linear equations, matrix inversion, and least squared approximation.

MODULE 2 - FAST FOURIER TRANSFORMS AND NUMBER THEORETIC ALGORITHMS

Representation of polynomials, DFT and FFT; efficient FFT implementation (sequential and parallel). Elementary number theoretic notions, greatest common divisor, modular arithmetic, solving modular linear equations, Chinese remainder theorem, powers of an element, RSA public crypto system, primality testing, integer factorization.

MODULE 3 - STRING MATCHING ALGORITHMS

Rabin-Karp, Knuth-Morris-Pratt and Boyer-Moore string matching algorithms. Suffix trees and their applications in computational biology.

MODULE 4 - COMPUTATIONAL GEOMETRY AND PROBABILISTIC ANALYSIS

Line segment properties, determining whether pair of line segments intersects, finding the convex hull, finding the closest pair of points. Hiring problem, indicator random variables, randomized algorithms; probabilistic analysis and further uses of indicator random variables.

MODULE 5 - ADVANCED DATA STRUCTURES AND GRAPH ALGORITHMS

Fibonacci heaps, mergeable heap operations, decreasing a key and deleting a node, bounding the maximum degree. Van emde boas tree. Data structures for disjoint sets, analysis of union by rank with path compression. Flow networks, Ford-Fulkerson method, maximum bipartite matching.

Text Books:

Thomas H. Cormen, Charles E Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms., 3rd ed., The MIT Press, 2009.

Reference Books:

Donald E Knuth, Art of Computer Programming, Volumes 1-4A, Addison-Wesley, 2011.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER: II SEM / I YEAR
COURSE CODE: 21MCA4202
TITLE OF THE COURSE: JAVA PROGRAMMING
L:T:P:C: 3: 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the object oriented concepts of Java.
2. To learn GUI based application development and network programming.
3. To build dynamic web sites using server side technologies with database connectivity.
4. To learn the concepts of distributed objects, messaging and mail services. 5. To understand the importance of advanced frameworks.

COURSE OUTCOMES:

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

1. Practical - Implement object oriented concepts of Java programming.
2. Work with Generics, networking and GUI based application development.
3. Develop dynamic web applications with database connectivity using server side technologies.
4. Create distributed applications using RMI, Java Bean and web services.
5. Design and development of applications using advanced frameworks. 6. Understand the importance of advanced frameworks.

UNIT 1 - JAVA BASICS **9 Hrs**

Overview of Java – Java Fundamentals: Classes, Objects, Methods and Strings – Methods: A Deeper Look – Arrays and Array Lists – Classes and Objects: A Deeper Look – Inheritance – Polymorphism – Interfaces – Packages – Exception Handling – Strings, Characters and Regular Expressions.

UNIT 2 - GUI, I/O AND NETWORK PROGRAMMING **9 Hrs**

Applets – Applet based GUI – Graphics and Java 2D – Basics of Swings – I/O, Streams and Object Serialization – Recursion – Threads – Multithreading – Generic collections – Generic Classes and Methods – Networking Manipulating URLs – Reading web pages – Using stream sockets – Datagrams – Broadcasting – Multicasting – Chat application.

UNIT 3 - JDBC AND WEB APPLICATION DEVELOPMENT **9 Hrs**

Accessing Database with JDBC – Basics – Manipulating Databases with JDBC – Overview of Servlets – Servlet API – Servlet Life Cycle – Servlet Configuration – Running Servlet with Database Connectivity – Session Tracking – Basics of JSP – Java Server Faces – Multitier Application Architecture – MVC Architecture of JSF Apps – Common JSF Components – Session Tracking.

UNIT 4 - DISTRIBUTED OBJECTS **9 Hrs**

RMI Programming Model – Remote Object Activation – Java Beans Component – Java Beans API – Java Messaging Services (JMS) – Synchronous and Asynchronous Messaging – Java Mail API – Java Web Services.

UNIT 5 - ADVANCED FRAMEWORKS **9 Hrs**

Advanced Frameworks – Understanding Struts – MVC framework – Struts Control Flow – Building Model View Controller Component – Hibernate – Architecture – Understanding O/R mapping – Query language – Spring Framework – Architecture – Case Studies.

Text Books:

1. "Core and Advanced Java, Black Book", Dreamtech Press, 2018.
2. Paul J. Deitel, Harvey Deitel, "Java How to Program", Eleventh Edition, Pearson, 2017.
3. Cay S. Horstmann, "Core Java Volume I & II", Pearson Education, 2018.
4. Herbert Schildt , "Java The Complete Reference", Eighth Edition, Tata McGraw Hill, 2011.
5. Paul Dietel, Harvey Dietel, Abbey Dietel, "Internet and World Wide Web", Fifth Edition, Pearson Education, 2012.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER: II SEM / I YEAR
COURSE CODE: 21MCA4203
TITLE OF THE COURSE: COMPUTER COMMUNICATION AND NETWORKS
L:T:P:C: 3: 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the network fundamentals.
2. To explore various application layer protocols.
3. To understand the transport layer services.
4. To learn the network layer functionalities.
5. To understand the link layer services and data communication fundamentals.

COURSE OUTCOMES:

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

1. Describe the fundamentals of internetworking.
2. Design new application layer protocols for various applications.
3. Select suitable transport layer protocols for networkapplications.
4. Trace and analyze the packets between end-to-end applications.
5. Calculate the capacity of links between nodes.
6. Identify suitable signal encoding techniques for various scenarios.

MODULE 1 - APPLICATION LAYER **9 Hrs**

Principles of Network Applications – Protocol Architecture: TCP/IP Protocol Architecture – Introduction to Socket Programming – Web and HTTP – File Transfer Protocol – Domain Name System – SMTP – POP – IMAP – Peer to Peer Applications – Performance: Latency, Delay and Bandwidth Product.

MODULE 2 - TRANSPORT LAYER **9 Hrs**

Transport Layer Services – UDP – Reliable Byte Stream: TCP, Connection Establishment and Termination, Sliding Window, Triggering Transmission, Adaptive Retransmission, TCP Extensions – TCP Congestion Control.

MODULE 3 - NETWORK LAYER **9 Hrs**

Network Layer Functions – Switching and Forwarding: Datagrams, Virtual Circuit Switching, Source Routing – Internetworking: IPv4, IP Address Classes, Subnetting, CIDR, ARP, DHCP, ICMP – Routing: DVR, LSR, BGP – IPv6.

MODULE 4 - DATA LINK LAYER **9 Hrs**

Hardware Building Blocks: Nodes, Links – Link Layer Functions – Framing: PPP, HDLC – Error Detection: Two Dimension Parity, Checksum, CRC – Reliable Transmission: Stop and Wait, Sliding Window – MAC: Ethernet, WiFi, Bluetooth.

MODULE 5 - FUNDAMENTALS OF DATA COMMUNICATION **9 Hrs**

Communication Model – Data communications – Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments – Signal Encoding Techniques: Digital Data and Digital Signals – Multiplexing: FDM, TDM, Multiple Channel Access.

Text Books:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.

2. Larry L. Peterson and Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

References:

1. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson, 2014.

2. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, McGraw-Hill, 2012.

