MOHANLAL SUKHADIA UNIVERSITY: UDAIPUR
MASTER OF COMPUTER APPLICATION PROGRAMME
(NEP Based Choice Based Credit System, Session 2023 Onwards)

1. Duration of the Program

The Master of Computer Application program shall be of four semester's duration which will be conducted in two years. Each semester will be approximately 5 months (minimum 90 working days in a semester) duration.

2. Eligibility:

As per RMCAPP

3. Admissions:

Admissions to the first semester of M.C.A program shall be made on the basis of common admission policy of the State Government.

4. Medium of Instruction

The medium of instruction and examination shall be English.

5. No. of Seats

Maximum number of seats in the program of study will be decided by the committee of courses concerned on the basis of number of permanent teachers and the laboratory facilities available to teach each course of the program and will be notified after the approval of the competent bodies.

6.Curriculum under Choice Based Credit System

Terminologies:

Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or ability enhancement/Skill courses). The nomenclature used is the following:

Program means the conventional degree/PG courses offered such as B.Sc., M.C.A., Ph.D, Diploma etc.

Discipline means subjects in a program

Courses refer to papers in the conventional system

Credit means a unit by which the course work is measured. It determines the number of hours of instructions required per week.

6.1. Curriculum

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

The M.C.A Program has a two year, four semester prescribed course structure which in general terms is known as curriculum. It prescribes courses to be studied in each semester as given under courses of study and examination

The M.C.A. program shall have curriculum and course contents (syllabi) for the courses recommended by the committee courses and approved by the academic council of the university. The program shall follow a credit based semester system. Each academic year is divided into two semesters

6.2 Course Credit System/Structure
In general, a certain quantum of work measured in terms of credits is laid down as the requirement for a particular degree. A student earns the credits for a particular
Course by fulfilling the academic requirements viz. attendance and evaluation. In two years MCA programme, number of credits shall be 120. Number of credits of a course for a semester is calculated as follows for the different types of instructions for a course. A course need not necessarily have all the three types of instructions given in the table below. Credits have to be adjusted accordingly.

SNo.	Type of Instructions	Course	Credits
1	Theory/Class room instructions	One Lecture or tutorial hr/week	1
2	Practical, field work,	Two hours /week in the Laboratory/field	1
3	Seminar	One contact hour with the teacher/week	1

Credits are awarded to a student for Theory / Laboratory / Other Courses only if the student satisfies the minimum attendance requirement of 75% of the total classes held and the evaluation requirements.

6.3 Courses in the program :
In each program, candidates will be required to offer specified number of courses under following:

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement for the program is termed as a Core course.

Elective Course is generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

   (i) Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by department which is offering the main discipline).

(ii)   Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

(iii) Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

6.4. Ability Enhancement Courses (AEC):

The Ability Enhancement (AE) Courses may be of two kinds
Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC).
"AECC" courses are the courses based upon the content that leads to Knowledge enhancement;
In the post graduation Program, all the students will be required to earn 4 credits ofin Ability Enhancement Courses (if any) as audit course. The credits and grade points obtained in the audit courses shall not be counted towards calculation of SGPA and CGPA. Students can also offer various extra credit courses as Audit courses to earn extra credits and it is not mandatory for the students to offer these courses. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

6. 5. Earning credits:
For successful completion of M.C.A. Program, candidate will be required to earn minimum 120 credits during four semesters by
1. Registering for a minimum specified number of courses.
2. Attending minimum prescribed hours of instructions
3. Undergoing continuous internal assessment
4. Taking external end semester examinations

At the end of every course of a program, students who have earned credits undergoing the above procedures are awarded a letter grade in that course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.
Grades obtained in the audit courses are not counted for computation of grade point average. However, a pass grade is essential for passing an earning audit course.

6.6 Registering for a minimum specified number course.

(i)   Each candidate declared eligible for admission for a specified semester of the M.C.A. program shall be required to register for
        a) Core courses
        b) Discipline specific elective courses
        c) Ability Enhancement Courses
(ii)   Online registration facility will be available for the students for registration purpose.
(iii)   Students are required to contact the Faculty advisor / counselor and get information about the course, pre-requisites for selecting a course, scope of the course, future prospects etc.

Based on the previous performance of the students in pre-requisite courses, interest of the student in the elective and skill courses, thefaculty adviser will help a student in selecting elective and skill courses, earning extra credits, withdrawing from a course etc.

(iv) After obtaining the online registration form/data of registration, the department will enter name of the student in a Credit Bank Register maintained by each department under each course.

(v) Students will be offered elective courses and skill courses as per choices in the first cum first serve basis maintaining the spirit of choice based credit system.

(vi) The maximum number of students that can be admitted for an elective course or skill based course will be decided by the department based on number of teachers and facilities available for the course. Normally maximum number of candidates allowed to register for an elective or skill course should be limited to 20 to give individual attention to the candidates by the teacher.

(vii) A candidate may be allowed maximum period of one week to cancel the registration for a particular course and offer another elective or skill course provided a vacant seat is available for the course of candidate's choice. If a candidate cancel his registration in a course, he will be treated as withdrawn from the course and will be allowed to offer an elective or skill course if a vacant seat is available only in another semester as and when the course is offered.

(viii) No elective course or skill course will be offered if a minimum specified number of students are not registered for the course. Normally the minimum number of students required to offer an elective or skill course will be 10. For courses offered under self finance courses, the minimum number of students required to offer the course will be notified on the basis of availability of a teacher having specific skill to offer the course and economic viability.

(ix) It will be mandatory for each Department/College to publish a list of elective courses, name of teacher allotted for each elective/skill courses, proficiency of the teacher in the skill/elective paper to enable the candidates to select the course.

(x) Only those elective course or skill course will be offered by the Department for which a competent teacher and adequate laboratory facilities are available in the department and which are certified by a committee consisting the Faculty Chairman, Head of the Department and one professor from university department concerned. The committee will physically check the facilities required for offering the skill or elective courses and satisfy themselves about the expertise of the teacher to teach the course.

(xi) Every department will be required to provide a list of facilities available in the core courses. For affiliated colleges, the committee recommending affiliation should have members specified under para (x) and will certify that facilities to offer the core courses, elective and skill courses exist with the college. If facilities are not available for elective courses and skill courses, these courses shall not be offered in the department.

(xii) If facilities for an elective course or skill course is not available in the department/college, students may be allowed to offered these courses as per the rules under Credit Transfer

(xiii) Each college shall be required to create facilities and offer at least the skill courses as given in the appendix-A

6.7 Attending minimum prescribed hours of instructions

Regular attendance of the student is an important factor in the grading system. No grade can be given to a student unless he/she has attended the course regularly.

(i)   Regular attendance is expected of all students for every registered course in theory, laboratory, field work etc. Hence attendance is compulsory and will be monitored in the semester and students will be informed at the end of the month and end of semester by the teacher concerned.

(ii)   A maximum of 25% absence for the attendance may be condoned only on valid grounds such as illness, death in family or other emergency beyond students control and approved by the Head of the Department / Course Director. Sanctions are to be taken within a week after joining if on medical grounds. After condoning absence of the candidate a minimum 75% of the total classes held is mandatory for all the students to award credits and Grade points.

(iii)   All the students whose attendance is less than 75% in a course will be marked X grade against the course in their marksheet irrespective of whether they have appeared in any of the examinations conducted by the University.

(iv)   For Students participating in Sports / Cultural event/NCC camps during a semester, the maximum number of days of absence shall not exceed 8 days. Any waiver in this context shall be on the recommendation of the Dean - Student Welfare and the student will be required to apply in advance for the leave to the Head/Course Director through Faculty Advisor/Course Co-ordinator

(v)   A student having attendance lower that 75% in a course will be detained by the course instructor and debarred from appearing in the ESE for that course in that semester and the student will have to re-register for the course as and when it is offered.

(vi)   Overall Attendance in percentage of the total classes held will be printed on the mark sheet to validate the fact that Grades are awarded only to those candidates whose attendance is above 75%.

(vii)   Candidates whose attendance is above 70% but failed to obtain a minimum 75% may be allowed to attend remedial classes arranged, if any, by the course instructor provided the candidate pays a prescribed fee per class towards conduction of such classes. However, such classes shall not exceed 5% of the total classes held.

(viii) Leave of Absence

a) If the period of leave is for a short duration (less than a week), prior application for leave shall have to be submitted to the Head/Course Director stating fully the reasons for the leave requested for, along with the supporting document(s). Such leave shall be granted by the Head/Course Director

b) If the period of absence is more than 25% of the total number of instructions prescribed for that course, or is continuously absent for a period exceeding one month, the course instructor will inform name of such students to the Head of the Department and also publish name of such students on the notice board of the Department. A notice of cancellation of the Registration of the course and award of X-Grade will be informed to the candidate.

c) Name of candidates whose attendance is less than 75% will be automatically removed from the registration data. Candidates whose attendance is more than 70% but less than 75% shall be required to re-register in the course by applying for remedial classes by depositing prescribed fee. The re-registration will be effective only if the candidate

obtains a minimum attendance of 75% classes in the course concerned.

6.8 Undergoing continuous Internal assessment

Continuous Assessment (CA) will be carried out through Internal Assessment which is an essential component of the M.C.A (CBCS) programme. The Academic Council of the University will decide from time to time on the system of examinations in each program in each semester. The following continuous Assessment method will be followed in the M.C.A. (CBCS) program:

A student is evaluated for theory courses through Continuous Assessment (CA) with 20% weightage and End Semester External Examinations (ESE) with 80% weightage.

For a theory course of 100 marks, the CA component is 20 marks which consists of one internal semester examination of one hour duration (10 marks), and teacher evaluation (10 marks) through

Teacher is free to evaluate and assess internal marks as per his/her discretion

OR
a) Home assignments. (5 marks)
b) Class room test (Objective or short answer type)/ Class room viva/Quiz/Seminar etc (5 marks)

In the case of Laboratory /field work courses of 100 marks, the CA component is 20 marks which consist of one internal examination conducted as per same pattern of end semester examination (10 Marks) and Teacher evaluation (10 marks) through

(a)Completion of all prescribed number of laboratory work/Practical verified regularly by the teacher (5 marks)

(b)Viva/Quiz and the during the practical work, practical skill of the student assessed by the teacher (5 Marks)

In the case of seminar, project work etc. of 100 marks, the CA component is 20 marks which consist of one internal assessment of presentation of work in the same pattern of External examination (10 Marks) and Teacher evaluation (10 marks) on the basis of

(a)Completion of the work as per objective (5 Marks)

(b) Project Skill/Communication Skill/Reference work etc. of the student assessed by the teacher (5 Marks)

(ii) Separate grades will be awarded for both Internal and External Assessment. The procedure of Absolute Grading System will be used for calculating Grades of CA and ESE in Masters Programme. Minimum marks for passing CA will be same as that of ESE.

The CA marks will be awarded by the teacher concerned and will be presented to the following committee for necessary approval. The teacher will be required to prepare a report of the students where the reasons to justify the award of Internal marks of more than 90% and less than 36% is to be given.

The committee is expected to make sure that the CA is carried out as per the rules and may call for the internal examination answer books, assignment details etc. if necessary.

(a)Faculty Chairman/Principal or Nominee

(b)Head of the Department/Course Director

(c)Teacher Concerned

Since the Internal Assessment marks awarded is expected to follow a normal distribution, cases of giving inflated Internal Assessment marks, award of Internal Assessment marks without giving assignments etc. must be checked by obtaining marks for the individual components of CA as explained above and the marks awarded in each component should be displayed along with attendance of the students.

The Internal marks awarded and final attendance of the students must be displayed on the University web site using the Web Application for CBCS at least one week before the ESE. Grievances, if any, from the student shall be examined by the above committee. The student will be given an opportunity to represent his/her case to the committee.

(iii) The teacher shall announce the method of teacher evaluation at the beginning of the semester along with teaching Schedule. A teaching Schedule giving the Section/chapter of the Text book is followed, Reference books, Online Contents, date for submission of assignments, list of assignments, proposed date of assignment submission, Internal examination etc. as per details and examples given in the appendix.

(iv) All CA and ESE are compulsory for all students for award of credits in a course. The marking for all tests, tutorials and examinations will be on absolute basis. The final percentages of marks are calculated in each course as per the weightage indicated above.

(v)The final Internal Assessment marks finalized by the committee after hearing the grievances of the students must be uploaded on the Web site of the University.

.   (vi) If a candidate fails to attend an Internal examinations, in special cases and after being satisfied by the reason for absence, the department may conduct defaulters examination. The candidate will be required to pay prescribed fee for the defaulters examination to meet the expenditure towards conducting defaulters examination.

(vii)The laboratory course, whether offered as an independent course or as an attached course with a theory course will have continuous assessment for award of Internal Assessment marks.

Continuous Assessment of laboratory courses will be based on ,number of assignments/practical satisfactorily completed, punctuality, turn to turn supervision of student work, quality of work of journals, group discussions, overall understanding of the experiment and viva-voce examination (as per requirement of structure of course) .

(viii) The teacher shall announce the mode of evaluation and distribution of marks at the beginning of the laboratory course. It is obligatory to maintain and submit laboratory journal, prescribed documentation for the laboratory course and reports.

6.9 End Semester Examinations

(i) The End-Semester Examination (ESE) shall generally be of three hours duration for each theory course and is held as per the schedule declared. The ESE for the laboratory course will be of minimum 6 hrs duration. The detail time-tablefor this is declared by the university at the beginning of the Academic Session in the Academic Calendar of the Program.

(ii) Credits for a course will be awarded only if the student satisfies the minimum attendance requirements and acquires the necessary minimum grades for that course. Since a degree under CBCS awarded to a candidate who has not satisfied the minimum 75% attendance requirement is invalid, the teacher will be solely responsible for declaring a candidate eligible for appearing in the End Semester examination. So at least one week before the commencement of End Semester Examination, the teacher should enter the name of eligible candidates for appearing in the End Semester Examination of the Course with the approval of the Head of the Department. The Admit Card printed will bear the Non- Eligibility condition against the Course where he/she declared not eligible by the teacher, and the candidate shall not be allowed to appear in the End semester Examination in that course.

(iii) If a teacher or the college fails to declare a candidate eligible for appearing in the End Semester Examinations, the candidate will be assumed to be not eligible for appearing in the End Semester Examinations and the admit card will be made available accordingly to the students.

No credits are awarded if the student remains absent in internal examinations or ESE even though he/she has minimum attendance requirements.

7 Course Delivery

In the CBCS, each theory course is assigned to a teacher for delivering lectures, assessment of students and management of the course such as drawing course delivery plan (teaching schedule), marking attendance, declaring attendance and assessment marks etc. Once a course is assigned to a teacher, he/she is expected to complete the instructional hours required for the course within the prescribed period. Any loss of teaching hours due to unforeseen events must be compensated by conducting extra classes. In the case of laboratory courses, one teacher per batch of 20 students may be assigned to ensure personal attention to the laboratory work carried out by each student.