DAYANANDA SAGAR UNIVERSITY

School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR		**II SEM / I YEAR**
COURSE CODE		**21MCA4204**
TITLE OF THE COURSE	**:**	**DATABASE MANAGEMENT SYSTEMS**
L: T/A: P: C	**:**	**3 : 0 : 0 : 3**

COURSE OBJECTIVES:

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

COURSE OUTCOMES:

1. Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model.
2. Formulate solutions to a broad range of query problems using relational algebra/SQL.
3. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
4. Run transactions and estimate the procedures for controlling the consequences of concurrent data access.
5. Explain basic database storage structures, access techniques and query processing.
6. Describe distributed, semi-structured and unstructured database systems.

UNIT 1 - RELATIONAL DATABASES **9**

Purpose of Database System – Views of Data – Data Models – Database System Architecture – Introduction to Relational Databases – Relational Model – Keys – Relational Algebra – Relational Calculus – SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL.

UNIT 2 - DATABASE DESIGN **9**

Entity-Relationship Model – ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT 3 - TRANSACTION MANAGEMENT **9**

Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling – Recovery System – Failure Classification – Recovery Algorithm.

UNIT 4 - IMPLEMENTATION TECHNIQUES **9**

Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation – Query Optimization.

UNIT 5 - ADVANCED TOPICS **9**

Overview of Distributed Databases – Data Fragmentation – Replication – XML Databases – XML Schema – NOSQL Database: Characteristics – CAP theorem – Types of NoSQL Datastores: Column Oriented, Document, Key-Value and Graph Types – Applications – Current Trends.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2014.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

References:

1. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, Fourth Edition, Tata McGraw Hill, 2010.
3. G. K. Gupta, “Database Management Systems”, Tata McGraw Hill, 2011.
4. Carlos Coronel, Steven Morris, Peter Rob, “Database Systems: Design, Implementation and Management”, Ninth Edition, Cengage Learning, 2011.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : II SEM / I YEAR
COURSE CODE : 21MCA4205

TITLE OF THE COURSE : Advanced Algorithm Lab

L: T/A: P: C : 0 : 0 : 4 : 2

COURSE OBJECTIVES:

1. To understand the design and implementation of advanced algorithms and data structures.
2. To implement the applications of algorithms in different fields such as geometry, number theory, signal processing and linear algebra.

COURSE OUTCOMES:

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

1. Be skilled in advanced algorithm design and implementation. 2.

Knowledge of advanced data structures.

LIST OF EXPERIMENTS:

Implementation in the following topics:

Lab experiments and mini projects will include dynamic multi-threaded versions of matrix multiplication, solutions of linear equations, Fast Fourier Transforms – DFT and FFT, advanced string matching algorithms, computational geometry, probabilistic analysis, advanced data structures and graph algorithms.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : II SEM / I YEAR

COURSE CODE : 21MCA4206

TITLE OF THE COURSE : JAVA PROGRAMMING AND NETWORKS LABORATORY

L: T/A: P: C : 0 : 0 : 4 : 2

COURSE OBJECTIVES:

1. To understand and apply the fundamentals of core Java.
2. To implement inheritance, polymorphism, interfaces, multithreading, streaming, networking, generic collections and RMI.
3. To develop web applications using client side and server side programming.
4. To understand SOAP and REST based web service standards. 5. To learn and use MVC architecture for application development.

COURSE OUTCOMES:

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

1. Write programs on advanced features of Java such as streaming, networking, multithreading and generics.
2. Design and develop GUI based components and animations.
3. Develop chat and file transfer applications.
4. Create JDBC based distributed applications using RMI and Java Beans.
5. Develop dynamic data driven websites using server side programming. 6. Create MVC applications using advanced frameworks.

Lab experiments and mini projects will include Java Programming concepts, Java socket programming, JDBC, Remote Method Access using RMI Implementation Database Connectivity using Java Bean, Session Management and Implementation of Cookies using JSF, Web application development using Struts framework & Spring framework and Analyze live HTTP/DNS/UDP/TCP/IP/ICMP/DHCP packets using Wireshark tool.

Mini projects on Real time Applications.

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DEPARTMENT OF COMPUTER APPLICATIONS

COURSE CODE: 21MCA4207
TITLE OF THE COURSE: DATABASE SYSTEM MANAGEMENT LAB
L:T:P:C:0 : 0 : 4 : 2

COURSE OBJECTIVES:

1. To learn and implement important commands in SQL.
2. To learn the usage of nested and joint queries.
3. To understand functions, procedures and procedural extensions of databases.
4. To understand design and implementation of typical database applications. 5. To be familiar with the use of a front end tool for GUI based application development.

COURSE OUTCOMES:

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

1. Create databases with different types of key constraints.
2. Write simple and complex SQL queries using DML and DCL commands.
3. Realize database design using 3NF and BCNF.
4. Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
5. Create XML database and validate with meta-data (XML schema). 6. Create and manipulate data using NOSQL database.

Lab Experiments and Mini Projects will include:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in database table.
9. Create View and index for database tables with large number of records.
10. Create a XML database and validate it using XML schema.

11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above- mentioned features.

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DEPARTMENT OF COMPUTER APPLICATIONS

DEPARTMENT ELECTIVE - I

SEMESTER/YEAR	**:**	**II SEM / I YEAR**
COURSE CODE	**:**	**21MCA4209**
TITLE OF THE COURSE	**:**	**DATA ANALYTICS & VISUALIZATION**
L: T/A: P: C	**:**	**3 : 0 : 2 : 3**

COURSE OBJECTIVES:

1. This course the fundamentals statistics and probability required in the analysis of data
2. This course also gives the details of R and it's usage in Data Analytics

COURSE OUTCOMES:

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

1. To understand the statistical tools and techniques
2. To be able apply these tools and techniques in data analytics using R .

MODULE 1 **9**

Statistical Programming: R Fundamentals, Getting started with R, Data Types, Control Structures, Functions, Data files, Inputting data, Removing data sets, Data Structures, Types of Data, Variables within data, Transposing data, Missing values, Naming columns

MODULE 2 **9**

Statistical tests and Distance Metrics: Basic Tests: Mean, Variance, Quantile, Length, T-test: Variance equal/unequal, Paired t-test, T-test Step by Step. Chi Squared: Chi-Squared Step by Step, Goodness of Fit test, Distance Metrics

MODULE 3 **9**

Correlation and Regression: Inference and Learning, Multiple Regression, Linear and Logistic Regression Models, Regression coefficients, Beta coefficients, R squared, Graphing the regression

MODULE 4 **9**

Topic modeling: Hidden Markov Models, Latent Semantic Indexing, Probabilistic Latent Semantic Indexing, Latent Dirichlet Allocation (LDA), Gibbs Sampling for LDA

MODULE 5 **9**

Random Graphs- Basic models-Homogenous graphs- Fixed Degree Sequence- Intersection graphs-Digraphs-Hypergraphs – Tools and methods.

Text Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer 2009.

2. Richard Cotton, Learning R,Oreilly Publication.

3. Alan Frieze And Michał Karonsk, “Introduction To Random Graphs”, Cambridge university press, 2016.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR	**:**	**II SEM / I YEAR**
COURSE CODE	**:**	**21MCA4210**
TITLE OF THE COURSE	**:**	**Virtualization & Cloud Computing**
L: T/A: P: C	**:**	**3 : 0 : 2 : 4**

COURSE OBJECTIVES:

The student should be made to:

1. To understand Virtualization concepts and different types of virtualization
2. To understand cloud computing concepts, technologies and services

COURSE OUTCOMES:

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

1. Conceptual and sound knowledge of virtualization and different types of virtualization.
2. Acquire knowledge of cloud computing, technologies and services

MODULE 1 **9**

Virtualization: Definition, benefits, Virtualization History, Virtualizing x86 Computer virtualization: : MMU Virtualization, CPU Virtualization, IO Virtualization; Types of Virtualization: Binary Translation, Para Virtualization, Hardware Assisted, Networking in virtualized environment, Virtual Machines and Access Control.

MODULE 2 **9**

Storage Virtualization**:** Introduction and Basic concepts, Storage Interconnect, Abstracting Physical Storage, Virtualization at the host, Virtualization at the Storage Target. Server Virtualization**:** Introduction, Types of Server Virtualization, Server Virtualization Concepts, Planning and other Uses of Server Virtualization, Planning for Deployment, Server Virtualization Platform Differences.

MODULE 3 **10**

Introduction to Cloud Computing: History of Cloud, Cost angle and Usability angle, Capex to Opex, Cloud Deployment Models (Public, Private, Hybrid), Cloud Service Models (IaaS, PaaS, SaaS)

IaaS Deep Dive: Infrastructure as a service, Understanding of available IaaS models: AWS, Google Compute Engine, Azure, Open Stack.

PaaS Deep Dive: Understanding of available PaaS models: Google App Engine, Elastic Bean Stack, RedHat OpenShift

MODULE 4 **10**

MBaaS: Overview, MBaaS-Parse, MBaaS-AWS, Using MBaaS Services from Android.
Introduction to Business Processes as a Service (BPaaS) and Analytics as a Service (AaaS)

MODULE 5 **7 Hrs**

Introduction to developing Cloud Services: Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.

Text Books:

1. D. Marshall, W. A. Reynolds, and D. Mc Corry, Advanced Server Virtualization, Aurbech Publications, 2006.
2. T. Clark, *Storage Virtualization: Technologies for Simplifying Data Storage and Management,* Addison-Wesley Professional, 2005.
3. Dan C Marinescu-Cloud Computing Theory and Practice. Elsevier(MK) 2013
4. Rajkumar Buyya , James Broberg, Andrzej Goscinski- Cloud Computing Principles and Paradigms, Willey 2014

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR	**:**	**II SEM / I YEAR**
COURSE CODE	**:**	**21MCA4211**
TITLE OF THE COURSE	**:**	**FULL STACK DEVELOPMENT**
L: T/A: P: C	**:**	**3 : 0 : 2 : 4**

COURSE OBJECTIVES:

1. To get an overview of the full stack software and web development.
2. To understand the object oriented structure and user interface programming through Python.
3. To gain knowledge of web development using Flask Framework.
4. To learn the web application deployment in real time scenarios.
5. To learn to deploy the software in Linux and Windows platforms.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand the object oriented approach in Python.
2. Develop GUI applications with Python.
3. Use the collaborative version control system, git.
4. Package the developed code in Linux and Windows environment.
5. Deploy the developed web application using Flask in real time scenarios such as AWS.
6. Developer of the industrial software.

UNIT 1 - OBJECT ORIENTED APPROACH IN PYTHON **9**

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

UNIT 2 - U SER INTERFACE APPLICATIONS IN PYTHON AND VERSION CONTROL SYSTEM **9**

Wxpython Installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands.

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine.

UNIT 4 - REAL TIME DEPLOYMENT OF WEB APPLICATION 9

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

UNIT 5 - DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM 9

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment in Windows – Creation of Standalone Executable – Test Cases.

References:

1. Mark Lutz, “Learning Python”, Fifth Edition, O’ Reilly 2013.
2. http://zetcode.com/wxpython/
3. Scott Chacon and Ben Straub, “Pro Git”, Free e-book under Creative commons, Second Edition, Apress, 2016.
4. Miguel Grinberg, “Flask Web Development Developing Web Applications with Python”, OReilly, 2014.
5. Karl Seguin, “The Little Mongo DB Book”, https://github.com/karlseguin/the-little-mongodb-book.
6. Gareth Dwyer, “Flask by Example”, Packt Publishers, 2016.
7. https://aws.amazon.com/education/awseducate/
8. http://packaging.ubuntu.com/html/packaging-new-software.html
9. http://www.pyinstaller.org/
10. https://pypi.org/project/py2exe/0.9.2.0/

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4301
TITLE OF THE COURSE : AI and Machine Learning
L: T/A: P: C : 3 : 0: 0 : 3

COURSE OBJECTIVES:

1. Able to generate, analyze and interpret data summaries based on AI & ML
2. Able to carry out analyze machine learning algorithms
3. Able to design and implement classifiers clustering applications
4. Able to apply the techniques in the area of pattern recognition and data analytics.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Understand the basic principles of machine learning techniques.
2. Understand the supervised and unsupervised machine learning algorithms.
3. Choose appropriate techniques for real time problems.

MODULE – I Introduction
9hrs

Machine Learning, types of machine learning, examples. Supervised Learning: Learning class from examples, learning multiple classes, regression, model selection and generalization, dimensions of a supervised learning algorithm. Parametric Methods: Introduction, maximum likelihood estimation, evaluating estimator, Bayes' estimator, parametric classification.

MODULE - II Dimensionality reduction
9hrs

Introduction, subset selection, principal component analysis, factor analysis, multidimensional scaling, linear discriminant analysis.

Clustering: Introduction, mixture densities, k-means clustering, expectation-maximization algorithm, hierarchical clustering, choosing the number of clusters. Non-parametric: Introduction, nonparametric density estimation, non-parametric classification.

MODULE - III Decision Trees
9hrs

Introduction, Univariate trees, pruning, rules extraction from trees, learning rules from data. Multilayer perception: Introduction, training a perceptron, learning Boolean functions, multilayer perceptron, backpropagation algorithm, training procedures.

MODULE – IV BAYESIAN ESTIMATION & HMM
9hrs

Bayesian Estimation: Introduction, estimating the parameter of a distribution, Bayesian estimation, Gaussian processes. Hidden Markov Models: Introduction, discrete Markov processes, Hidden Markov models, basic problems of HMM, evaluation problem, finding the state sequence, learning model parameters, continuous observations, HMM with inputs, model selection with HMM.

MODULE - V GRAPHICAL MODELS
9hrs

Introduction, canonical cases for conditional independence, d-separation, Belief propagation, undirected graph: Markov random field. Reinforcement Learning: Introduction, single state case, elements of reinforcement learning, temporal difference learning, generalization, partially observed state.

TEXT BOOKS

1. E. Alpaydin, *Introduction to Machine Learning*. 2nd MIT Press, 2009.
2. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes" McGraw Hill Education India, 4th Edition, New Delhi, 2010.