7.1 Procedure for awarding Grades

(i)Absolute Grading System: Absolute grading system will be used if number of students appearing in the ESE of a course in a University is less than 300 as number of answer scripts of a course allotted to an examiner is normally 300. In the Master Program Grades in the Continuous Assessment will also be calculated using Absolute Grade System.

Grade	Marks Range
O	90% to 100%
A+	80% to 89.99%
A	70% to 79.99%
B+	60 % to 69.99%
B	50% to 59.99%
C	40% to 49.99%
P	36% to 40.99%
F	Less than 36%
X	Not Allowed to Appear ESE due to shortage of Attendance
Ab	Absent

(ii)   Relative Grading System:
This grading system will be used if number of students appearing in ESE of a course in a University is over 300. However, the grading in the Continuous Assessment will be through Absolute Assessment since number of students assessed by a teacher in a class is normally 60.

Grade	Marks Range
O	Top 5% in the Merit
A+	Top 15% excluding O
A	Top 35% excluding O and A+
B+	Top 65% excluding O,A+ and A
B	Top 85% excluding O,A+,A and B+
C	Top 95% excluding O,A+,A,B+ and B
P	Remaining in the merit
F	Less than 40%
X	Absent/Not Allowed to Appear ESE due to shortage of Attendance
Ab	Absent

(iii)   Grade "X"

(a) The grade "X" is assigned to the student if his/her attendance is less than 75% in the Lectures/Tutorial/Laboratory course. A student with X grade shall not be permitted to take the ESE in that subject. The student will be detained for that subject only and will have to re register for the subject as and when it is offered and appears as and when it is conducted. However if a student is detained in any of the course he/she, will not be admitted to the next year, unless he/she Re- registers for that course and obtained passing grade

(b)   An'X' grade is treated as equivalent to F for purpose of CGPA calculation, and the following criteria in addition to poor attendance (less than 75% may be considered for the award of X grade :

(1)   Badly incomplete in semester record (due to non-medical reasons) (for example, in the case of a student who has missed all tests and assignments etc.)

(2)   Misconduct/use of unfair means in the examination, assignments etc., of a nature serious enough to invite disciplinary action in the opinion of the instructor. (It is emphasized that award of the X grade is in the nature of an immediate action in such cases, and the case may be referred to the Disciplinary Action Committee for consideration of further punishment depending on the seriousness of the offence). The names/roll numbers of students to be awarded the X grade should be communicated to the examination section in advance of the end-semester examination.

(c) The following rules apply for the course registered in any semester in which a student has acquired grade "X"

(i) He/she shall try to get a passing grade by registration for full examination in the next regular semester whenever it is offered. In this case the earlier performance of a student in all the evaluations will be treated as null and void.

(ii) A student registering for the course (Grade X) will pay fees for respective subject or lab and then undergo all evaluations including CA and ESE and is eligible to acquire any grade as per his/her performance.

(iii) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) will be calculated on the credit weighted average of the grade points obtained with letter grades countable in GPA based on ESE only. The Grades awarded in the Internal Assessment shall not be used in SGPA and CGPA.

(v) The SGPA, CGPA Letter grades will be assigned as per table given below.

Grade	Grade Point	Grade Definition
O	9.5 to 10.00	Outstanding
A+	8.5 to 9.49	Excellent
A	7.50 to 8.49	Very Good
B+	6.50 to 7.49	Good
B	5.50 to 6.49	Above average

C	4.50 to 5.49	Average
P	3.60 to 4.49	Below Average

(v)   There will be no supplementary/due paper/special examination. The candidates can improve performance in the subsequent ESE and performance in the next appearance will overwrite earlier performance. Student will have to prepare on his own for improvement. Improvement in CA will not be permitted.

(vi)   The University will issue a complete transcript of credits, grade obtained, SGPA and CGPA on declaration of each semester result and a Cumulative Transcript on the accumulation of minimum credits required for the award of Certificate/Diploma/Degree when EXIT is sought by the student.

(vii)   Non collegiate students are not eligible for the award of M.C.A. (CBCS).

7.2 Award of Grades:

(a) The ESE will be conducted by the examination section of the university. The question papers will be set by the examiners appointed by the university as per the syllabus, teaching plan and model question paper. University may conduct centre evaluation of the answer books by inviting external examiners or the answer books may be sent to the individual examiners for evaluation. After the evaluation
of the answer books based on the CA and ESE marks, a semester board will award the grades.

(b)   The semester board will consist of following
    (i) Faculty Chair person or nominee
    (ii) Convener of the Committee of Courses
    (iii)Head/Course Director
    (iv)Two teachers who taught the course

In case the semester board feels moderation/re-checking of the answer book is necessary, recommendation with reason will be sent for the consideration of the Result committee of the University. The semester board will maintain strict confidentiality of the marks and results. The result will be declared by the Controller of Examinations.
(c)Evaluated answer papers of CA and ESE should be preserved at least for a minimum period of one semester.
Calculation of SGPA and CGPA

A.   Semester Grade Point Average (SGPA)

a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student
b) The SGPA is the weighted average of the grade points obtained in all the registered by the student during the semester

c) If a numerical grade point equivalent to letter grade obtained by the student for the course with credit Ci then, SGPA for that semester calculated using the formula

SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Where the summation is for all the courses registered by a student in that semester. The SG PA is calculated using pass grades excluding Audit or skill papers. For example, if a student passes five courses in a semester with credits C1,C2,C3,C4,C5 and his/her grade points in these courses are G1, G2,G3,G4,G5 respectively, then SGPA is equal to

SGPA=C1G1+ C2G2 + C3G3 + C4G4 + C5G5 C1+ C2 + C3 + C4

The SGPA is calculated to two decimal places and rounded off.

B.   Cumulative Grade Point Average (CGPA)

(a)   The overall performance of a student from the first semester onwards till completion of the program is obtained by calculating a number called CGPA
(b)   The CGPA is weighted average of the grade points obtained in all the courses registered by the student
CGPA = $\sum$(Ci x Si) / $\sum$ Ci where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester
Where summation is for all the courses registered by a student till that semester excluding Audit courses and Skill courses so that it reflects the performance of the student in the discipline of study. The CGPA is calculated only when the candidate successfully completes all the courses from first to last semester
(c)   The CGPA shall not include the grade points obtained in the skill courses or in the extra credit courses.
(d)   The CGPA will be awarded only if a candidate obtain a minimum pass grade in all the Audit or skill courses.

7.3.   Illustration of Computation of SGPA and CGPA and Format for Transcripts Computation of SGPA and CGPA
(a) Illustration for SGPA

Course Code	Credit	ESE Marks	ESE	CA	ESE	ESE
Course-1	3	74	A	B	8	3X8=24
Course-2	4	54	B	A	7	4x7=28
Course-3	3	58	B	B	6	3x6=18
Course-4	3	92	O	A	10	3x10=30
Course-5	3	48	C	A	5	3x5=15

Course-6	4	57	B	B	6	4x6=24
TOTAL	20	383				139

ESE: End Semester Examination, CA: Continuous Internal Assessment, SGPA=139/20=6.95
      Grade: B+

(b) Illustration for CGPA

Semester-1	Semester-2	Semester-3	Semester-4
Credit=20 SGPA=6.95	Credit=22 SGPA=7.80	Credit=25 SGPA=5.60	Credit=26 SGPA=6.00

Thus
CGPA = 20 x 6.95 + 22 x 7.80 + 25 x 5.60 + 26 x 6.00   = 6.52   Grade: B+   = 93

8   Examination rules

a. University will conduct examinations normally after completion of at least90 working days of instruction in each semester as per examination schedule declared in advance. External examination will be conducted on consecutive working days without any gap.
b. Each theory paper shall be of 100 marks (80 marks for written examination of 3-hrs duration and 20marks for Continuous Internal Assessment)
c. Each practical/Project paper shall be of 100 marks (80 marks for semester practical examination of six hours duration and 20 marks for Continuous Internal Assessment).
d. Marks obtained in the Continuous Internal Assessment and End Semester Examination will be converted in to letter grades as per range of marks obtained by the candidates.
e. Candidates will be required to obtain a minimum pass grade in Internal Assessment and External Assessment separately. The CGPA and SGPA shall not include the Internal Assessment grades.
f. In the Masters Programme, the grades obtained in the Audit courses, Skill courses, Extra Credit courses etc. shall not be used for SGPA and CGPA calculation. Only the grades obtained in the Core and Discipline Specific Elective courses shall be used. In the case of Project work, the grades will be counted towards SGPA and CGPA, if it is a Core/DSE courses.
g. Grace Marks @ one mark/course will be awarded. One mark per course may be granted as a special grace by the Vice-Chancellor in a course. However, total grace marks shall not exceed   six marks in a semester for the first attempt and three marks for all the Due/improvement courses in a semester. Grace marks shall not be counted towards merit posit position.
h. The merit position of a candidate shall be decided on the basis of the absolute marks awarded to the candidate in the Core and Discipline Specific Elective courses at the end of the fourth semester end semester examination in the first attempt. The marks obtained by a candidate in any course through improvement or change of electives shall not be counted towards merit position.
i. Masters Degree shall be awarded to the candidates whose satisfy following:

（a） Obtained a minimum pass grade in each course registered except extra credit courses

（b） CGPA is minimum 3.60

（c） Minimum attendance in each of the course is 75% for the Regular category of students.

j. The question paper for end semester theory examination shall consist of a total of 16 questions. Part-A shall consist of one compulsory question of 20 marks with ten parts covering the entire syllabus for which answer must be provided with a maximum of 50 words for each. Part-B will consist five long answer questions (which requires answers in maximum 250 words each), one from each unit with internal choice. Each question in the part-B will carry 8 marks each. Part- C will consist five questions , one from each unit, out of which answer must be given for any two questions 10 marks each using maximum 300 words. Only one answer booklet will be given to the students for answering all the questions. No supplementary answer books shall be allowed.

k. The practical examination for End Semester Examination shall be conducted by the Department/College consisting the following:

（a） Internal Examiner nominated by the Head of the department

（b） External examiner from the panel of Examiners approved by the University.

l. If marks awarded to any candidate is more than 90%, or less than 36% then the justification for the same must be given by the examiner in a prescribed performa along with the award.

m. All the Colleges and University Departments will inform and get approval of the schedule of practical examination in advance (at least one week before the commencement of examination) to the University. The Faculty Chairman may send anobserver to the examination Centre on the day of examination or in advance who will submit a report of the number of experiments as per syllabus available in the college and carried out by each student , maintenance of attendance record etc.

n. The Faculty chairman will examine the reports received and submit his/her to the university. On the basis of the report received from the Faculty Chairman, the Vice-Chancellor may order for re-conduct of the practical examination. The expenses towards the reconduct of the examination will be borne by the College concerned.

o. A student who failed in a course will be allowed to re-appear in the End Semester Examination in that paper as and when it is again conducted by the University as per the syllabus of the course applicable for the current students.

p. A student will also be allowed to improve his credits by appearing in the End Semester Examinations as per university rules. However, improvement shall not be allowed in Practical papers.

q. Student shall not be eligible to improve his Grades in the Internal Assessment. However, a candidate who obtained Fail grade or X-grade in the Internal Assessment shall be allowed to re-appear in the Internal Assessment by applying to the Department and paying a prescribed fee. On the basis of his/her previous performance in the Assignments and Internal examinations, the student will be required to complete prescribed number of assignments and appear in the internal examination along with the current students.

r. Minimum passing marks and criteria for promotion to nexthigher semester

s. A candidate will be declared PASS in a Semester if he/ she has minimum Pass Grade in each papers and shall be eligible for registration for the courses in the next semester.

t. A candidate shall be PROMOTED from one semester to next semester if he/she has obtained minimum Pass grade in 50% of the courses registered.

u. A candidate fails to obtain minimum pass grade in 50% of the courses shall be declared FAIL and shall be required to reappear in the External End Semester examinations (as and when conducted by the university) in the courses he/she failed to obtain a minimum pass grade and satisfy conditions for pass or promotion to the next higher semester. However, he/she shall be eligible for admission in the higher semester only when these semesters are offered by the university.

v. A candidate who could not PASS in all the courses in each semester shall be required to re-register for the external examinations in the courses he/she failed to obtain pass grade and shall be required to pass all the due courses within 4 years from taking admission in the first semester.

w. In case result of a semester is not declared by the university, before the starting of the next higher semester, the students who have appeared in all the courses in the semester will be allowed to attend the classes of the next higher semester at their own risk. Candidates who are not eligible to be promoted shall have to leave that semester.

x. Evaluation of the Project will be carried out centrally at the University Departments only by a committee of examiners as given in para.12 (viii)

y. Program Span Period: A candidate admitted to the MCA programme will be required to pass the course within four academic years from the year of admission to the first semester. The span period will be decided as on 1st July of an academic session. During the span period candidate is free to apply for cancellation of the grade awarded to him/her and reappear in the same by re- registering for the same or for any other course including elective courses by paying prescribed fee. In the case of new elective course, he/she shall be required to attend classes and undergo internal assessment and satisfy all the regulations for earning credits including Continuous Internal Assessment grades

z. University examination rules for CBCS program approved by the Academic council of the University from time to time shall be applicable to students appearing in the Internal and External Examinations and will over ride the rules given above.

9. COURSE MANAGEMENT

Faculty Adviser

A student or a group of students is assigned to a faculty adviser from the concerned department, who will mentor the student throughout his/her tenure in the Institute. The students are expected to consult the faculty advisor on any matter relating to their academic performance and the courses they may take in various semesters / summer terms. The faculty advisor is assigned to extend guidance to the students enabling them to complete their courses of study for the required degree in a smooth and timely manner. Thus, the role of the faculty advisor is of immense importance. The faculty advisor is the person to whom the parents/guardians should contact for performance related issues of their ward. In view of the guidance to the students the role of faculty advisor is outlined as below

(a) Guidance about the rules and regulations of the courses of study for the program
(b) Pay special attention to weak students.
(c) Guidance and liaison with parents of students for their performances and other

personal problems a student may have.

Student Counselor

Each College/Faculty/Department will make arrangement for a student Counselor who will provide the complete information about the Masters Program CBCS to the students as well as help them in the Registration. The Counselor will also help the Teachers for using the Web application for CBCS where uploading of attendance of the students, Teaching Schedule, Course syllabus, reminding
Departments and teachers for uploading Internal marks, declaring eligibility of candidates in the ESE, sending of marks and other information to the University etc. The student counselor will hear the grievances of the students and make a registration of grievances.

Maintenance of Student Registration Register

Each college/Department will maintain discipline wise Student Registration Register where following information will be maintained for each semester session wise:
   a. Brief Information of the students
   b. Course registration details of Each Semester
   c. Monthly attendance of the students in each course
   d. Assignment marks in each course
   e. Internal Examination Marks in each course
   f. Final Internal Marks and Internal Credits in each course
   g. University examination marks and Credits in each course
   h. Details of the extra credits earned by the student

Maintenance of Attendance

The Teacher in charge of the course will display monthly attendance as per the academic calendar on the Notice Boar/Web site. Candidates whose attendance is short will be informed to the parents of the candidate and Rs 100/- per letter will be deducted from the caution deposit of such students towards the Postal and office expenses.

10 Extra Credits and Credit Transfer

A student can earn maximum 20 credits during Masters program by taking courses from various categories of courses given below. Students shall be required to apply to the University for earning extra credits before taking the credits and submit required documents after completion of the course to the
Faculty Chairman. Credit Transfer will be made only the credit earned is relevant to the programme and discipline of studies.

   a. Skill courses recognized by MHRD, Govt. of India

A student may offer certain professional courses/vocational courses recognized by the National Skill Development Centre and State Skill Development Centres during summer or as an evening

course from an organization/training centers recognized by MHRD and is of minimum 60 hrs duration and obtain a certificate recognized by the State or Central Govt. bodies. The student will be required to submit an application for the consideration of a committee for credit transfer by attaching the following documents to the Department/College:

    (i) Information about the course, course contents, credit hours, passing criteria, examination etc.
    (ii) Recognition of Training Centre and Agencies/Bodies conducted examination by State Govt./Central Government
    (iii) Copy of the certificate issued by a competent body
    (iv) Brief write up of the relevance of competency in the Program

    b. Skill courses/Vocational courses conducted by the University/Affiliated Colleges

Students can take skill courses, vocational courses etc recognized by the university and offered at various units of the university or affiliated colleges. Credits/credits calculated on the basis of the number of hours of the course and marks obtained will be given as extra credits provided the course is relevant in the discipline of the program as recommended by the committee for credit transfer.

    c. Skill courses/ Vocational courses conducted by other universities

Students who have attended Skill courses/vocational courses under credit system and conducted by recognized Universities at the University centre or their affiliated Colleges can apply to the university for credit transfer by submitting following documents

    (i) Information about the course, course contents, credit hours, passing criteria, examination etc.
    (ii) Attendance certificate from the Department/College where the student attended the course
    (iii) Copy of the certificate issued by the University
    (iv) Brief write up of the Relevance of competency in the Program.

The committee will recommend transfer of credits on the basis of the performance in a personal interview/presentation by the candidate.

    d. Internship/Elective Courses/Summer Projects/ Project work/Seminar etc. recognized by the University
    (i) Internship/Industry Project

A student may be allowed to take summer projects or internships in other institutions and Industries and credits so earned can be transferred as extra credits after assessing the work of the candidate by the departmental committee. The industry/Institution where the summer project to be carried must be approved by the Departmental Committee. A proposal for summer project/Internship must be submitted by the student to the departmental committee before proceeding for the summer project/Internship. Candidate will be required to produce attendance certificate, satisfactory completion of the work and a report of the work carried out must be submitted for assessment by the Credit Transfer Committee. The committee will assign maximum 8 credits for Internship.

    (ii)   Seminars

Seminar is a course requirement wherein under the guidance of an internal guide a student is expected to do in depth study of topics allotted to them by doing literature survey, and understanding different aspects of the technology. It is mandatory to give a seminar presentation before a panel constituted for the purpose. Participation in the seminars by the students shall be compulsory. The credits shall be awarded on the basis of the following:

a)   Understanding of the concept and presentation by the student concerned.(50%)
b)   Literature survey & detailed report (25%)
c)   Active participation & attendance in the seminars (25%)

(iii) Summer Projects/Minor projects /Training etc.

Students are allowed to carry out summer projects/Minor Projects or undergo Industrial Training in recognized institutions by the department. The duration of the Summer projects /Minor projects/Training should be minimum two months duration.12 credits will be awarded provided the candidate submits project/training report, attendance certificate showing a minimum 24 hrs/week work/training for four months duration. The   candidate will be required to present his project/training report which will be assessed by a committee as described separately below and will award grade as per performance as well as taking in to consideration confidential reports of the Project/Training supervisor.

Minor Projects /Training also can be carried out in the University Departments in the Research laboratories with the permission of the department.

11. Evaluation of Major/Minor Projects/Summer Training/ Internship etc for which credit to be awarded or credit transfer to be made.

(i)   All the students offering following courses shall be required to register for these courses.
   (a)   Major Project
   (b)   Minor Project
   (c)   Summer Project
   (d)   Industrial Training
   (e)   Internship

(ii) Students who wants to carry out Skill Courses/extra courses for credit Transfer will also be required to submit their application in advance.

(iii)All the applications received by the Department will be considered and will be send to the Concerned University Department /Skill Development Centre with their recommendation.

(v)Within one week from date of receipt of the application, concerned University department will request the faculty chairman to call the meeting of the Credit Transfer Committee Meeting to evaluate the Proposal

(vi) The Credit Transfer Committee will consist following members
   a) Faculty Chairman
   b) Head of the Department
   c) Convenor of Committee of Course concerned
   d) One Senior Professor /Subject expert

(vii) The Credit Transfer Committee will examine the required documents submitted by the candidate. If required the committee will ask the candidate to appear for an interview/test to

ensure whether the candidate has acquired the skill. The committee may accept or reject the application for the Credit Transfer based on their assessment.

(viii) In case of Major/Minor projects, Internships, Training etc., the candidate from University Departments and Affiliated colleges will be centrally evaluated by the following committee constituted and approved by the Faculty Chairman

(a)   Head of the Department
(b)   One Internal Examiner from University department
(c)   One External examiner (for Major Projects)
(d)   Nominee of the faculty chairman(for Credit transfer cases)

(ix). The credit transfer courses recommended by the above committee will be sent to Controller of Examinations after entering in the department Credit Register for incorporating it in the marksheets/certificates.

(ix) If the course for which credit transfer is approved is a part of the Elective/Skill courses curriculum, then same will be printed on the marksheet by the

University. For other courses, the Faculty Chairman will issue necessary extra credit/Credit Transfer Certificate against a fee decided by the Faculty.

12   TEMPORARY WITHDRAWAL FROM THE PROGRAM

A student seeking temporary withdrawal is granted permission by the Vice-Chancellor to withdraw from the Program for one semester/year for reasons of ill health or other valid reasons on the recommendations of concerned HOD/Course Director on the following terms:

The student applies to the Head/Course Director within four weeks of commencement of the term or from within four weeks of his / her last attendance in class whichever is earlier, stating the reasons for such withdrawal with supporting documents and endorsement of his/her parents.

The fee deposited for the current semester shall not be refunded for the students who applies for withdrawal after two weeks of commencement of the terms.

Normally, a student shall be permitted to avail of temporary withdrawal only once during the Program for a maximum duration of two semesters.

Such student who has discontinued and re-joins again will be governed by rules and regulations, courses of study, syllabus and fee in force at the time of his re-joining the Department. The joining time shall be the normal commencement of the term.

Appendix-A

Details of the Elective Skill Courses recommended to be offered in the colleges in addition to the Specialized skill courses recommended by University Departments.

General Skill Courses for M.C.A.(CBCS)

(i)   Communication and Presentation Skill
(ii)   Scientific Writing Skill
(iii)   Information and Communication Skills
(iv)   Mathematical and Analytic Skill (For biological Sciences)

Course outline

(i) Communication and Presentation Skill

Basic Language Skills, Comprehension of an unseen passage, Phonology and Stress Marking , Social and Official Correspondence, Interpretation of Short Unseen Literary Prose Pieces (fiction and non-fiction), Making presentations, public speaking. Detailed syllabus will be prepared by the Department of English and will be published on the web site.

(ii) Scientific Writing Skill

Introduction; principles of effective writing (cutting unnecessary clutter), Principles of effective writing (verbs),Crafting better sentences and paragraphs, Organization; and streamlining the writing process,,The format of an original manuscript, Reviews, commentaries, and opinion pieces; and the publication process, Issues in scientific writing (plagiarism, authorship, ghostwriting, reproducible research), How to do a peer review; and how to communicate with the lay public
Reference :http://online.stanford.edu/course/writing-in-the-sciences

(iii) Information and Communication Skills

Introduction to Important current Information technologies, Basics of Computer Hardware, Input Output devices, Specifications, System Software, Application software: Word processing, Desktop publishing, Spread Sheets, presentation, web authoring
graphing software. Network, Internet and Web, Internet Access, search tools, web utilities
Detailed syllabus including list practical will be published on web site of the University.

(iv) Mathematical and Analytic Skill (For biological Sciences)

This course details and syllabus will be made available on the university web site.

Department of Computer Science

Master of Computer Application MCA 2023 onwards

Name of University   : Mohanlal Sukhadia University, Udaipur

Name of Faculty   : Computer Science

Name of Discipline/Subject   : MCA

Course Curriculum
2-Year M.C.A Degree Programme Batch 2023 onwards Credit Structure Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week

1				I				32			48	
2				II				32			40	
3				III				32			40	
4				IV				24			36	
				Total				120			164	

level	Sem	Course Type	Course Code	Title of Course	Delivery Type			Total Hours	Credi	Internal Assessmen	EoS Exam	Total
					L	T	P					
			Semester – I									
8	I	DCC	MCA8001T	Database Management System	3	1	0	60	4	20	80	100
	I	DCC	MCA8002T	Python Programming	3	1	0	60	4	20	80	100
	I	DCC	MCA8003T	Web Technology	3	1	0	60	4	20	80	100
	I	DCC	MCA8004T	Operating System	3	1	0	60	4	20	80	100
	I	DCC	MCA8005T	MIS & E-Commerce	3	1	0	60	4	20	80	100
	I	DCC	MCA8006T	Advanced Data Structure	3	1	0	60	4	20	80	100
	I	DCC	MCA8001P	DBMS Lab	0	0	8	80	4	20	80	100
	I	DCC	MCA8002P	Python Programming Lab	0	0	8	80	4	20	80	100
	I	MBC	MCA8030B	Data Structure *	3	1	0	30	*	20	80	100
	I	MBC	MCA8031B	Basic Mathematics*	3	1	0	30	*	20	80	100

			*Bridge Course [For students other than BCA / B.Sc. (CS/IT) or 12th level with maths)] It will be an audit course for Non Computer Graduates. No Marks will be added. But Student has to pass this Course; in order have basic knowledge of Computer Science. Guidelines for Evaluation of Bridge Course Students except BCA / B.Sc. (CS/IT) have to qualify a Bridge Course as per University norms. I. Bridge course shall be an Audit Course whose award shall not be considered for overall MCA Course credit & percentage. However, grades will be reflected in the mark sheet of student. II. The students have to clear Bridge Course before End Term Examination of third semester.								
			Semester – II								
8	II	DCC	MCA8007T	Design & Analysis of Algorithms	3	1	0	60	4	20	80	100
	II	DCC	MCA8008T	Java Programming	3	1	0	60	4	20	80	100
	II	DCC	MCA8009T	Software Engineering	3	1	0	60	4	20	80	100
	II	DCC	MCA8010T	Computer Networks	3	1	0	60	4	20	80	100
	II	DCC	MCA8011T	Computer Architecture	3	1	0	60	4	20	80	100
	II	DCC	MCA8007P	Design & Analysis of Algorithms Lab	0	0	8	80	4	20	80	100
	II	DCC	MCA8008P	Java Programming Lab	0	0	8	80	4	20	80	100
	II	DSE	MCA810XT	Departmental Elective I	3	1	0	60	4	20	80	100
			Semester – III								
9	III	DCC	MCA9001T	Artificial Intelligence & Machine Learning	3	1	0	60	4	20	80	100
	III	DCC	MCA9002T	Embedded Systems	3	1	0	60	4	20	80	100
	III	DCC	MCA9003T	Digital Marketing	3	1	0	60	4	20	80	100
	III	DCC	MCA9004T	Information Systems & Cyber Security	3	1	0	60	4	20	80	100

					L	T	P		C			
	III	DCC	MCA9001P	Artificial Intelligence and Machine Learning Lab	0	0	8	80	4	20	80	100
	III	DCC	MCA9002P	Embedded Systems Lab	0	0	8	80	4	20	80	100
	III	DSE	MCA910XT	Departmental Elective-II	3	1	0	60	4	20	80	100
	III	DSE	MCA910YT	Departmental Elective-III	3	1	0	60	4	20	80	100
			Semester – IV									
9	IV	IOJ	MCA9003P	Project	0	0	36	480	24	20	80	100

List of Departmental Elective(s) – I									
MCA8100T	Content Management and Web Development	3	1	0	60	4	20	80	100
MCA8101T	Cloud Computing	3	1	0	60	4	20	80	100
MCA8102T	Real Time Systems	3	1	0	60	4	20	80	100
MCA8103T	Business Intelligence in ERP System	3	1	0	60	4	20	80	100
MCA8104T	Image Processing	3	1	0	60	4	20	80	100
MCA8105T	Mobile Computing	3	1	0	60	4	20	80	100
List of Departmental Elective(s) – II									
MCA9106T	Software Testing	3	1	0	60	4	20	80	100

MCA9107T	Robotics	3	1	0	60	4	20	80	100
MCA9108T	Internet of Things	3	1	0	60	4	20	80	100
MCA9109T	Compiler Design	3	1	0	60	4	20	80	100
MCA9110T	R Programming	3	1	0	60	4	20	80	100
List of Departmental Elective(s) – III									
MCA9111T	Ethical Hacking and Digital Forensics	3	1	0	60	4	20	80	100
MCA9112T	Data Mining and Data Warehousing	3	1	0	60	4	20	80	100
MCA9113T	Soft Computing	3	1	0	60	4	20	80	100
MCA9114T	Ad Hoc Networks	3	1	0	60	4	20	80	100
MCA9115T	Natural Language Processing	3	1	0	60	4	20	80	100

Course Code   : MCA8001T
Title of the course : DBMS(Database Management System)
Level of the Course : NHEQF Level 6
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   : NONE

Objectives of the Course:
1. Helps students in understanding the concepts of databases
2. Helps students in Modelling the databases with different types of models available.
3. Helps students in designing the databases.
4. Helps students to learn about how to store and retrieve the data from databases
5. Helps students to write and execute difficult queries
6. Helps students to learn advance concepts of DBMS

Learning Outcomes:
1. On successful completion of the course, students will be able to:
2. Learn about different features of database management systems.
3. Differentiate between database systems and file systems.
4. Model a database system using modelling tools like ER diagrams
5. Design database schemas based on the conceptual model.
6. Write queries in relational algebra / SQL.
7. Normalizedatabase schema.
8. Understand ACID Properties of transactions

UNIT I
Introduction: Database system applications, database systems versus file systems, views of data, data models, database languages, database users and administrators, transaction management, database system structure, application architecture.
Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, unique key, generalization, aggregation, reduction of an ER diagram to tables.
(12 lectures)

UNIT II
Relational model: Structure of relational databases, relational algebra, tuple relational calculus, domain relational calculus.
SQL: Characteristics of SQL, advantages of SQL, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub-queries, aggregate functions, insert, update and delete operations, joins, union, intersection, minus, cursors in SQL. Domain constraints, referential integrity, assertions, triggers, authorization and authentication. Relational

database design & normalization: Functional dependencies, normal forms- First, second, third, BCNF, fourth and fifth normal forms, decomposition

(12 lectures)
UNIT III
Indexing and Hashing: Basic concepts, ordered indices, B-tree, B+ tree, static hashing, dynamic hashing, comparison of ordered indexing and hashing, index definition in SQL, multiple-key access. Query Processing & Optimization: Measure of query cost, selection operation, sorting, join operation, other operations

(12 Lectures)
UNIT IV
Transactions: Transaction concept, atomicity and durability, concurrent execution, serializability, conflict and view, testing of serializability.
Concurrency Control: Concurrency Control, Locking Techniques for Concurrency control, Time stamping protocols for concurrency control, validation-based protocols
Recovery System: Failure classification, storage structure (RAID), recovery and atomicity, log based recovery, shadow paging

(12 Lectures)

UNIT V
Object Oriented Database Concept: Data types and Object, Evolution of Object-Oriented Concepts, Characteristics of Object-Oriented Data Model. Object Hierarchies, Generalization, Specialization, Aggregation.
Object Schema. Inter-object Relationships, Similarities and difference between Object Oriented Database model and Other Data models. Object Oriented DBMS Architecture, Application Selection for Object Oriented DBMS, Data Access API (ODBC, DAO, ADO, JDBC, OLEDB)

(12 Lectures)

Books
1. Database Systems Concepts, Korth
2. Fundamental of database system - Elmasiri and Navathe
3. Database Systems, Date C.J., AddisionWesley

Suggested E-Resources:
1. W3Schools
2. Codecademy
3. LearnSQL.com
4. Khan Academy
5. SQLZoo
6. Tutorialspoint
7. SoloLearn

Course Code : MCA8002T
Title of the Course : Python Programming
Level of the Course : NHEQF Level 6
Credit of the Course : 4
Type of the Course : DCC Course for MCA in computer science
Delivery Type :Lecture.
Total Lectures : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisite:
1. Experience with a high level language (C/C++, Java) is suggested. Prior knowledge of a scripting
2. Language (Perl, UNIX/Linux shells) and Object-Oriented concepts are helpful but not mandatory.