REFERENCE BOOKS

1. K. P. Murphy, Machine Learning: A Probabilistic Perspective. MIT Press, 2012.
2. P. Harrington, Machine Learning in Action. Manning Publications, 2012
3. C. M. Bishop, Pattern Recognition and Machine Learning. Springer, 2011.
4. S. Marsland, Machine Learning: An Algorithmic Perspective. 1st Ed. Chapman and Hall, 2009.
5. T. Mitchell, Machine Learning. McGraw-Hill, 1997.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4302
TITLE OF THE COURSE : EMBEDDED SYSTEMS AND INTERNET OF THINGS
L: T/A: P: C : 3 : 0: 0 : 3

COURSE OBJECTIVES:

1. To understand the fundamentals of Embedded Systems.
2. To learn about the basics of IoT protocols
3. To Develop IoT applications using Arduino and Raspberry Pi.
4. To apply the concept of Internet of Things in the real-world scenario.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Develop IoT Applications using Arduino and Raspberry Pi
2. Analyze various Applications.
3. Deploy an IoT application and connect to the cloud.
4. Analyze applications of IoT in real time scenario

MODULE I- Embedded System – Introduction 9hrs

RISC- ARM- Embedded Hardware – Embedded Software- ARM Processor Fundamentals: Registers, Program Status Registers, Pipeline, ARM Processor Family- Instruction Set.

MODULE II- Introduction to Internet of Things
9hrs

Introduction: Definition & Characteristics of IoT - Physical Design of IoT: Things in IoT, IoT Protocols- Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs - IoT Enabling Technologies- IoT World Forum Architecture- IoT OneM2M Architecture.

MODULE III- IoT Application Development
10hrs

Arduino: Introduction - Tour of an Arduino Board- Arduino Family- Programming with Arduino. Raspberry Pi: Introduction, Raspberry Pi Interfaces-Programming Raspberry Pi with Python- Other IoT Devices.

MODULE IV- IoT Physical Servers & Cloud Offerings
8hrs

Introduction to Cloud Storage Models & Communication APIs- WAMP - AutoBahn for IoT- Xively Cloud for IoT- Python Web Application Framework – Django- Amazon Web Services for IoT.

MODULE V- Case Studies Illustrating IoT Design
9hrs

Home Automation – Smart City – Smart Environment: Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection – Agriculture.

Text Books

1. Andrew N Sloss, D. Symes, C. Wright, "ARM System Developers Guide", Morgan Kauffman/ Elsevier,2006. (unit 1)
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015 (Unit 2, 4, 5)
3. Simon Monk, "Programming Arduino Getting Started with Sketches", McGraw-Hill, 2012. (unit 3)

Reference Books

1. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.
2. Microcontroller and Embedded Systems", Pearson Education, Second edition, 2007.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4303
TITLE OF THE COURSE : AI and Machine Learning Lab using Python L:
T/A: P: C : 0 : 0: 4 : 2

COURSE OBJECTIVES:

1. To get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions
2. To implement supervised learning and their applications
3. To understand unsupervised learning like clustering and EM algorithms
4. To understand the theoretical and practical aspects of probabilistic graphical models.

COURSE OUTCOMES:

At the end of the course students will be able to

1. The Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate Machine Learning algorithms to data sets
4. Identify and apply Machine Learning algorithms to solve real world problems

LIST OF EXPERIMENTS

1. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.
2. Detecting Spam mails using Support vector machine
3. Implement facial recognition application with artificial neural network
4. Study and implement amazon toolkit: Sagemaker
5. Implement character recognition using Multilayer Perceptron
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Implement sentiment analysis using random forest optimization algorithm
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
9. Choose best machine learning algorithm to implement online fraud detection
10. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

TEXT BOOKS

1. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019
2. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

REFERENCE BOOKS

1. Sebastain Raschka, “Python Machine Learning”, Packt publishing (open source).
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
3. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020

SOFTWARE: • Python with ML packages

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4304
TITLE OF THE COURSE : Embedded and Internet Of Things Laboratory L:
T/A: P: C : 0 : 0: 4 : 2

COURSE OBJECTIVES:

- To understand embedded-system programming and apply that knowledge to design and develop embedded solutions.
- To learn tools relevant to embedded system and IoT development.
- To write simple assembly programs that uses various features of the processor.
- To design and develop IoT application Arduino/Raspberry pi for real world scenario.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Embedding Program with IOT to perform various tasks.
2. Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices
3. Get familiarized with programming environment to develop embedded solutions.
4. Write and implement simple assembly programs that use various features of the processor.
5. Test and experiment different sensors for application development Arduino/ Raspberry Pi/ Equivalent boards.
6. Develop IOT applications with different platform and frameworks.

EXPERIMENTS:

PART I:

1) Study of ARM evaluation system 2) Interfacing ADC and DAC.
3) Interfacing LED and PWM.
4) Interfacing real time clock and serial port.
5) Interfacing keyboard and LCD.

PART II:

1. Implement assembly and Interfacing Programs Using Embedded C.
2. Embedded Application Development (i) Using Arduino and Raspberry Pi
   (ii) Using Bluemix platform
3. IoT Application Development
   (i) Using sensors and actuators (temperature sensor, light sensor, infrared sensor)
   (ii) Interfacing sensors with Arduino/Raspberry Pi/other equivalent boards

(iii) Reading data from sensors

4. Explore different communication methods with IoT devices.
5. Collecting and processing data from IoT systems in the cloud using XivelyPaaS.
6. Develop IoT applications using Django Framework and Firebase/ Bluemix platform.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III/II
COURSE CODE : 21MCA4306
TITLE OF THE COURSE : Distributed Computing (Hadoop and Scala)
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To understand the concepts of distributed systems.
2. To get an insight into the various issues and solutions in distributed operating systems.
3. To learn about real-time operating systems.

COURSE OUTCOMES:

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

1. Identify the features of distributed operating systems.
2. Demonstrate the various protocols of distributed operating systems.
3. Identify the different features of real time operating systems.
4. Discuss the features of mobile operating systems.
5. Discuss the features of cloud operating systems.

MODULE – I DISTRIBUTED COMPUTING

9hrs

Distributed File Systems – Design Issues – Google File System – Hadoop Distributed File System – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory – Load Distributing Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol.

MODULE - II BASICS OF HADOOP

9hrs

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

MODULE - III INTRODUCTION TO SCALA

9hrs

What is Scala? Why Scala for Spark? Scala in other Frameworks - - Setup and configuration of Scala - Developing and running basic Scala Programs - Different Scala APIs for common operations. Scala in other frameworks.

MODULE – IV EXPLORING SCALA

9hrs

Introduction to Scala REPL Basic Scala operations -Variable Types in Scala-Control Structures in Scala - Foreach loop, Functions and Procedures -Collections in Scala- Array, ArrayBuffer, Map, Tuples, Lists, and more.

MODULE - V HADOOP RELATED TOOLS

9hrs

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

TEXT BOOKS

1. MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database and Multiprocessor Operating Systems", Tata MC Graw-Hill, 2001.
2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
3. Tom White "Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale", Oreilly, 4th Edition.

REFERENCE BOOKS

1. KarimYaghmour, "Embedded Android", O'Reilly, First Edition, 2013.
2. NikolayElenkov, "Android Security Internals: An In-Depth Guide to Android's Security Architecture", No Starch Press, 2014.

DAYANANDA SAGAR UNIVERSITY

School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4307
TITLE OF THE COURSE : Data Mining
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. This course aims at providing the required skill to apply the business Intelligence.

COURSE OUTCOMES: At the end of the course students will be able to

2. To Demonstrate an understanding of the concepts of importance of data mining.
3. To Organize and Prepare the data needed for data mining using pre preprocessing techniques To Implement the appropriate data mining methods like classification, clustering, or Frequent Pattern mining on large data sets.
4. To Define and apply metrics to measure the performance of various data mining algorithms.

MODULE – I Data Mining and its Applications

9hrs

Introduction, What is Data Mining, Motivating Challenges, Kinds of pattern that can be mined, Classification of Data Mining Systems, Data Mining task Primitives, Applications, Data Preprocessing, Data cleaning, , data integration and data transformation, data reduction.

MODULE - II Data Warehouse and OLAP Technology: An Overview

10hrs Data Warehouse basic concepts, From Tables and Spreadsheets to Data Cubes, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Databases, Examples for Defining Star, Snowflake, and Fact Constellation Schemas, Measures: Their Categorization and Computation, OLAP Operations in the Multidimensional Data Model, A Starnet Query Model for Querying Multidimensional Databases.

MODULE - III DataCube Computation

12 hrs

Data warehouse Implementations, Efficient Methods for Datacube Computation: A Road Map for the Materialization of Different Kinds of Cubes, Multiway Array Aggregation for Full Cube Computation,
BUC: Computing Iceberg Cubes from the Apex Cuboid Downward, Star-cubing: Computing Iceberg Cubes Using a Dynamic Star-tree Structure, Precomputing Shell Fragments for Fast High-Dimensional OLAP, Computing Cubes with Complex Iceberg Conditions.

MODULE – IV Mining Frequent Patterns, Associations, and Correlations

9 hrs

Efficient and Scalable Frequent Itemset Mining Methods: The Apriori Algorithm: Finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, Mining Frequent Itemsets without Candidate Generation, Mining Frequent Itemsets Using Vertical Data Format, Mining Closed Frequent Itemset, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis.

MODULE - V Classification and Prediction
9hrs

What is classification and Prediction? Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods—Increasing the Accuracy

Text Books:

1. Jiawei Han and MichelineKamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.

2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison- Wesley, 2005.

Reference Books:

1. Arun K Pujari: Data Mining Techniques University Press, 2nd Edition, 2009.

2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

3. Alex Berson and Stephen J.Smith: Data Warehousing, Data Mining, and OLAP Computing McGrawHill Publisher, 1997.

DAYANANDA SAGAR UNIVERSITY

School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III/II
COURSE CODE : 21MCA4308
TITLE OF THE COURSE : Business Intelligence Technology
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. The student will define the importance of business intelligence by:

a) describing key business intelligence terms.
b) determining the relevance of data to business
c) aligning business intelligence to organizational strategy.

2. The student will identify how various business intelligence systems can contribute to organizational success by:

a) examining CRM concepts and solutions.
b) learning data warehouse concepts and solutions
c) exploring data mining concepts and solutions.

COURSE OUTCOMES:

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

1. Explain the fundamentals of business intelligence.
2. Link data mining with business intelligence.
3. Apply various modeling techniques.
4. Explain the data analysis and knowledge delivery stages.

MODULE – I INTRODUCTION

9hrs

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non-Technical Infrastructure Evaluation.

MODULE - II BUSINESS INTELLIGENCE

9hrs

Managing The BI Project, Defining and Planning the BI Project, Project Planning Activities, Roles And Risks Involved in These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process.

MODULE - III EFFICIENCY

9hrs

Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis.

MODULE – IV BUSINESS INTELLIGENCE APPLICATIONS

9hrs

Marketing models – Logistic and Production models – Case studies.

MODULE - V BUSINESS VIEW

9hrs

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead. Advanced Visualization – Rich Report, Future beyond Technology.

TEXT BOOKS

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.
2. "Business Intelligence Guidebook: From Data Integration to Analytics" by Rick Sherman.

REFERENCE BOOKS

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw- Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007.

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School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4309
TITLE OF THE COURSE : Big Data with R
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To provide an insight into Big Data Analytics using R Programming.

COURSE OUTCOMES:

At the end of the course students will be able to

1. explore the fundamental concepts of big data analytics
2. analyze the big data using R-Programming
3. understand the various search methods and visualization techniques
4. understand the applications using Map Reduce Concepts

Module-I Big Data and Analytics

9hrs

Example Applications, Basic Nomenclature, Analysis Process Model, Analytical Model Requirements , types of Data Sources, Sampling, Types of data elements, data explorations, exploratory statistical analysis, missing values, outlier detection and Treatment, standardizing data labels, categorization.

MODULE II- Introduction to R- Programming

9hrs

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes- Control Structures in R

Module III- Data Analysis

9hrs

Descriptive Statistics - Analysis of Variance and Correlation – Regression – LASSO - Ridge Regression- Classification : Logistic Regression Classifier, Linear Discriminant Analysis, K-Nearest Neighbors Classifier (KNN), Support Vector Machines (SVM)- Clustering.

Module IV- Natural Language Processing

9hrs

Text Pre-processing (tokenization, stop-word removal, tf-idf) - Exploratory Data Analysis - Text Clustering - Text Classification - Sentiment Analysis- Predictive Analytics

Module V- Data Visualization

9hrs

Exploratory Analysis with base graphics tools in R- Customize plot axes, labels, add legends, and add colors. Hadoop's Parallel World- History of Hadoop, Apache Hadoop and the Hadoop Ecosystem Hadoop Releases Response

Text Books

1. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani,Introduction to Statistical Learning with Applications in R, Springer 2013. Available free online.
2. Christian Kleiber and Achim Zeileis, Applied Econometrics with R, Springer-Verlag, New York, 2008.
3. Bart Baesens, " Analytics in a Big Data World : The Essential Guide to Data Science and its Applications" Wiley

Reference

1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Michael Minelli, Michele Chambers, AmbigaDhiraj, Wiley CIO Series, 2013.
2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012
3. Bollen, Johan, Huina Mao, and Xiaojun Zeng. "Twitter mood predicts the stock market." *Journal of computational science* 2, no. 1 (2011): 1-8.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4310
TITLE OF THE COURSE : Data Science
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To prepare data for analysis
2. To identify suitable models for respective applications
3. To understand visualization models for interpreting results

COURSE OUTCOMES:

At the end of the course students will be able to

1. Acquire fundamental knowledge of the concepts of data science.
2. Identify various type of data used for analysis.
3. Apply various supervised and unsupervised algorithms to real world problems.
4. Interpret the results of developed models using different visualization technique

MODULE – I Data, Relations and preprocessing

9hrs

Data Analytics - Data Mining - Knowledge Discovery - Data and Relations - Data preprocessing - Data Visualization

MODULE - II Correlation and Regression

9hrs

Correlation: Linear Correlation, Correlation and Causality, Chi-Square Test - Regression: Linear Regression - Linear Regression with Nonlinear Substitution - Robust Regression - Neural Networks - Radial Basis Function Networks - Cross Validation - Feature Selection - Forecasting: Finite State Machines - Recurrent Models - Autoregressive Models.

MODULE - III Association Rule Mining and Classification

9hrs

Mining Frequent item-sets - Market based model - Apriori Algorithm - FP growth algorithm, Handling large data sets in Main memory - Classification Criteria - Naive Bayes Classifier - Linear Discriminant Analysis - Support Vector Machine - Nearest Neighbor Classifier - Learning Vector Quantization - Decision Trees - Neural Networks.

MODULE – IV Clustering and Time Series Analysis

9hrs

Clustering Partitions - Sequential Clustering - Prototype-based Clustering - Fuzzy Clustering - Relational Clustering - Cluster Tendency Assessment - Cluster Validity - Self-Organizing Map - Time Series Analysis: Introduction to Stream Concepts - Stream data model and architecture - Stream Computing, Sampling data in a stream - Filtering streams - Counting distinct elements in a stream.