Objective of the course:
1. To learn how to design and program Python applications.
2. To learn how to use lists, tuples, and dictionaries in Python programs.
3. To learn how to identify Python object types.
4. To define the structure and components of a Python program.
5. To learn how to write loops and decision statements in Python.
6. To learn how to write functions and pass arguments in Python.
7. To learn how to build and package Python modules for reusability.
8. To learn how to read and write files in Python.
9. To learn how to design object-oriented programs with Python classes.
10. To learn how to use exception handling in Python applications for error handling.

Learning Outcomes:
1. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
2. Express proficiency in the handling of strings and functions.
3. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
4. Identify the commonly used operations involving file systems and regular expressions.
5. Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

UNIT I

INTRODUCTION TO PYTHON
Python installation, Python syntax, Scripts, Native Data Types, Booleans, Numbers, Lists, Tuple, Sets, Dictionaries, Comprehensions, List Comprehensions, Dictionary Comprehensions, Set Comprehensions

(12 Lectures)

UNIT II

Strings and modules: String operation, Formatting, Bytes, Encoding, Regular Expressions, Verbose, module declaration, Importing modules, Objects, and Indenting as Requirement, Exceptions, Unbound Variables, Lambda Functions and map

(12 Lectures)

UNIT III

Classes: Creating classes, instance methods, Instance Variables, Closures, Generators, Iterators, Assert, Generator Expressions

(12 Lectures)

UNIT IV

Testing and files: Reading and Writing Text Files, Binary Files, Stream Objects, Standard Input, Output and Error modes, with statement

(12 Lectures)

UNIT V

GUI in python: Components and events, root component, entry widgets, test widgets, check buttons, Serializing Objects, Pickle Files, Debugging, Introduction to Django framework

(12 Lectures)

Books:
1. Dive into Python,MarkPilgrim,Press,
2. Python: The Complete Reference, Martin C. Brown
3. Fluent Python: Clear, Concise, and Effective Programming (1st Edition), Luciana Ramalho, OReilly
4. Learning Python: Powerful Object-Oriented Programming, Mark Lutz, O'Reilly, Shroff Publishers And Distributors.

Suggested E-Resources:

1. https://www.gcreddy.com/2021/07/introduction-to-python-programming-language.html
2. https://goo.gl/WsBpKe
3. https://www.youtube.com/watch?v=Bsv_07Q-D70

Semester – I

Code of the course   : MCA8003T
Title of the course   : Web Technology
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60
Prerequisites   : NONE

Objectives of the Course:
1. This Course helps students in designing methodologies for better programs, including HTML, JavaScript, CSS and PHP.
2. Students will have a quick review of the Internet and Internet programming concepts, Web Servers and Web Application Servers.
3. Students would be able to write HTML, JavaScript and CSS codes.
4. Students will be able to evaluate (benchmark) Website performance.

Learning Outcomes:
1. Understand, analyze and design creative, dynamic and interactive websites.
2. Understand current and evolving Web languages for integrating media and user interaction in both front end and back end elements of a Web site
3. Able to write HTML, JavaScript and CSS.
4. Understand PHP, working with files, forms & Database.

UNIT I

Introduction of HTML: introduction, markup language, editing HTML: common tags, headers, text styles, linking, images, formatting text, horizontal rules and more line breaks, unordered lists, nested and ordered lists, basic HTML tables: intermediate HTML tables and formatting: basic HTML forms, more complex HTML forms, HTML5: Input Types & Attributes, internal linking, creating and using image maps

(12 Lectures)

UNIT II

Java script Introduction to scripting: introduction- memory concepts- arithmetic- decision making. Java script control structures, Java script functions: introduction, program modules in java script - function definitions, duration of identifiers, scope rules, recursion, java script global functions. Java script arrays: introduction, array-declaring and allocating arrays, references and reference parameters – passing arrays to functions, multiple subscripted arrays, introduction to DHTML and JQuery.

(12 Lectures)

UNIT III

Cascading Style Sheets: introduction, inline styles, external style sheets, creating style sheets with the style element, conflicting styles, linking external style sheets, positioning elements, backgrounds, element dimensions, text flow and the CSS box model, user style sheets

(12 Lectures)

UNIT IV

HTML: HTML form using GET, POST, REQUEST, SESSION, COOKIE variables, Sending e-mail, Database Operations with PHP, Connecting to My-SQL (or any other database), selecting a db.

(12 Lectures)

UNIT V

Introduction to PHP & web server Architecture Model Overview of PHP Capabilities, PHP HTML embedding tags & syntax, Simple script examples, PHP & HTTP Environment variables. PHP Language Core-Variables, constants, data types, PHP operators, flow control & loops, Arrays, string, functions Include & require statements, Simple File & Directory access operations, Error handling, Processing.

(12 Lectures)

Books
1. Internet and World Wide Web, H.M. Deitel, P.J. Deitel, A.B. Goldberg Pearson Education
2. Web Technologies Black Book Dreamtech Press (2018)
3. Web Technologies by Achyut S Godbole and Atul Kahate
4. PHP 5.1 for Beginners Ivan Bayross Sharanam Shah, SPD Publisher

Suggested E-Resources:
1. https://nptel.ac.in/courses/106106222
2. https://learn.shayhowe.com/html-css
3. http://www.w3schools.com
4. www.devguru.com

Code of the course : MCA8004T
Title of the course : Operating System
Level of the Course : NHEQF Level 6
Credit of the Course : 4
Type of the Course : DCC Course for MCA in computer science
Delivery Type : Lecture.
Total Lectures : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites : NONE

Objective of the course:

1. To understand the need of Operating Systems
2. To understand the Roles of an Operating System
3. To understand how these Roles are performed by an Operating System

Learning outcomes:
1. Student will understand the need and role of the Operating System.
2. Students will also understand the various alternative techniques/ algorithms to handle various resources utilization.
3. Students will understand how CPU scheduling is done.
4. Students will learn how memory management is done.
5. Students will learn how to resolve the process synchronization issues.
6. Students will also learn how to avoid deadlock and how to recover if the system goes in the deadlock.

UNIT I

Introduction to Operating Systems: Mainframe systems, desktop systems, multiprocessor systems, distributed systems, clustered systems, real-time systems, handheld systems. Feature migration and computing Environments.
Computer System Structures: Computer system operation, I/O structure, storage structure, storage hierarchy, hardware protection, network structure.
Operating System Structures: System components, operating system services. System calls, system programs, system structure, virtual machines.

(
12 lectures)

UNIT II

Processes: Process concept, process scheduling, operations on processes, cooperating processes, Inter-process communication, communication in client-server systems.
Threads: Overview, multithreading models, threading issues.

(12 lectures)

UNIT III

CPU Scheduling: Basic Concepts, scheduling criteria, scheduling algorithms, multiple- processor scheduling, real-time scheduling, algorithm evaluation.

Process Synchronization: The critical section problem, synchronization hardware, semaphores, classical problems of synchronization, monitors.

Deadlocks: System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

(12 lectures)

UNIT IV

Storage and Memory Management: Swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory: Demand paging, process creation, page replacement, allocation of frames, thrashing.

File System Interface: File concept, access methods, directory structure, file system mounting, file sharing, protection.

File-System Implementation: File system structure, file-system implementation, directory implementation, allocation methods, free space management, efficiency and performance.

(12 lectures)

UNIT V

Protection: Goals of protection, domain of protection, access matrix, implementation of access matrix, revocation of access rights.

Security: The security problem, user authentication, program threats, system threats, security systems and facilities, intrusion detection, cryptography.

(12 lectures)

Books
1. Operating System Concepts, Silberschatz G.G., John Wiley &SonsInc.
2. Modern Operating Systems, Andrew S. Tanenbaum,Pearson Prentice Hall,
3. Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems, Mukesh Singhal and Niranjan G. Shivaratri, Tata McGraw-Hill

4. Operating Systems: A Concept-based Approach, Dhananjay M. Dhamdhere, Tata McGraw-Hill Education.

Suggested E-Resources:
1. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2. https://www.udacity.com/course/introduction-to-operating-systems--ud923
3. https://www.coursera.org/learn/os-power-user
4. https://www.youtube.com/watch?v=mXw9ruZaxzQ
5. https://www.udemy.com/courses/it-and-software/operating-systems/

Semester – I

Code of the course   : MCA8005T
Title of the course   : MIS & E-Commerce
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : Discipline Centric Compulsory (DCC) Course for Computer Science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   : NONE

Objective of the course:

1. Provide students with a foundational understanding of what e-commerce is, its history, and its significance in modern business.
2. Apply sound managerial concepts and principles in the development and operation of information systems
3. Apply systems analysis, IS design and project management concepts effectively
4. Improve business processes through the effective application of information technology concepts and practices
5. Familiarize students with the technologies and platforms used in e-commerce, including websites, mobile apps, payment gateways, and security measures.

Learning outcomes:
1. Develop problem-solving skills and the ability to adapt to the rapidly changing landscape of e-commerce.
2. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
3. Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
4. Communicate effectively in a variety of professional contexts.
5. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
6. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
7. Support the delivery, use, and management of information systems within an information systems environment.
8. Students will learn about emerging trends and innovations in e-commerce, such as mobile commerce, social commerce, and blockchain technology, and their potential impact on the industry.
9. Students will learn about different customer service and support options in e-commerce, such as live chat, email, social media, and telephone support.

UNIT I

Management Information Systems - Need, Purpose and Objectives- Contemporary Approaches to MIS – Business processes and Information Systems –Information systems function in Business-Use of Information Systems for competitive advantage - MIS as an instrument for the organizational change: Management issues – Types of Business Information Systems.

(12 lectures)

UNIT II

Enhancing Decision Making: Information, Management and Decision Making - Models of Decision Making - Classical, Administrative and Herbert Simon's Models - Attributes of information and its relevance to Decision Making - Types of information, Decision Support Systems - Group Decision Support Systems –- Executive Support Systems

(12 lectures)

UNIT III

E-commerce: Introduction, Definition of e-commerce, emergence of Internet, commercial use of Internet, history of e-commerce, advantages and disadvantages of e-commerce
Business models for e-commerce: B2C, B2B, C2C, C2B, brokerage model, aggregator model, infomediaries, communities, value-chain model, manufacturer model, advertising model, subscription and affiliate model

(12 lectures)

UNIT IV

Enabling technologies: Internet Client server applications, networks, Uniform Resource Locator (URL), search engines, software agents, Internet Service Providers(ISP), broadband technologies,Electronic Data Interchange(EDI).
E-payment systems: token-based system, card-based system, e-cash. E-cheque, e-banking, risks, data protection

(12 lectures)

UNIT V

E-marketing: characteristics, methods, e-marketing value-chain, site adhesion, browsing behavior model, e- advertising, e-branding, e-marketing strategies
E-security: Security risks, risk management issues, legal and ethical issues, security mechanisms, encryption, digital signature, digital certificates.

(12 lectures)

Books
1. Management Information Systems, Laudon and Laudon, 7th Edition, Pearson Education Asia
2. P.T. Joseph, S.J. E-commerce: An Indian Perspective, Prentice Hall India, Second Edition, 2007

Suggested E-Resources:
1. https://www.drnishikantjha.com/booksCollection/E-Commerce%20.pdf
2. E Commerce Author MS K Bhavithravani.pdf - Google Drive
3. https://www.google.co.in/books/edition/E_commerce/MwEB8LuK0P0C?hl=en&gbpv=1 &dq=e+commerce&printsec=frontcover&bshm=rime/1
4. https://nitsri.ac.in/Department/Electronics%20&%20Communication%20Engineering/MI S-Notes_New_-word.pdf
5. https://ebooks.lpude.in/management/mba/term_4/DMGT505_MANAGEMENT_INFOR MATION_SYSTEM.pdf
6. https://www.google.co.in/books/edition/Management_Information_Systems_Manageria/ ZaNDDAAAQBAJ?hl=en&gbpv=1&dq=mis&printsec=frontcover&bshm=rime/1

Semester – I

Course Code   :MCA8006T
Title of the Course   :Advanced Data Structure
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : Discipline Centric Compulsory (DCC) Course for Computer Science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisite:
1. Induction / recursion, asymptotic notation, recurrence relations.
2. Data structures: linked lists, stacks, queues, binary trees, heaps.
3. Algorithms: binary search, sorting.

Objective of the course:
Understand storage, organization, management of data for efficient, easy accessibility &modification.

Learning Outcomes:
1. Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
2. Master a variety of advanced abstract data type (ADT) and data structures and their implementations.
3. Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

UNIT I
Priority Queues (Heaps) – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations.

(12 lectures)

UNIT II
Trees: Threaded trees and advantages, Applications: Decision trees, Game trees and expression parsing. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion.
Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree.

(12 lectures)

UNIT III

Graphs: Graphs and their representations: Matrix representation, List structure ,Graph traversal algorithm (DFS and BFS), Application of graphs. Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm.