MODULE - V Visualization and Applications

9hrs

Classification of Visual Data Analysis Techniques - Data Type to be visualized - Visualization Techniques - Interaction Techniques - Specific Visual Data Analysis Techniques - Systems and Applications: Diversity of Intelligent Data Analysis (IDA) Applications - Development Issues - Online Visualization Tools: D3 - Fusion Charts - Data Wrapper.

TEXT BOOKS

1. Runkler, Thomas. A, "Data Analytics: Models and Algorithms for Intelligent Data Analysis", Springer, 2012.
2. Michael Berthhold, David J. Hand, "Intelligent Data Analysis - An Introduction", 2nd Edition, Springer Publications, 2002.

REFERENCE BOOKS

1. Jiawei Han, Micheline Kamber, Jian Pie, "Data Mining Concept and Techniques", Morgan and Kaufmann Publisher, Third Edition, 2012.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4311
TITLE OF THE COURSE : Cloud Networking & Security
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now.
2. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

COURSE OUTCOMES:
At the end of the course students will be able to

1. Understand the concepts of Virtualization, cloud architecture and deployment models.
2. Ability to identify the architecture, infrastructure and delivery models of cloud computing.
3. Ability to address the core issues of cloud computing such as security, privacy. Design Cloud Services and Set a private cloud.

MODULE I- CLOUD ARCHITECTURE AND MODEL
9hrs

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

MODULE II- VIRTUALIZATION
9hrs

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

MODULE III- CLOUD INFRASTRUCTURE
9hrs

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE IV- PROGRAMMING MODEL

9hrs

Parallel and Distributed Programming Paradigms – Map Reduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim.

MODULE V- SECURITY IN THE CLOUD

9hrs

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management.

Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control- – Autonomic Security.

Text Books

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
4. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR	**: III SEM / II YEAR**
COURSE CODE	**: 21MCA4312**
TITLE OF THE COURSE	**: Cloud Storage**
L: T/A: P: C	**: 3 : 0: 2 : 4**

COURSE OBJECTIVES:

1. This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domains from a while now.
2. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it. **OBJECTIVES:**
   1. To understand the concept of cloud computing.
   2. To appreciate the evolution of cloud from the existing technologies.
   3. To have knowledge on the various issues in cloud computing.
   4. To be familiar with the lead players in cloud.
   5. To appreciate the emergence of cloud as the next generation computing paradigm.

MODULE I- INTRODUCTION

9hrs

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

MODULE II- CLOUD ENABLING TECHNOLOGIES

9hrs

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

MODULE III- CLOUD ARCHITECTURE, SERVICES AND STORAGE

9hrs

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

MODULE IV- RESOURCE MANAGEMENT AND SECURITY IN CLOUD

9hrs

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

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DEPARTMENT OF COMPUTER APPLICATIONS

MODULE V- CLOUD TECHNOLOGIES AND ADVANCEMENTS

9hrs

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security||, CRC Press, 2017.

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing||, Tata Mcgraw Hill, 2013. 2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach||, Tata
Mcgraw Hill, 2009. 3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)||, O'Reilly, 2009.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : III SEM / II YEAR
COURSE CODE : 21MCA4313
TITLE OF THE COURSE : MOBILE APPLICATION DEVELOPMENT TECHNIQUES
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. This course aims at providing the required skill about Mobile Application Development.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Understand the basic concepts of Mobile application development
2. Design and develop user interfaces for the Android platforms
3. Apply Java programming concepts to Android application development

MODULE I- MOBILE OS

9hrs

Brief History of embedded device programming-History of Mobile apps-App development trends of past years- Mobile Operating systems- Mobile Operating systems Architecture- Types of Mobile Operating systems- Android OS- Types- Architecture- Android Application Development Platforms.

MODULE II- ACTIVITY AND INTENTS

9hrs

Introduction to Activity and Intent, Activity life cycle and state, Implicit and Explicit Intents, The Android Studio debugger, App testing and Android support library. Understanding the views, components, understanding screen, screen orientation, Button, clickable images, Input controls, Menus and pickers.

MODULE III- MULTIMEDIA & 2D GRAPHICS

9hrs

Graphics Introduction-Simple Graphics , View, Canvas- 2D, 3D with OpenGL – Audio – Video

MODULE IV- SERVICES

9hrs

Location service- Tablets- Fragment – SQLite- In & Out – Data Binding – Content Provider.

MODULE V- FLUTTER

9hrs

Flutter Introduction - Meet Flutter - A brief intro to Dart - Breaking into Flutter- Flutter User Interaction, Styles & Animations - Flutter UI: Important widgets, themes, and layout.

TEXT BOOKS

1. Android programming for beginners, John Horton, Packt-Birmingham, Mumbai-2nd edition, 18 ISBN – 978-1-78953-850-2.
2. Flutter in Action, Eric Windmill, Manning - 1st edition, 2020 ISBN – 978-1617296147.

REFERENCE BOOKS

1. Android Programming: The Big Nerd ranch Guide (4th edition), Bill Philips, Chris Stewart, Kristin Masrsicano, 2019, ISBN :-100136590071
2. Head First Android Development: A Brain-Friendly guide, Dawn Griffiths and David Griffiths, O'Reilly , 2nd edition-2019.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4401 (Department Elective)
TITLE OF THE COURSE : Information Security
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

To understand the basics of Information Security

1. To know the legal, ethical and professional issues in Information Security
2. To know the aspects of risk management
3. To become aware of various standards in this area
4. To know the technological aspects of Information Security

COURSE OUTCOMES:

At the end of the course students will be able to

1. Discuss the basics of information security
2. Illustrate the legal, ethical and professional issues in information security
3. Demonstrate the aspects of risk management.
4. Become aware of various standards in the Information Security System 5. Design and implementation of Security Techniques.

MODULE – I INTRODUCTION

9hrs

History, what is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

MODULE –II SECURITY INVESTIGATION

9hrs

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

MODULE – III SECURITY ANALYSIS

9hrs

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

MODULE – IV LOGICAL DESIGN

9hrs

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

MODULE – V LOGICAL DESIGN

9hrs

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security||, Vikas Publishing House, New Delhi, 2003

REFERENCES

1. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management||, Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed||, Tata McGraw- Hill, 2003 3. Matt Bishop, — Computer Security Art and Science||, Pearson/PHI, 2002.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM/II YEAR
COURSE CODE : 21MCA4402 (Department Elective)
TITLE OF THE COURSE : INTRODUCTION TO SOCIAL NETWORK ANALYSIS
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To understand the components of the social network.
2. To model and visualize the social network.
3. To mine the users in the social network.
4. To understand the evolution of the social network.
5. To know the applications in real time systems.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to

1. Work on the internals components of the social network
2. Model and visualize the social network
3. Mine the behavior of the users in the social network
4. Predict the possible next outcome of the social network
5. Apply social network in real time applications

MODULE – I INTRODUCTION

9hrs

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

MODULE - II MODELING AND VISUALIZATION

9hrs

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- NodeLink Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

MODULE - III MINING COMMUNITIES

9 hrs

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

MODULE – IV EVOLUTION

9 hrs

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

MODULE - V APPLICATIONS

9 hrs

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

TEXT BOOKS

1. Social Network Analysis for AU (Elective IV) (English, Paperback, I.A.DHOTRE).
2. Introduction to Social Network Analysis with R, Wiley Series in Computational and Quantitative Social Science Series, Michal Bojanowski, 2022.
3. Introduction to social network methods, Hanneman, Robert A. and Mark Riddle. 2005.