(12 lectures)

UNIT IV

Strings and their features: Strings-Representation and Manipulation using Arrays and lists-String matching algorithms. Brute force, Knuth-Morris-Pratt and Boyer-Moore strategies. The Huffman Coding Algorithm, Longest Common Subsequence Problem (LCS)
Tables: Decision tables-Symboltables-HashTables- representation Examples, implementation and Applications

(12 lectures)

UNIT V

Disjoint Sets – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm.
Review of Hashing: Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing

(12 lectures)

Books:
1. Data Structure & Algorithms, Aho A.V. & Ullman J.E.
2. Introduction to Data Structures, Bhagat Singh & Thomas Naps.
3. Introduction to Algorithms, Charles Leiserson, Ronald Rivest, & Thomas H. Cormen, MIT Press

Suggested E-Resources:
1. https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/resources/
2. https://archive.nptel.ac.in/courses/106/102/106102064/
3. https://www.sathyabama.ac.in/course-materials/advanced-data-structure-and-algorithms

Semester – I

Code of the course   : MCA8001P
Title of the course   : DBMS Lab (Database Management System Lab)
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science

Delivery Type   : Practical.
Total Lectures   : 80.
Prerequisites   : NONE

Objectives of the Course:
1. This Course helps students in implementing the concepts of databases learned in theory.
2. This Course helps students in Modelling the databases with different types of models available.
3. This course helps students to perform the operations to store and retrieve the data from databases

Learning Outcomes:
   On successful completion of the course, students will be able to:
1. Model a database system using modelling tools like ER diagrams
2. Design database schemas based on the conceptual model.
3. Write queries in relational algebra / SQL.

List of sample programs for reference

1. Create a database having two tables with the specified fields, to computerize a library system of a MLSU.
   LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price)
   IssuedBooks (Accession number, Borrower)
   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Delete the record of book titled "Database System Concepts".
   c) Change the Department of the book titled "Discrete Maths" to "CS"
   d) List all books that belong to "CS" department.
   e) List all books that belong to "CS" department and are written by author "Navathe".
   f) List all computer (Department = "CS") that have been issued.
   g) List all books which have a price less than 500 or purchased between "01/01/1999" and "01/01/2004".
2. Create a database having three tables to store the details of students of Computer Department in your college, as per the given schema.
   Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)
   Paper Details (Paper code, Name of the Paper)
   Student Academic and Attendance details (College roll number, Paper code, Attendance, Marks in home examination).
   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
   c) List all students who live in "Delhi" and have marks greater than 60 in paper 1.
   d) Find the total attendance and total marks obtained by each student.

e) List the name of student who has got the highest marks in paper 2.
3. Create the following tables and answer the queries given below:
      Customer (CustID, email, Name, Phone, ReferrerID)
      Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
      BicycleModel (ModelNo, Manufacturer, Style)
      Service (StartDate, BicycleID, EndDate)
        a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
        b) List all the customers who have the bicycles manufactured by manufacturer"HONDA"
        c) List the bicycles purchased by the customers who have been referred by customer "C1"
        d) List the manufacturer of red colored bicycles.
        e) List the models of the bicycles given for service.
4. Create the following tables, enter at least 5 records in each table and answer the queries given below.
      EMPLOYEE (Person_Name, Street, City)
      WORKS (Person_Name, Company_Name, Salary)
      COMPANY (Company_Name, City)
      MANAGES (Person_Name, Manager_Name)
        a) Identify primary and foreign keys.
        b) Alter table emp
        c) Find the name of all managers who work for both Samba Bank and NCB Bank.
        d) Find the names, street address and cities of residence and salary of all employees who earn more than $10,000.
        e) Find the names of all employees who live in the same city as the company for which they work.
        f) Find the highest salary, lowest salary and average salary paid by each company.
        g) Find the sum of salary and number of employees in each company.
        h) Find the name of the company that pays highest salary.
5. Create the following tables, enter at least 5 records in each table and answer the queries given below.
      Suppliers (SNo, Sname, Status, SCity)
      Parts (PNo, Pname, Colour, Weight, City)
      Project (JNo, Jname, Jcity)
      Shipment (Sno, Pno, Jno, Quantity)
        a) Identify primary and foreign keys.
        b) Get supplier numbers for suppliers in Paris with status>20.
        c) Get suppliers details for suppliers who supply part P2. Display the supplier list in increasing order of supplier numbers.
        d) Get suppliers names for suppliers who do not supply part P2.
        e) For each shipment get full shipment details, including total shipment weights.
        f) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
        g) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
        h) Get the names of cities that store more than five red parts.
        i) Get full details of parts supplied by a supplier in London.
        j) Get part numbers for part supplied by a supplier in London to a project in London.

k) Get the total number of project supplied by a supplier (say, S1).

l) Get the total quantity of a part (say, P1) supplied by a supplier (say, S1).

Suggested E-Resources:

        Online virtual lab

Scheme of EoSE :

      (i)Exercise(s)/ Experiment(s) :50   (ii)Viva Voce:20   (iii)Evaluation of record book: 10

Semester – I

Course Code   : MCA8002P
Title of the Course   : Python Programming Lab
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Practical.
Total Lectures   : 80
Prerequisites   : NONE

Objectives of the Course:
1. To learn how to write functions and pass arguments in Python.
2. To learn how to build and package Python modules for reusability.
3. To learn how to read and write files in Python.
4. To learn how to design object-oriented programs with Python classes.

Learning Outcomes:
1. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
2. Express proficiency in the handling of strings and functions.
3. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
4. Identify the commonly used operations involving file systems and regular expressions.
5. Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python

List of sample programs for reference
1. Write python program/ script to create a list and perform the following methods
   1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
2. Write python program/ script to create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
3. Write python program/ script to create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4)Access items
4. Write a python program to add two numbers, to print a number is positive/negative using if-else, to find the largest number among three numbers.
5. Write a python Program to read a number and display corresponding day using if_elif_else?
6. Write a menu driven program to create with the following options 1. TO PERFORM ADDITION 2. TO PERFORM SUBTRACTION 3. TO PERFORM MULTIPLICATION 4. TO PERFORM DIVISION
7. Python Program to Implement Conditionals and Loops
8. Python program to use functions and modules
9. Python program to read and write data from & to files in Python
10. Python program based on Classes and Objects
11. Python program based on inheritance

12. Python program based on lambda Function

Suggested E-Resources:
 Online virtual lab

Scheme of EoSE :

 (i)Exercise(s)/ Experiment(s) :50 (ii)Viva Voce:20 (iii)Evaluation of record book: 10

Semester – I

Course Code :MCA8030B
Title of the Course : Data Structures
Level of the Course : NHEQF Level 6
Credit of the Course : (2) Audit
Type of the Course : SES Bridge Course for MCA in computer science
Delivery Type : Lecture.
Total Lectures : 20
Prerequisite :Knowledge of programming language-loop, array, recursion, function

Objectives of the Course:
1. To provide the knowledge of basic data structures
2. To provide Know the strength and weakness of different data structures
3. To understand concepts about searching and sorting
4. To assess how the choice of data structures and algorithm design methods impacts the performance of programs.

Learning Outcomes:
1. To provide the knowledge of basic data structures and their implementations.
2. To understand the importance of data structures in the context of writing efficient programs.
3. To develop skills to apply appropriate data structures in problem solving.
4. To understand standard application of different basic data structures

UNIT I

Data Type - Data Object - Data Structure: Data abstraction and abstract data type; Notion of an algorithm - Complexity measures: Rate of growth, basic time analysis of an algorithm; ordering notion- detailed timing analysis - space complexity.

Arrays: Arrays and their representation-Single and multidimensional arrays-row major and column major ordering-address calculation.

(
12 lectu res)

UNIT II

Stacks and Queues: Stacks and Queues-representation and Manipulation-Uses of stacks and Queues- Recursion, polish expressions

Storage Management: Dynamic storage management-Reclamation and compaction- Boundary Tag method.

(
12 lectures)

UNIT III

Linked lists: Pointers and their uses- Continuous vs. linked storage. Singly and doubly linked lists- Operations on lists-representation of sparse matrices and polynomials using lists- Circular lists- generalized lists

(
12 lectures)

UNIT IV

Trees: Trees-Binary and N-ary trees-Representation of trees-Tree traversal algorithms and advantages- Conversion of general trees to Binary trees-B trees- Applications

(
12 lectures)

UNIT V

Sorting and Searching: Searching and sorting-Sequential, Binary and hashed Searching- Bubble sort, Insertion sort, shell sort, Merge sort and Quicksort-Comparison.

(
12 lectures)

Books
1. Data Structure & Algorithms, Aho A.V. & Ullman J.E.
2. Data Structures using C, Aron M. Tannenbaum.
3. Introduction to Data Structures, Bhagat Singh & Thomas Naps.
4. An Introduction to Data Structures with Applications, Trembley & Sorenson.

Suggested E-Resources:
1. https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/resources/
2. https://archive.nptel.ac.in/courses/106/102/106102064/

Semester – I

Course Code   :MCA8031B

Title of the Course : Basic Mathematics
Level of the Course : NHEQF Level 6
Credit of the Course : (2) Audit
Type of the Course : Bridge Course for MCA Computer Science
Delivery Type : Lecture
Total Lectures : 20

Prerequisites: Knowledge of functions and basic Algebra

Objectives of the Course:
1. Computer science is a division or subset of general computer science and mathematics which focuses on more   abstract or mathematical aspects of computing.
2. Students will be able to apply problem-solving and logical skills.
3. Students will have a deeper understanding of mathematical theory.
4. Students will be able to communicate mathematical/logical ideas in writing.

Learning Outcomes:
1. To be able to apply mathematical logic to solve problems.
2. To have the concept of relations and sets.
3. Understand different operations on matrices.
4. Apply Propositional logic and first order logic to solve problems.
5. Analyze different types of Probability and their application.

UNIT I

Set:- Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union, Intersection, Difference, Symmetric Difference of Sets), Universal Sets, Complement of a Set, Applications of Sets.

Mathematical Logic:- Basic Logical connections; Conjunction; Disjunction; Negation; Negation of Compound Statements; Truth tables. Tautologies: Logical Equivalence; Applications.

(12 lectures)

UNIT II

Matrices and Determinants: Definition of a matrix; Representation of a Matrix; Equality of Matrices; Operations on matrices; Square Matrix and its inverse; Multiplication of 2 matrices; Transpose of a Matrix, Determinants: Properties of determinants; the inverse of a matrix; solution of equations using matrices and determinants; solving equations using determinants.

(12 lectures)

UNIT III

Counting: Basic counting principles, factorial notation, binomial coefficient, permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, ordered and unordered partition.

(**12 lectures**)

UNIT IV

Probability: Concept of probability; sample space and events; three approaches of probability; Kolmogorov's axiomatic approach to probability; conditional probability and independence of events; Baye's theorem.

(**12 lectures**)

UNIT V

Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means, Geometric Progression, Geometric Mean, Harmonic Progression, Harmonic Mean

(**12 lectures**)

Books
1. Discrete Mathematics, Lipschutz S., Lipson M.
2. College Mathematics, Schaum's Series, TMH
3. Elements of Mathematics, ML Bhargava
4. Discrete Mathematical Structures with Applications to Computer Science, Trembley J.P. and Manohar R.P.
5. Discrete Mathematical Structures for Computer Science, Kolman B., Busby R, PHI

Suggested E-Resources:
1. www.see.leeds.ac.uk/geo- maths/basic_maths.pdf
2. www.britannica.com/science/matrix-mathematics
3. www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-editionschaumse6841453.html
4. MIT – Introduction to Probability and statistics by Jeremy Orloff and Jonathan Bloom
5. https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probabilityand-statistics-spring-2014/index.htm

Course Code   :MCA8007T
Title of the Course   : Design & Analysis of Algorithms
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   :60
Prerequisite:
> The Students should have basic knowledge of programming and mathematics. The Students should know data structure very well.

Objectives of the Course:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.

Learning Outcomes:
1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
6. Explain the major graph algorithms and their analyses
7. Explain the matrices and their applications
8. Understand the use of finite automata

UNIT-I
Algorithms Analysis: Algorithms and structured programming. Analyzing algorithms, asymptotic behavior of an algorithm, recurrence relation, Order notations, time and space complexities, average and worst case analysis, lower and upper bounds.

(
12 lectures)

UNIT-II
Algorithm design strategies: Divide and conquer (Merge sort, Quick sort, matrix multiplication), Greedy method (knapsack problem, minimum spanning trees).
Basic search & Traversal Techniques (Breadth first and Depth first traversals of Graphs).

(**12 lectures**)

UNIT-III
Dynamic programming: 0/1 knapsack, Travelling salesman problem Backtracking: 8-queen problem, sum of subsets, 0/1 Knapsack
Branch & Bound: 0/1 knapsack, Travelling salesman.

(**12 lectures**)

UNIT-IV
Matrix algorithms: Basics of matrices, Strassen's matrix-multiplication algorithm
Data structures for set manipulation problems: Fundamental operation on sets, a simple disjoint-set union algorithm, tree structures for UNION-FIND problem, applications and extensions of the UNION-FIND algorithm.

(**12 lectures**)

UNIT-V
Finite automata and regular expression, recognition of regular expression, patterns, recognition of substrings, Conversion from NFA to DFA
Complexity Theory: Overview, Turing machine, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, Idea of problem Classes: P class, NP class & NP complete problems

(**12 lectures**)

Books
1. Fundamentals of Computer Algorithms, E. Horowitz, S. Sahni, Galgotia Publications.
2. Introduction to Algorithms, Charles Leiserson, Ronald Rivest, & Thomas H. Cormen, MIT Press
3. Design & Analysis of Computer Algorithms, Av. Aho, J.E. Hopcroft, & J.D. Ullman, Addition Wesley.
4. Design and Analysis of algorithms, S.K. Basu, PHI Publications

Suggested E Resources
1. https://www.sathyabama.ac.in/course-materials/design-and-analysis-algorithms
2. https://nptel.ac.in/courses/106106131

3. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/video_galleries/lecture-videos/

Course Code   :MCA8008T
Title of the Course   : Java Programming
Level of the Course   : NHEQF Level 6
Credit of the Course : 4
Type of the Course   : Discipline Centric Compulsory (DCC) Course for Computer Science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisite:
1. The students should have basic knowledge of programming languages like C and C++.
2. Prior knowledge of Object-Oriented concepts is helpful but not mandatory.

Objectives of the Course:

1. The learning objective of this course are:
2. To understand the basic concepts and fundamentals of platform independent object oriented language Java.
3. To understand the concepts of packages and interfaces in java.
4. To demonstrate skills in writing programs using exception handling techniques and multithreading.
5. To understand the connectivity of the Java programming language with databases.
6. To understand the advanced concepts of java including Servlet and Java Server Pages (JSP) used for web application development.

Learning Outcomes:

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
4. Design web related applications which mimic the real world scenarios using JDBC,Servlet and JSP.

UNIT-I

OOPS Concepts: Encapsulation, Inheritance and polymorphism, Classes and data abstraction, constructors and destructors.

(
12 lectures)

UNIT-II

Packages and Interfaces, Access Control, Method Overriding, Garbage Collection, Abstract Classes.
Exceptions handling, throwing an exception, try block, catching an exception, Multithreading, Synchronization

(
12 lectures)

UNIT-III

J2EE Platform: Enterprise architecture style (2 tier, 3 tier, N tier), J2EE run time, J2EE APIs, J2EE technology, web components
JDBC Overview, JDBC implementation, Connection class, Statements, Types of statement objects (Statement, Prepared Statement and Callable Statement), and Types of result set.