REFERENCE BOOKS

1. Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis||, Springer, 2010.
2. Guandong Xu , Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications||, Springer, 1st edition, 2012
3. Peter Mika, —Social Networks and the Semantic Web||, Springer, 1st edition, 2007.
4. Przemyslaw Kazienko, Nitesh Chawla,||Applications of Social Media and Social Network Analysis||, Springer,2015

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4403 (Department Elective)
TITLE OF THE COURSE : Deep Learning
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To present the mathematical, statistical and computational challenges of building neural networks
2. To study the concepts of deep learning
3. To introduce dimensionality reduction techniques
4. To enable the students to know deep learning techniques to support real-time applications
5. To examine the case studies of deep learning techniques

COURSE OUTCOMES:

At the end of the course students will be able to

5. Understand basics of deep learning
6. Implement various deep learning models
7. Realign high dimensional data using reduction techniques
8. Analyze optimization and generalization in deep learning
9. Explore the deep learning applications

MODULE – I INTRODUCTION

9 hrs

Introduction to machine learning- Linear models (SVMs and Perceptron, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

MODULE - II DEEP NETWORKS

9 hrs

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks. Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

MODULE - III DIMENTIONALITY REDUCTION

9 hrs

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

MODULE – IV OPTIMIZATION AND GENERALIZATION

9 hrs

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization, Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

MODULE - V CASE STUDY AND APPLICATIONS

9 hrs

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

TEXT BOOKS

1. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aeron Courville, MIT Press,First Edition, 2016.
2. Deep Learning, A practitioner's approach, Adam Gibson and Josh Patterson, O'Reilly, First Edition, 2017.
3. Hands-On Learning with Scikit-Learn and Tensorflow, Aurelien Geron, O'Reilly, First Edition, 2017.
4. Deep Learning with Python, Francois Chollet, Manning Publications Co, First Edition, 2018.
5. Python Machine Learning by Example, Yuxi (Hayden) Liu, First Edition, 2017.
6. A Practical Guide to Training Restricted Boltzmann Machines, Geoffrey Hinton, 2010,

REFERENCE BOOKS

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015

DAYANANDA SAGAR UNIVERSITY

School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4405 (Department Elective)
TITLE OF THE COURSE : Blockchain Technology
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To give students the understanding of emerging abstract models for Blockchain Technology and to familiarise with the functional/operational aspects of cryptocurrency eco-system.

COURSE OUTCOMES

1. Understand emerging abstract models for Blockchain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
3. It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

MODULE I- INTRODUCTION TO BLOCKCHAIN 9 hrs

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic Hash Function, Properties of a hash function-Hash pointer and Merkle tree

MODULE II- BITCOIN AND CRYPTOCURRENCY 9 hrs

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network

MODULE III- BITCOIN CONSENSUS 9 hrs

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment.

MODULE IV- DISTRIBUTED CONSENSUS 9 hrs

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance

MODULE V- HYPER LEDGER FABRIC & ETHERUM
9 hrs

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code-Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle- Design and issue Crypto currency, Mining, DApps, DAO.

REFERENCES

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

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School of Engineering

DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM/II YEAR
COURSE CODE : 21MCA4406 (OPEN ELECTIVE)
TITLE OF THE COURSE : Business Data Analytics
L: T/A: P: C : 3: 0:2 : 4

COURSE OBJECTIVES:

1. To understand the basics of business analytics and its life cycle.
2. To gain knowledge about fundamental business analytics.
3. To learn modeling for uncertainty and statistical inference.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Identify the real-world business problems and model with analytical solutions.
2. Solve analytical problem with relevant mathematics background knowledge.
3. Convert any real-world decision-making problem to hypothesis and apply suitable statistical testing.

MODULE – I OVERVIEW OF BUSINESS ANALYTICS

9 hrs

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.

MODULE - II ESSENTIALS OF BUSINESS ANALYTICS

9 hrs

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

MODULE - III MODELING UNCERTAINTY AND STATISTICAL INFERENCE

9 hrs

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables –Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis.

MODULE – IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK

9 hrs

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce –

Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce.

MODULE - V OTHER DATA ANALYTICAL FRAMEWORKS

9 hrs

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

TEXT BOOKS

1. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, 2013.
2. Umesh R Hodeghatta, Umesha Nayak, "Business Analytics Using R – A Practical Approach", Apress, 2017.
3. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
4. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, "Essentials of Business Analytics", Cengage Learning, second Edition, 2016.

REFERENCE BOOKS

1. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, 2017.
2. A.Ohri, "R for Business Analytics", Springer, 2012
3. Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publication, 2015.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4407
TITLE OF THE COURSE : Industrial Safety (Open Elective)
L: T/A: P: C : 4 : 0: 0 : 4

COURSE OBJECTIVES:

1. To develop an expert manpower to handle the complex industrial environment.
2. To give knowledge about occupational health, industrial hygiene, accidental prevention techniques to the students.
3. To make the student aware about safety auditing and management systems, pollution prevention techniques etc.
4. To train the students about risk assessment and management.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Develop an expert manpower to handle the complex industrial environment.
2. Comprehend occupational health, industrial hygiene, accidental prevention techniques to the students.
3. Become aware of safety auditing and management systems, pollution prevention techniques etc.
4. Understand risk assessment and management.

MODULE- I INTRODUCTION

9 hrs

Henrichs Axioms Of Industrial Safety ,Concepts Of Safety, Organization For Safety, Organization,Definition, Need & Principles Organizing For Health ,and ,Environmental, Activities, Organization Structure, Function & Responsibilities

MODULE- II SAFETY MANAGEMENT

9 hrs

Directing For Safety, Direction, Definition, Process, Principles and Techniques Leadership, Role, Function And, Attributes of a Leader. Safety Management System, Objectives of Health, Safety and Environment Policy, Responsibility for Implementation of HSE Policy

MODULE- III ROLES AND ACCIDENT PREVENTION

9 hrs

Role of Occupier and Factory Manager, Factory Safety Committee, Structure and Functions and Working Tenure Details Etc**.** Accident Prevention :Definition : Incident, Accident, Injury , Dangerous occurrence ,Unsafe Act, Unsafe, Conditions, Hazards, Error, Oversight, Mistake, Near Miss ,Electricity & Hazards ,Of Electricity, Explosives And ,Transportation Safety.

MODULE - IV THEORIES AND PRINCIPLES OF ACCIDENT CAUSATION

9 hrs

The effect of accident, unsafe act, unsafe condition, unpredictable performance, Human factors contributing to accidents - causes for unsafe acts, ii. Safety and psychology -Theories of motivation and their application to safety. Consequences of accident, accident prevention programmers, Role of safety. iii. Accidents related with maintenance of machines & advantages of Maintenance of machines, work permit system- significance of Documentation

MODULE -V FIRST AID

9 hrs

Need of First aid. Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and joints, Bleeding, Burns, Scalds and accidents caused by electricity, Respiratory problems, Rescue and Transport of Casualty. Cardiac massage, poisoning, wounds. Statutory provisions.

TEXT BOOKS

1.Fundamentals of Industrial safety & health by K.U. Mistry.
2.Factories Act 1948

REFERENCE BOOKS

1. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai 2. Grimaldi and Simonds , Safety Management, AITBS Publishers , New Delhi (2001)
3. Industrial Safety –National Safety Council of India ISHET.
4. Dr. K. U. Mistry - Fundamentals of Industrial Safety & Health, Siddharth Prakashan, Ahmedabad.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4408 (Open Elective)
TITLE OF THE COURSE : Operations Research
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To provide basic knowledge of optimization techniques to be used to optimize the real world problems.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Define and formulate linear programming problems and appreciate their limitations.
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. Develop mathematical skills to analyse and solve integer programming and network models arising from a wide range of applications.

MODULE-I

9 hrs

Linear Programming-Graphical, Simplex, Two Phase & Big M Methods, Dual Linear Programming-Dual of a Problem, Dual Simplex Method.

MODULE-II

9 hrs

Transportation Methods- North West Corner, Least Cost, VAM Methods, Optimal Solution by Modi &Stepping Stone Method, Assignment Problem

MODULE-III

9 hrs

Queuing Theory, Inventory Control- EOQ, Price Break , Production Inventory Model, Lead Time, Inventory Control System, Inventory Models, Network Analysis-Time Estimation, PERT and CPM, Statistical Quality Control.

MODULE-IV

9 hrs

Game Theory, Integer and Dynamic Programming, Quadratic Programming, Goal Theory, Simulation and Forecasting Techniques.

MODULE-V

CPM & PERT- project scheduling, critical path calculations, Crashing.

Text Books:

1.Taha, H.A, “Operations Research-An Introductin”,Macmillian

Reference Books:

1.Hadley, G., "Linear Programming and Massachusetts", Addison-Wesley
2. Hillller, F.S., G.J. Lieberman, "Introduction to Operations Research", Holden-Day
3.Harvey M. Wagner, "Principles of Operations Research with Applications to Managerial Decisions".
4.Swarup K. et.al. ," Operation Research", S. Chand Pub.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4409 (Open Elective)
TITLE OF THE COURSE : Cost Management of Engineering Projects
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

The course should enable the students to:

1. Establish systems to help streamline the transactions between corporate support departments and the operating units.
2. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units.

COURSE OUTCOMES (COs):

1. Understand the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept.
2. Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.
3. Understand the meaning and different types of project management and project execution, detailed engineering activities.
   Understand the project contracts, cost behaviour and profit planning types and contents, Bar charts and Network diagram.
4. Analyse by using quantitative techniques for cost management like PERT/CPM.

MODULE I- INTRODUCTION
9 hrs

Introduction and Overview of the Strategic Cost Management Process.

MODULE II- COST CONCEPTS
9 hrs

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision Making.

MODULE III- PROJECT MANAGEMENT
9 hrs

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents. Project team: Role of each member. Importance Project site: Data required with significance.

Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

MODULE IV- COST BEHAVIOR AND PROFIT PLANNING

9 hrs

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing.
Costing of service sector. Just-in-time approach, Material Requirement, Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets;

MODULE V- COST MANAGEMENT TECHNIQUES

9 hrs

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation Problems, Assignment problems, Simulation, Learning Curve Theory.

TEXT BOOKS:

1.Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

REFERENCES:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster Advanced Management Accounting.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4410 (Open Elective)
TITLE OF THE COURSE : Composite Materials
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. To understand the fundamentals of composite material strength and its mechanical behavior
2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
3. Thermo-mechanical behavior and study of residual stresses in Laminates during processing.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Implement a Classical Laminate Theory (CLT) to study and analyze residual stresses in anisotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING

12 hrs

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law.
Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic
Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes.

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS

10 hrs

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations –Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates,
Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS

5 hrs

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS

8 hrs

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Offaxis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES

10 hrs

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies.

TEXT BOOKS:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw- Hill, 1998

REFERENCES:

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

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DEPARTMENT OF COMPUTER APPLICATIONS

SEMESTER/YEAR : IV SEM / II YEAR
COURSE CODE : 21MCA4411 (Open Elective)
TITLE OF THE COURSE : Waste to Energy
L: T/A: P: C : 3 : 0: 2 : 4

COURSE OBJECTIVES:

1. The objective of the course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production.
2. To enable students to understand the concept of Waste to Energy.
3. To link legal, technical and management principles for production of energy from waste.
4. To learn about the best available technologies for waste to energy.
5. To analyze case studies for understanding success and failures.
6. To facilitate the students in developing skills in the decision making process.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Correlate legal, technical and management principles for production of energy from waste.
2. Learn about the best available technologies for waste to energy.
3. Analyze case studies for understanding success and failures.

MODULE – I Introduction
9 hrs

Introduction to energy from waste: characterisation and classification of waste as fuel – agrobased, forest residues, industrial waste, Municipal solid waste. Waste to energy options: combustion (unprocessed and processed fuel), gasification, anaerobic digestion, fermentation, pyrolysis.

MODULE - II Conversion devices and Properties of fuels
9 hrs

Conversion devices: combustors (Spreader Stokes, Moving grate type, fluidized bed), gasifier, digesters. Briqueting technology: Production of RDF and briquetted fuel. Properties of fuels derived from waste to energy technology: Producer gas, Biogas, Ethanol and Briquettes, Comparison of properties with conventional fuels.

MODULE - III Power generation, IGCC and IPCC
9 hrs

Power generation using waste to energy technologies: Cl and Sl engines , IGCC and IPCC concepts. Landfills: Gas generation and collection in land fills, Introduction to transfer stations. Comparison with non-energy options like Vermiculture, Composting.

MODULE – IV Waste to Energy Options
9 hrs

Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications. Energy from Plastic Wastes – Non-recyclable plastic wastes for energy

recovery. Energy Recovery from wastes and optimization of its use, benchmarking and standardization. Energy Analysis

MODULE - V Case Studies & Waste To Energy & Environmental Implications
9 hrs

Case Studies – Success/failures of waste to energy Global Best Practices in Waste to energy production distribution and use. Indian Scenario on Waste to Energy production distribution and use in India. Success and Failures of Indian Waste to Energy plants. Role of the Government in promoting 'Waste to Energy'. Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on nonrenewable fuel resources. Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

TEXT BOOKS

1. M.M. EL-Halwagi, Biogas Technology- Transfer and diffusion, Elsevier Applied science Publisher, New York, 1984.
2. D.O Hall and R.P. Overeed, Biomass – regenerable energy, John Willy and Sons Ltd. New York. 1987

REFERENCE BOOKS

1. Environmental and Resource Economics
2. Environmental Monitoring and Assessment
3. Journal of Environmental Assessment Policy and Management
4. Industrial and Urban Waste Management in India, TERI Press.
5. Wealth from Waste: Trends and Technologies by Banwari Lal and Patwardhan, TERI Press.
6. Fundamentals of waste and Environmental Engineering, S.N Mukhopadhyay, TERIPress.
7. Gazette Notification on Waste Management Rules 2016.
8. CPCB Guidelines for Co-processing in Cement/Power/Steel Industry
9. Waste-to-Energy in Austria – White Book – Figures, Data Facts, 2nd edition , May 2010
10. Report of the Task Force on Waste to Energy,
11. Niti Ayog (Formerly Planning Commission) 2014.
12. Municipal Solid Waste Management Manual, CPHEEO, 2016.