(
12 lectures)

UNIT-IV

Servlet: Servlet API, Overview of Servlet, Servlet Life Cycle, HTTP Methods, Attributes in Servlet, Request Dispatcher interface.

(
12 lectures)

UNIT-V

Java Server Pages: JSP Overview, Problem with Servlet, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, JSP Directives, JSP Action, JSP Implicit objects, JSP Session and Cookies Handling.

(
12 lectures)

Books:
1. Java: The Complete Reference by Herbert Schildt
2. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication
3. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
4. Complete Reference J2EE by James Keogh McGraw publication

Suggested E-Resources:

1. https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/pages/lecture-notes/
2. https://math.hws.edu/javanotes/
3. https://www.youtube.com/watch?v=hBh_CC5y8-s
4. https://www.youtube.com/watch?v=BGTx91t8q50
5. https://www.youtube.com/watch?v=BGTx91t8q50
6. https://www.youtube.com/watch?v=eIrMbAQSU34
7. https://www.youtube.com/watch?v=UmnCZ7-9yDY

Course Code   : MCA8009T
Title of the course   : Software Engineering
Level of the Course   : NHEQF Level 6
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
Software engineering involves programming and working with computers, it is important to have a basic level of computer proficiency. This includes knowledge of operating systems, file management, and basic software applications.

Objectives of the Course:
The basic objective of software engineering is to develop methods and procedures for software development that can scale up for large systems and that can be used consistently to produce high-quality software at low cost and with a small cycle of time.

Learning outcome
1. Understanding the Software Engineering Fundamentals, Software development Process with different types of models, Project management Concepts.
2. Understand the Software Quality Assurance concepts, Software Configuration Management,
3. Understand the Software Quality Assurance concepts, Software Configuration Management, Analysis Concepts and Principles
4. Get acquainted with Design Concepts and Principles, Software Testing.
5. Understand the purpose of Reengineering with some CASE Tools.

UNIT-I
Software Engineering Fundamentals: Definition of Software, Software characteristics, Software Applications.
Software Process:
Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model.
Project management Concepts: The Management Spectrum - The People, The Product, The Process, The Project.

(
12 lectures)

UNIT –II

Software Process and Project Metrics: Measures, Metrics and Indicators, Software measurement: Size - Oriented Metrics, Function - Oriented Metrics, Extended Function point metrics

Software Project Planning: Project Planning Objectives, Software Project Estimation, Decomposition Techniques - Problem Based Estimation, Process Based Estimation, Empirical Estimation Models- The COCOMO Model

Risk Analysis and Management: Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring and Management

(12 lectu res)

UNIT –III

Software Quality Assurance: Basic concepts- Quality, Quality Control, Quality Assurance, Cost of Quality, Software Quality Assurance (SQA), Formal Technical Review

Software Configuration Management: Baselines, Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting.

Analysis Concepts and Principles: Requirements Elicitation for Software, Analysis Principles - The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)

(12 lectu res)

UNIT –IV

Design Concepts and Principles: Design Principles, Design Concepts, Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure, Software Procedure, Information Hiding, Effective Modular Design- Cohesion, Coupling

(12 lectu res)

UNIT –V

Software Testing: Testing Objectives & principles, Unit Testing, Integration Testing (Top Down Integration, Bottom Up Integration, Regression Testing, Smoke Testing), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing, Performance Testing).

Reengineering: Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering CASE Tools: What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The Integration Architecture, The CASE Repository.

(12 lectures)

Books
1. Software Engineering, R. Pressman, McGraw-Hill.
2. Software Engineering, K.K. Agrawal and Y. Sing, New Age International.
3. Software Project Management in Practice, P. Jalote, Pearson.

Suggested E-resources
1. https://www.cs.uct.ac.za/mit_notes/software/pdfs/SE_top.pdf
2. https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Software-Engineering-9th-Edition-by-Ian-Sommerville.pdf
3. https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Semester – II

Code of the course   : MCA8010T
Title of the course   : Computer Networks
Level of the Course   : NHEQF Level 6
Credit of the Course   :4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   : NONE

Objectives of the Course:
1. Understanding the fundamental concepts of computer networks
2. Learning standard models of computer networks having layered architecture,
3. Identifying data communication, network topologies,
4. Learn about various protocols at different layer in networks

Learning Outcomes:
1. State the use of computer networks and different network topologies.
2. Distinguish between LAN, MAN, WAN, and between Intranet, Extranet and Internet.
3. Compare OSI and TCP/IP architectures
4. Enumerate different transmission media and describe the use of each of them.
5. Design web pages using HTML.

UNIT I

Introduction: Overview of Networks, Circuit switching to packet switching principles, Protocols, protocol architecture, Reference Models, TCP/IP Model. Design Issues for the layers.

(12 lectures)

UNIT II

Physical Layer:
Concepts of Frequency, Spectrum, bandwidth. Wireless and Wired Transmission , Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission: Microwave, satellite communication etc..

(12 lectures)

UNIT III

Data Link Layer

Data Encoding: Introduction, Block coding, cyclic codes, checksum, framing, Noiseless channels, noisy channels, Asynchronous and Synchronous transmission, Full and Half duplex, Encoding schemes : BCA (NRZ, Bipolar AMI, B8ZS, HDB3, ASK, FSK,PSK,PCM,AM,FM,PM),

Data Link Control: Flow control: Stop and Wait, Sliding window, Error detection: Parity Check, CRC. Error control: Stop and Wait ARQ, Go back-N ARQ, Selective-Reject ARQ, Brief idea of HDLC and other Data Link control protocols

(**12 lectures)**

UNIT IV

Network layer

Logical addressing, internetworking, address mapping, LAN Technology: LAN architecture, IEEE 802 standards, Ethernet (CSMA/CD): Medium Access Control, Ethernet, Fast Ethernet, Brief survey of other LAN systems (Token ring, FDDI, ATM, Fiber channel). Wireless LANS, Bridges, Latest trends in LAN technologies LAN Devices: Study of specifications of L2 and L3 switches. IPv4, IPv6, IP multicasting, Principles of routing. Routing protocols. Link-state and distance vector routing

(**12 lectures)**

UNIT V

Transport Layer:

Process to process delivery, UDP and TCP protocols, SCTP, data traffic, congestion, congestion control,

Application Layer : Principles of Internetworking, connection less Internetworking, HTTP, WWW, FTP, SMTP, SNMP, and MIME POP3, DNS, Firewall and Gateways etc

(**12 lectures)**

Books
1. Data & Communications, William Stallings, Prentice Hall,
2. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill Education,
3. Computer Networks, A. S. Tanenbaum, Prentice-Hall,
4. Computer networks and internets, Douglas Comer, Prentice Hal

Suggested E-Resources:
1. https://nptel.ac.in/courses/106105183
2. https://www.youtube.com/watch?v=61A6iwJL3fw&ab_channel=5MinutesEngineering

Course Code   : MCA8011T
Title of the course : Computer Architecture
Level of the Course : NHEQF Level 6
Credit of the Course : 4
Type of the Course : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Pre Requisite   : NONE

Objectives of the Course:
1. To understand basic working of a processor
2. To understand the designing of a processor
3. To understand working of Memory and Peripheral Devices

Learning outcomes:
1. Students should be able to understand basic behavior of a typical processor.
2. Students should be able to understand various formats of number representations and various operations on the numbers.
3. Student will be able to do the data path designs.
4. Students will be able to explain the need, working, efficiency and limitations of a pipeline.
5. Students will be able to demonstrate the micro programmed control unit.
6. Students will be able to demonstrate the hardwired programmed control unit.
7. Students will be able to understand the design and working of SRAM as well as DRAM.
8. Students will be able to explain how memory allocation is done.
9. Students should be able to explain working of IO Systems.

UNIT I

Processor Basics
Processor Basics: CPU Organization: Fundamentals, additional features. Data representation: Basic formats, fixed point numbers, floating-point numbers. Instruction sets: Instruction formats, instruction types, programming considerations.

(**12 lectures)**

UNIT II

Data path Design
Data path Design: Fixed point arithmetic- Addition and subtraction, multiplication, division. Arithmetic Logic Unit: Combinational ALUs, sequential ALUs. Advanced topics: Floating-point arithmetic, pipeline processing.

(**12**

UNIT III

Control Design

Control Design: Basic concepts: Introduction, hardwired control, design examples. Micro-programmed control: Basic concepts, multiplier control unit, CPU control unit. Pipeline control: Instruction pipelines, pipeline performance, super-scalar processing.

(
**12
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UNIT IV

Memory Organization

Memory Organization: Memory technology: Memory device characteristics, random-access memories, serial-access memories. Memory systems: Multilevel memories, address translation, memory allocation. Caches: Main features, address mapping, structure versus performance.

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**12
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UNIT V

System Organization

System Organization: IO and System Control: Programmed IO, DMA and interrupts, IO processors. Parallel processing: Processor-level parallelism, multiprocessors.

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**12
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res)**

Books
1. Computer Architecture and Organization, J.P. Hayes: McGraw-Hill International
2. Computer Architecture: A Quantitative Approach,J. L. Hennessy, David A. PattersonMorgan Kaufmann
3. Computer Organization and Architecture, William Stallings, Pearson.
4. Advanced Computer Architecture, Kai Hwang, McGraw-Hill
5. Computer Organization and Architecture: Designing for Performance, William Stallings, Pearson Education Limited

Suggested E-Resources:

1. https://www.coursera.org/learn/comparch
2. https://learn.saylor.org/course/CS301
3. https://www.codecademy.com/learn/computer-architecture
4. https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/
5. https://online.princeton.edu/computer-architecture
6. https://pll.harvard.edu/course/computer-architecture

Semester – II

Course Code   : MCA8007P
Title of the Course   : Design & Analysis of Algorithms Lab
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Practical.
Total Lectures   : 80

Prerequisite:
1. Proficiency in a C & C++ programming language, basic program design concepts (e.g, pseudo
   code), proof techniques, familiarity with trees and graph data structures, familiaritywith basic algorithms such as those for searching, and sorting

Objectives of the Course:

1. To identify and analyze worst-case running times of algorithms.
2. To model a given engineering problem using graphs and trees and write the corresponding algorithm to solve the problems.
3. To strengthen the ability to identify and apply the suitable algorithm for the given real world problem.

Learning Outcomes:

1. Design an algorithm in a effective manner
2. Apply iterative and recursive algorithms.
3. Design iterative and recursive algorithms
4. Implement optimization algorithms for specific applications.
5. Design optimization algorithms for specific applications

List of Some Programs for reference:
1. Implement Merge Sort
2. Implement Quick Sort
3. Implement Binary Search
4. Implement DFS and BFS traversals
5. Implement knapsack problem
6. Implement N Queens Problem
7. Implement minimum cost spanning tree
8. Implement all pair shortest path
9. Implement Strassen Multiplication

Suggested E-Resources:
            Online virtual lab

Scheme of EoSE :

(i)Exercise(s)/ Experiment(s) :50   (ii)Viva Voce:20   (iii)Evaluation of record book: 10

Course Code   : MCA8008P
Title of the Course   : Java Programming Lab
Level of the Course : NHEQF Level 6
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Practical.
Total Lectures   : 80

Prerequisite:
1. The students should have basic knowledge of programming languages like C.
2. Prior knowledge of Object-Oriented Language like C++ is helpful but not mandatory.

Objectives:
1. The learning objective of this course are:
2. The course aims to strengthen the conceptual knowledge of Object Oriented Programming Language JAVA at core level and advance level.
3. Lay foundation for further learning of the subject C++ and Advance Java Programming Language which is useful for the design of desktop and web applications in Computer Science

Learning Outcomes:
 After successful completion of the course, the students are able to:
1. The student will be able to learn conceptual and advanced level of programming with a modern programming language, Java.
2. The student gets an understanding of how to install and use a good Java development environment.
3. The student learn how to produce robust programs in Java using :Variables, Expressions, Looping,

       Branching, Methods / Functions, Classes, Interfaces and Inheritance, Package, Exceptions,
       Multithreading,
4. The student will be able to learn connectivity of the Java programming language with databases using JDBC.
5. Design web related applications which mimic the real world scenarios using servlets and JSP.

List of Sample programs for reference:
1. Program to develop an in depth understanding of Java: data types, variables, operators, operator precedence,
2. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
3. Write object oriented programs in Java: objects, classes, constructors and destructors.
4. Write object oriented programs of inheritance, using super, final with inheritance, overloading and overriding
5. Programs on access control,static member, abstract classes and variables.
6. Program to develop understanding of packages & Interfaces in Java

7. Write a program using exception handling mechanisms.
8. Programs using JDBC.
9. Programs using Servlets.
10. Programs using JSP for web applications.

Books:
1. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication
2. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
3. Complete Reference J2EE by James Keogh McGraw publication

Suggested E-Resources:
    Online virtual lab
Scheme of EoSE :

        (i)Exercise(s)/ Experiment(s) :50   (ii)Viva Voce:20   (iii)Evaluation of record book: 10

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MCA810XT   Departmental Elective I
List of Departmental Elective(s) – I

Semester – II
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Course Code   : MCA8100T
Title of the Course   : Content Management and Web Development
Level of the Course   : 8
Credit of the Course : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisite: : Understanding of Website creation, E-commerce, Management Information System

Objectives:
After completing this course, the students will be able to understand
    1. Use of open source web-based content management systems
    2. Used to create dynamic and flexible web sites, galleries, ecommerce sites, and blogs.
    3. Understand the fundamentals of planning dynamic websites, CMS database management, manipulating CSS-controlled site templates, and creating database driven websites

Learning Outcomes:
    1. Students will be able to create a website using a content management system.
    2. Students will be able to describe what a content management system is
    3. Students will be able to use WordPress to make a website.
    4. Students will be able to make a WordPress Plugin
    5. Basic understanding and use of Moodle, Drupal, Bootstrap and Jhoomla

UNIT I

Overview of Content Management System (CMS), Features, advantages and disadvantages, WordPress – installation, dashboard, – general settings, creating post, editing post, previewing and publishing post, creating page, editing page, previewing and publishing page

(**12 lectures**)

UNIT II

Adding Images & Managing Media Library: Adding an Image to a Post or Page, Editing Images (Resizing, Cropping, & Rotating), Media Settings (Customizing of Thumbnail size, Medium, & Large), Adding a Featured Image, Uploading Images & Files Directly Into the Media, Library Editing & Deleting Images in the Media Library.

(**12 lectures**)

UNIT III

Theme and its customization, activating theme, working with links, customize a site by adding widgets, Create and format posts to a blog site, Categorize and tag posts, Utilize advanced formatting features to add URLs and graphics, Add plug-ins to a WordPress site.

(**12 lectures**)

UNIT IV

Introduction to Website hosting and developing content for social media platforms such as wiki and blog; e-publications and virtual reality, e-learning platform such as Moodle, overview of Drupal and Joomla

(**12 lectures**)

UNIT V

Web site design using Bootstrap Framework, Advantages and features, Responsive web page, setting up Environment, Bootstrap Grid, Container, Typography, Tables, Form Layout, Button and plugins

(**12 lectures**)

Books:

1. WordPress 5 Complete: Build beautiful and feature-rich websites from scratch, 7th Edition, Karol Krol
2. WordPress 5   Cookbook, RakhithaNimesh Ratnayake, Packt Publishing

Suggested E-Resources:

1. W3Schools   2. Tutorialspoint3.SoloLearn

Code of the course   : MCA8101T
Title of the course   : Cloud Computing
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   : NONE

Objectives of the Course:
1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Learning Outcomes:
1. After successful completion of this course, student will be able to
2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about.
3. Characteristics, advantages and challenges brought about by the various models and services in cloud computing.
4. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
5. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
6. Analyze various cloud programming models and apply them to solve problems on the cloud.

UNIT I

Introduction Cloud Computing: Definition, Types of Clouds, Layer & Services models, Deployment models, Cloud Computing Architecture & infrastructure: Cloud Reference Model, Virtualization: Definition, Types of virtualizations (Compute, Network, Storage), Types of Hypervisor

(
12 lectu res)

UNIT II

Cloud Platforms in Industry: Major vendors and their offerings, Introduction to Microsoft Azure, Amazon web services (EC2, S3, Etc.), Google AppEngine. Integration of Private and Public Clouds

Cloud applications: Protein structure prediction, Data Analysis, Satellite Image Processing, CRM and ERP, Social networking. Cloud Application- Scientific Application, Business Application.

(12 lectures)

UNIT III

Advance Topic in Cloud Computing: Cloud Security, Risks and Approaches of Migration into Cloud. Federated Cloud/ Intercloud, Third Party Cloud Services, Business Continuity and Disaster Recovery, Service Level Agreement (SLA), Dynamic resource provisioning and management, Server consolidation and placement policies, Energy efficiency in data centers, Elastic Load Balancing and Auto Scaling.

(12 lectures)

UNIT IV

Storage Network Design: Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations. Techniques for Big data processing (Google GFS, BigTable, and Map-Reduce Hadoop Distributed File System (HDFS), HIVE).

(12 lectures)

UNIT V

Consensus in Cloud Computing: Issues in consensus, Consensus in synchronous and asynchronous system, Byzantine Agreement: Agreement, Faults, Tolerance, Measuring Reliability and Performance, SLIs, SLOs, SLAs, TLAs, Byzantine failure, Byzantine Generals Problem, Failures & Recovery Approaches in Distributed Systems, Check pointing.

(12 lectures)

Books
1. Distributed and Cloud Computing, Kai Hawang, GeofreyC.Fox, Jack J.

DongarraElservier
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing, Kumar Saurabh, Wiley Pub
4. Cloud Security, Krutz, Vines, Wiley Pub
5. Cloud Computing- A Practical Approach, Velte, TMH

Suggested E-Resources:
1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.youtube.com/watch?v=HhStJ7FDBpc&ab_channel=5MinutesEngineering
3. https://www.cs.cmu.edu/~msakr/15619-s16/15319_15619_s16_Syllabus.pdf

Code of the course   : MCA8102T
Title of the course   : Real Time Systems
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   : Operating Systems

Objectives of the Course:
1. To form a solid foundation of knowledge, practical skills sufficient for successful production activities
2. Designing applications running under the real time control

Learning Outcomes:
1. To understand the functionality and selection criteria of various operating systems when designing automation systems for technological complexes in real time;
2. basic principles of construction and the scope of use of embedded operating systems.
3. To be able to program applied tasks for embedded systems and be able to control the processes occurring in real-time systems
4. To have practical skills for solving problems of designing control and monitoring systems for technological complexes in real time based on existing operating systems and programming languages.

UNIT I

Introduction to Real-time systems, Issues in Real-time Systems, Real-time System Components, Classification of Real-time systems and Real-time tasks, Misconceptions about Real-time computing. Real-time System requirements: Speed, Predictability, reliability, adaptability, Specification of timing constraints.

(12 lectures)

UNIT II

Real-time scheduling: Requirements and Issues, Terminology, modeling, Introduction to static and dynamic scheduling schemes, cyclic scheduling, Schedulability tests.

(12 lectures)

UNIT III

Priority driven scheduling of periodic tasks, scheduling a periodic task, mixed task scheduling, aperiodic task scheduling: fixed priority server/non-server based scheduling algorithms.

(12 lectures)

UNIT IV

Task Synchronization: Need and priority inversion problem, Priority Inheritance protocol, priority ceiling protocol and stack-based priority ceiling protocol for fixed priority preemptive system.

(12 lectures)

UNIT V

Introduction to multiprocessor real-time systems, problems and issues. Fault tolerant real time system design: types of faults, causes, detection techniques, mitigation techniques, reliability evaluation, E.g. of real-time operating system

(12 lectures)

Books
1. Real-Time Systems, J.W.S.Liu, Pearson Education Asia
2. Real-time system Design, S.T.Lavi, A.K.Agrawala: McGraw Hill

Suggested E-Resources:
1. https://onlinecourses.nptel.ac.in/noc21_cs98/preview
2. Rajib Mall, Real-Time Systems: Theory and Practice, Pearson Education, 2007.
3. C. M. Krishna, Kang G. Shin, Real-Time Systems, McGraw-Hill, 2010.

Semester – II

Course Code   : MCA8103T
Title of the course   : Business Intelligence in ERP System
Level of the Course   : NHEQF Level 6
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites
1. Basic understanding of Enterprise Resource Planning (ERP) systems and their functionalities. Familiarize yourself with common ERP systems like SAP, Oracle, or Microsoft Dynamics, as well as the modules and components that make up an ERP system.
2. Basic understanding of databases, including concepts such as tables, relationships, and SQL (Structured Query Language). This knowledge will help you comprehend how data is stored, retrieved, and manipulated in an ERP system.

Objectives of the course
1. Students gain knowledge and skills in extracting data from various sources within an ERP system, including transactional databases and other operational systems. They may also learn techniques for integrating and transforming data to make it suitable for BI purposes.

Learning Outcomes
The students would be able to understand:
1. Purpose of business intelligence is to support better business decision making.
2. Provides an overview of the technology of BI and the application of BI to an organization's strategies and goals.
3. Objective of improving strategic decision-making and providing a competitive advantage.
4. An overview of Business Intelligence (BI) and analytics in the ERP

UNIT-I

Business Intelligence an Introduction: Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Real time Business Intelligence, Business Intelligence Applications Business Intelligence Essentials: Introduction, Creating Business Intelligence Environment, Business Intelligence Landscape, Types of Business Intelligence

(**12 lectures**)

UNIT -II

Business Intelligence Types: Introduction, Multiplicity of Business Intelligence Tools, Types of Business Intelligence Tools, Modern Business Intelligence, the Enterprise Business Intelligence, Information Workers.

Architecting the Data: Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM)

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UNIT-III

Introduction to Data Mining: Introduction, Definition of Data Mining, Data mining parameters, How Data Mining works, Types of relationships, Architecture of Data Mining, Kinds of Data which can be mined, Functionalities of Data Mining, Classification on Data Mining system, Various risks in Data Mining, Advantages and disadvantages of Data Mining, Ethical issues in Data Mining, Analysis of Ethical issues, Global issues.

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UNIT-IV

Business Intelligence Issues and Challenges: Introduction, Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development methodology, Planning the BI Projects, Business Analysis and Data Standardization, affect of Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution.

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UNIT-V

Business Intelligence Strategy and Road Map: Introduction, Planning to implement a Business Intelligence Solution, Understand Limitations of Business Intelligence, Business Intelligence Usage, How to make the best use of Business Intelligence?, The Advantages of BI with Sales, How can BI be used for the rescue?, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership.

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Books
1. Business Intelligence And Analytics by Efraim Turban and Ramesh Sharda, PEARSON
2. ERP Systems by, Dimpi Srivastava, Aarti Batra , Dreamtech Press WILEY

Suggested E-resources
1. https://mrcet.com/downloads/digital_notes/CSE/III%20Year/ERP%20Digital%20notes.pdf
2. http://projanco.com/Library/Enterprise%20Resource%20Planning%20and%20Business%20Intelligence%20Systems%20for%20Information%20Quality.pdf

Semester – II

Code of the course   : MCA8104T
Title of the course   : Image Processing
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Calculus and probability.
2. Knowledge of Digital Systems, combinational circuits
3. It would be good if some knowledge about signals and systems.

Objectives of the Course:
1. Familiarize students with image enhancement and restoration techniques
2. Explain different image compression techniques.
3. Introduce segmentation and morphological processing techniques.

Learning Outcomes:
1. Understand the need for image transforms and their properties and types
2. Understand the rapid advances in Machine vision.
3. Learn different techniques employed for the enhancement of images.

UNIT I

Image presentation and transform: Elements of visual perception, color representation, Image capture, representation and storage. Gray level transformation, histogram equalization, multi-image operations.

Image transform: Discrete Fourier transforms (DFT), Discrete cosine transform (DCT), Walsh-Hadamard transform, Haar transform, Karhunen – Loeve transform, singular value decomposition.

(**12 lectures)**

UNIT II

Image enhancement: Contrast Intensification, linear stretching, Non-linear stretching, histogram specification, modifying gray level co-occurrence matrix, smoothing, image averaging, mean filter, order statistic filter, edge preserving smoothing, low pass filtering, Image sharpening, high pass filtering, homomorphism filtering.

(**12 lectures)**

UNIT III

Image restoration: Mean square error restoration, least-square error restoration, restoration by singular value decomposition, restoration by maximum a posteriori estimation, restoration by Homomorphic filtering, distortion model and range of parameter, filtering procedure and related problems.

(12 lectures)

UNIT IV

Image compression: Fidelity Criteria, run length coding, Huffman coding, LZW, arithmetic coding, JPEG encoder and decoder, vector quantization compression.

(12 lectures)

UNIT V

Image segmentation: Region extraction, pixel based approach, multilevel thresholding, local thresholding, region based approach, growing, splitting, merging, split and merge techniques.

(12 lectures)

Books
1. Digital Image processing and analysis, B.Chandraand, D.Majumder
2. Fundamental of digital image processing, Anil K. Jain

Suggested E-Resources:
1. https://www.youtube.com/watch?v=YvTVI0dboiM
2. https://www.youtube.com/watch?v=Yd6QISby8kk
3. https://www.youtube.com/watch?v=Zh6JDrKA27M

Code of the course   : MCA8105T
Title of the course   : Mobile Computing
Level of the Course   : NHEQF Level 6
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
  1. Fundamentals of Networking
  2. Basic Knowledge of OS
  3. Programming Concepts

Objectives of the Course:
  1. To understand how to develop system and application level software for small terminals.
  2. Use of mobile technologies in teaching and learning.

Learning Outcomes:
  1. Understand concepts of Mobile Communication and its different layers
  2. Analyze the next generation Mobile Communication System.

UNIT I

Basic of mobile technology & smart client Mobile Devices - Definition, m-commerce, m-business, component of wireless environment, wireless communication, mobile device classification, Wireless Network - WPANS, WLAN, WWANS (1 G, 2G, 2.5G, 3G) Introduction to Mobile Communications and Computing, Mobile Computing, novel applications, limitations and architecture Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, security in MANETs.

(12 lectures)

UNIT II

Cellular concept and its initial implementations the cellular concept, Multiple access technologies for cellular systems, Cellular system operation and planning (General principles, System Architecture, Location updating and call setup), Handoff and power control Initial implementations of the cellular concept: The AMPS system, TACS system, NMT system, NTT system, Concluding remarks.

(12 lectures)

UNIT III

Digital cellular mobile systems Introduction, GSM: The European TDMA digital cellular standard, GSM standardization and service aspects GSM reference architecture and function partitioning, GSM radio aspects, Security aspects, GSM protocol model, Typical call flow sequences in GSM, Evolutionary directions for GSM IS-136,The North American TDMA digital cellular standard(D-AMPS), Background on North American digital cellular, Service aspects of D-AMPS (IS-136), Network reference, Radio aspects, Security aspects, Protocol model and typical Flow sequences, Evolutionary directions.

(
12 lectu res)

UNIT IV

Mobile data communications Introduction, Specialized packet and mobile radio networks, Circuits witched data services on cellular networks, circuit switched data on analog cellular networks, Circuit switched data on digital cellular networks, high speed Circuit switched data in GSM, Packets witched data services on cellular networks, Packet data in analog cellular networks, CDPD (cellular digital packet data), Packet data in digital cellular Evolution of cellular mobile data capabilities: The EDGE concept, Data over lower power wireless or cordless telecommunication networks, Data services over DECT (Digital enhanced cordless telecommunications), Data services in PACS (Personal Access communications System), Data services in PHS (Personal Handy phone system), Data services in CT2 (Cordless Telephony2).

(
12 lectu res)

UNIT V

Android Basic & Its components:- Introduction to Android -History of android, The Open Handset Alliance, Android SDK installation, Android SDK & their code names, Advantages of android, The Android O/S Architecture, Over view of IDE for Android application, AVD, launching and starting AVD (android virtual device) Managing Application Resources –What are resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus) Android Application Components –Activities & its lifecycle, Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter.

(
12 lectu res)

Books
1. Mobile and personal communication systems and Services, By Raj Pandya
2. Mobile communications, By Jochen Schiller Addison-Wesley.
3. Mobile Computing, By TalukderYavagal

4. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley.
5. Android Application Development by Rickrogers, JohnLombardo, O'Reilly Professional
6. Android2 application development by RetoMeier – Wrox

Suggested E-Resources:
1. https://service.snom.com/display/wiki/DECT+-+Digital+Enhanced+Cordless+Telecommunications
2. https://phsdocs.stanford.edu/v1.0/start-here/phs-data-use-workflow
3. https://developer.android.com/guide/components/fundamentals
4. https://www.youtube.com/watch?v=fPh15wcywV8
5. https://www.youtube.com/watch?v=PzFlElW9R2Y
6. https://www.youtube.com/watch?v=v_9i0eDAN6c

Semester – III

Course Code : MCA 9001T
Title of the Course : Artificial Intelligence and Machine Learning
Level of the Course : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course :Discipline Centric Compulsory (DCC) Course for Computer Science
Delivery Type : Lecture
Total Lectures : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisite:
1. Knowledge of Mathematics
2. Good programming knowledge
3. Analytical skills
4. Ability to understand complex algorithms
5. Basic knowledge of Statistics and modelling
6. Basics of Algorithms
7. Basics of Python Programming Language

Objectives:
1. The learning objective of this course are:
2. To educate the students of MCA with industrial standards.
3. To understand the concepts of Artificial Intelligence and Machine Learning (AI&ML)
4. To elevate innovative research and development in AI & ML to serve as per society needs.
5. To understand various strategies of generating models from data and evaluating them
6. To apply ML algorithms on given data and interpret the results obtained
7. To design appropriate ML solution to solve real world problems in AI domain
8. To create an academic environment for higher learning through self learning and academic practices

Course Outcome:
1. Understand the meaning, purpose, scope, stages, applications, and effects of AI.
2. Develop a good understanding of fundamental principles of machine learning.
3. Gain an in-depth understanding of AI problems and techniques.
4. Gain an in-depth understanding of machine learning algorithms.

UNIT I

Overview of AI, Problems, Problem space and searching techniques, Definition- production system, Control strategies- forward and backward chaining, Heuristic search techniques-Hill Climbing, Best first Search, A* algorithm, AND/OR Graphs

(
12 lectures)

UNIT II

Knowledge representation-Propositional Logic, First Order predicate logic, Skolemization, Resolution Principles and unification, Horn clause

Expert System: Introduction, Component, development process. Learning, Planning and Explanation in Expert Systems, Study of existing expert systems: MYCIN & AM

(12 lectures)

UNIT III

Machine Learning: Learning, Types of Machine Learning, Learning: Supervised, Unsupervised, Semi supervised and Reinforcement learning. Data source, Curse of dimensionality, Overview of Dimension Reduction

(12 lectures)

Unit-IV

Supervised learning: Regression & Classification : Linear regression, Logistic regression, Support Vector Machines, Baye's classifiers, Decision Trees, Ensemble Learning, Nearest Neighbor Methods, Applications

(12 lectures)

Unit-V

Neural Architecture: Human brain, Neuron model, Single layer, perceptron, Multiple layer perceptron, Forwards and Backwards Propagation, Error, learning rule. Back propagation: generalized delta rule, Neural network applications.

Unsupervised learning: Clustering, K-means algorithm, Association rules, Applications.

(12 lectures)

Books:
1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig. Prentice Hall.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Machine Learning, C. Bishop T. M. Mitchell, McGraw-Hill
5. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

6. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017

7. Foundations of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017.

8. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman

Suggested E-Resources:
1. https://archive.nptel.ac.in/courses/106/106/106106139/
2. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
4. https://mitsloan.mit.edu/ideas-made-to-matter/machine-learning-explained
5. https://www.andrewng.org/courses/

Course Code   : MCA9002T
Title of the course : Embedded Systems
Level of the Course : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   :60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisite   :MCA 7011T: Computer Architecture

Objectives:
1. To understand the need of Embedded Systems
2. To familiarize about the Challenges in Embedded System Designs
3. To Demonstrate a Complete Embedded System Design

Learning Outcomes
1. The students should be able to understand and explain about various processor technologies, IC technologies and Design technologies.
2. The students should be able to explain working of a general purpose processor.
3. The students should be able to select a right processor for the given situation and requirements.
4. The students should be able to design a custom hardware for the known functionality.
5. The student must be aware about an emerging processor technology, namely ASIP.
6. The students should be able to explain various types of memories and bus protocols.
7. The students should be able to demonstrate complete embedded system design taking a case study.

UNIT I

Overview and General Purpose Processor
Overview: Overview of embedded systems, Design challenges, common design metrics, processor technologies: general purpose processors,   single-purpose processors, application specific Instruction set processors, IC technologies- full custom/VLSI, semicustom ASIC, PLD, Design Technologies- compilation/ synthesis, libraries/ IP, test/ verification.
General-Purpose Processors: Basic architecture, data path, control unit, memory, operation, instruction execution, pipelining, superscalar and VLIW architectures, programmers view, instruction set, program and memory data space, registers, I/O, interrupts, development environment, design flow and tools, debugging and testing, selecting a microprocessor.

(
12 lectu res)

UNIT II

Custom Processors
Custom-Single purpose processors: Custom single purpose processor design, optimizing custom single processors. Standard single-purpose processors: peripherals Timers, counters, watchdog timers, UART, Pulse width modulator, LCD controller, Keypad controller, ADC, Real time clocks.

(12 lectures)

UNIT III

Application Specific Instruction Set Processors
Application Specific Instruction Set Processor (ASIP) Design: ASIP Design methodologies, steps involved in ASIP design: application analysis, design space exploration, generation of software tools like compiler, debugger, instruction set simulator etc., and synthesizing processor. Simulation based and scheduler based design space exploration techniques and their comparison.

(12 lectures)

UNIT IV

Memory and Interfacing
Memory: Memory write ability and storage performance, Common memory types, composing memories, memory hierarchy and cache, advanced RAM:DRAM, FPM DRAM, EDO DRAM, SDRAM, RDRAM, Memory management.
Interfacing: Arbitration, Muti-level bus architectures, Serial protocols: I2C bus, CAN bus, Fire Wire bus, USAB, Parallel protocols: PCI and ARM bus, Wireless Protocols: IrdA, Bluetooth, IEEE802.11.

(12 lectures)

UNIT V

Case Study
Case study of embedded system (Digital Camera): Introduction to a simple digital camera- user's perspective and designer's perspective, requirements specification- non functional requirements, informal functional specification, refined functional specification. Design alternatives-microcontroller alone, microcontroller and CCDPP, microcontroller and CCDPP/ Fixed-Point DCT, microcontroller and CCDPP/DCT.

(12 lectures)

Books
1. Frank Vahid & Tony Givargi s: Embedded system design: A unified hardware/software Introduction, John Wiley & Sons Inc. 2002.
2. Denial D. Gajski, Frank Vahid: Specification and design of embedded systems, PH
3. Jonathan W. Valvano: Embedded Microcomputer Systems, Thomson Learning
4. Ayala: 8051 Micro controllers, Penram Press

Suggested E Resources
1. http://esd.cs.ucr.edu/
2. http://dsp-book.narod.ru/ESDUA.pdf
3. https://mrcet.com/downloads/digital_notes/ECE/IV%20Year/10082021/EMBEDDED%20SYSTEMS%20DESIGN.pdf
4. https://users.ece.cmu.edu/~koopman/lectures/index.html
5. https://cseweb.ucsd.edu/classes/wi13/wes237A-a/handouts/introductionWES.pdf
6. https://www.arm.com/resources/education/online-courses/efficient-embedded-systems

Course Code   : MCA9003T
Title of the course   : Digital Marketing
Level of the Course   : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites
Knowledge of various digital platforms such as social media networks (Facebook, Twitter, Instagram, LinkedIn), search engines (Google, Bing), content management systems (WordPress), email marketing tools, and advertising platforms (Google Ads, Facebook Ads).

Objectives
The course aims to provide a comprehensive understanding of the digital marketing ecosystem, including the various channels, platforms, and technologies involved. It covers topics such as website optimization, search engine marketing, social media marketing, email marketing, content marketing, and mobile marketing.

Learning Outcomes
1. Developing an overall understanding of digital marketing / online marketing platforms
2. Idea of web analytics, social media tools, marketing through search engines, search engine optimisation,
3. Idea of mobile marketing, email marketing, Pay per click, digital display marketing, content marketing and Strategizing marketing
4. Understand the search engine as a default entry point to the internet. Learn how to get a website listed among top search engine results.
5. Learn to use white paper, brochure, case studies for unique interaction.

UNIT-I

Introduction to Digital Marketing:
Importance of digital marketing, Difference between traditional and digital marketing, recent trends and current scenario of the industry, Case studies on digital marketing strategies
Website Planning and Creation:
Adding content, install and activate plug-in, incorporate design elements to website.

(
12 lectures)

UNIT-II

Search Engine Optimization (SEO)

various search engines and their algorithms, various to make a website rank ,different aspects of SEO like on-page and off-page optimization, keywords research, meta tags, meta description, link building and more.

(12 lectures)

UNIT-III

Search Engine Marketing
Advertisement Strategies, SEM activities via Google Ads platform, Google Keyword Planner, search volume, cost-per-click (CPC), and customer lifetime value (CLV) and other such metrics. (10 Lectures)

(12 lectures)

UNIT-IV

Social Media Marketing
Marketing on Paid advertisements on social media platforms like Facebook, Instagram, Effective social media strategies on platforms such as Facebook, Twitter, Google+, Snapchat etc, building a social media campaign, write ad copies and ad creatives., case studies on social media strategies

(12 lectures)

UNIT-V

Web Analytics, Digital Media Planning and Buying, Web Remarketing, Email Marketing, Mobile Marketing, E-Commerce Management, Content Strategy, Ad sense, Blogging and Affiliate Marketing.

(12 lectures)

Books
1. Fundamentals of Digital Marketing by Puneet singh Bhatia, PEARSON
2. Digital Marketing: From Fundamentals to Future Paperback by Swaminathan T. N./Karthik Kumar, Cengage publications

Suggested E-resources

1. https://digitalfireflymarketing.com/wp-content/uploads/2017/02/Big-Book-of-Digital-Marketing.pdf
2. ascdegreecollege.ac.in/wp-content/uploads/2020/12/Understanding-Digital-Marketing.pdf
3. https://www.drnishikantjha.com/booksCollection/Marketing%204.0_%20Moving%20from%20Traditional%20to%20Digital%20(%20PDFDrive%20).pdf

Code of the course   : MCA9004T
Title of the course   : Information Systems & Cyber Security
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Basic knowledge of computer security is desired.
2. Understanding Copyright and Related Rights.
3. Understanding knowledge and application of laws governing copyrights, patents, trademarks and trade secrets.
4. Understanding fundamentals underpinning copyright law and practice, and describe the different types of rights which copyright and related rights law protects

Objectives of the Course:
1. To provide an in-depth understanding of Cyber Security concepts and techniques
2. To introduce various tools and technologies used in Cyber Security.
3. Describe the concept of intellectual property, explain the classification of intellectual property rights, and elaborate on the justification and scope of IPRs.
4. Create awareness of the rights and infringements of rights and related protections of inventions, creations, and ideas using various IPRs under IP Laws of India.
5. Understand the circumstances under which a granted patent/copyright/design etc. could be revoked, opposed, taken away, or licensed.

Learning Outcomes:
1. To understand the elements of information security and techniques of network.
2. Define and describe the nature and scope of cybercrime.
3. Identify the Information Technology Act, 2000.
4. Define the key concepts of Intellectual Property and IP Infringements.
5. Understand and acquire knowledge of IPR policy followed in India

UNIT I

Security Essentials
Introduction, Elements of Information security, Security Policy, Techniques, steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security.

(**12 lectures)**

UNIT II

Cyber Crime

Introduction to cyber crime, Categories of cyber crime, Types of Cyber crimes, cyber space and information technology, Nature and scope of cyber crime, Jurisdiction of cyber crime

Cyber crime issues: unauthorized access, white collar crimes, viruses, malwares, worms, Trojans, logic bomb, Cyber stalking, Cyber Pornography, Hacking, Phishing, espionage , e-fraud, threatening email, Cyber Terrorism.

(12 lectures)

UNIT III

Cyber Laws and Security

Introduction to Cyber Law, Definition, Objectives of Cyber Law, Need, Scope, Copyright issues in Cyberspace, Data encryption, Cryptography, Digital Signatures, Password, Encrypted smart card, Bio-metric, firewall. Information Security Management System and other Security Compliances, Security Assurance, Security Laws, International Standards, Security Audit, SSE-CMM / COBIT etc.

(12 lectures)

UNIT IV

Information Technology Act

Background of Information Technology Act 2000, Preliminary, Definitions, amendments, Authentication of electronic records, Legal recognition of electronic records, Legal recognition of digital signatures, Attribution, Regulation of Certifying Authorities, Acknowledgment and Dispatch of electronic records, Secure records and secure digital signatures, Functions of controller, Duties of Subscribers, Penalties and Offences.

Overview of amended laws by the IT Act, 2000: The Indian Penal Code, The Indian Evidence Act, The Banker's Book Evidence Act, The Reserve Bank of India Act, Cyber Theft and the Indian Telegraph Act, Digital Signatures and certificate- legal issues.

(12 lectures)

UNIT V

Intellectual Property Rights

Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, objectives of copyright, Requirement and meaning of copyright, copyright as a bundle of rights, Copyright acts: Copyright Act, 1957,Trade Mark Act, 1999, Framing, Linking and

Infringement, Information Technology act related to copyright, Linking and Infringement, information Technology act related to Copyright.

(12 lectures)

Books
1. Cyber Laws, Dr. Gupta & Agrawal, Premier publishing Company
2. Nature of Cyber Laws, S.R. Sharma, Anmol Publications
3. Dimensions of Cyber Crime, S.R. Sharma, Anmol Publications
4. Computer Forensics & Cyber Crimes, MarjieBritz , Pearson.
5. 5.   e-Commerce - Concepts, Models, Strategies, C S V Murthy, Himalaya Publishing House
6. Cyber Laws and IT Protection 2nd ed. , 2022, Gagandeep Chander, Harish Kaur, PHI

Suggested E-Resources:
1. National IPR Policy 2016 - http://cipam.gov.in/wpcontent/uploads/2017/10/National-IPR-Policy-English-.pdf
2. Intellectual Property – The Future, CIPAM, 2017 – 2.http://cipam.gov.in/wp-content/uploads/2017/09/bookletIPR.pdf
3. https://www.startupindia.gov.in/
4. https://dipp.gov.in/
5. http://ipindia.nic.in/

Semester – III

Course Code   : MCA9001P
Title of the Course : Artificial Intelligence and Machine Learning Lab
Level of the Course : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Practical.
Total Lectures   : 80
Prerequisite: The students should have basic knowledge of programming languages like Python.

Objectives:
1. The learning objective of this course are:
2. The course aims to strengthen the conceptual knowledge of AI concepts and techniques to resolve problems.
3. The course aims to get practical exposure to several ways of data collection required for application of machine learning.
4. The course aims to provide conceptual and practical implication of various supervised and unsupervised learning algorithms.
5. The course aims to get in touch with various python libraries like pandas, numpy, sklearn and matplotlib used for data manipulation, analysis and visualization.

Course Outcome:
1. Understand the meaning, purpose, scope, stages, applications, and effects of AI.
2. Develop a good understanding of fundamental principles of machine learning.
3. Able to implement AI problem and machine learning algorithms.
4. Gain expertise in mathematical computing using the NumPy and scikit learn package.
5. Master the concepts of supervised and unsupervised learning
6. Validate machine learning models and decode various accuracy metrics.

List of Sample programs for reference:
1. Program on state space search techniques like:
      a.   Water jug problem,
      b.   N-queen etc.
2. Program on heuristic search techniques like:
      a.   Hill climbing,
      b.   A* etc.
3. Program to display data collected from various sources using 'pandas' and 'csv' libraries of Python
4. Program to depict train test split using 'sklearn' library of Python.
5. Program on various regression based algorithms (using 'sklearn' and 'numpy' library of Python.)
6. Program to demonstrate evaluation parameters of various regression based algorithms.
7. Program on various classification based algorithms (using 'sklearn' and 'numpy'library of

Python.)
8. Program to demonstrate evaluation parameters of various classification based algorithms.
9. Program to use 'matplotlib' and 'seaborn' library of python.
10. Program on unsupervised learning.

Books:
1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig. Prentice Hall.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Machine Learning, C. Bishop T. M. Mitchell, McGraw-Hill
5. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
6. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017
7. Foundations of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017.

Suggested E-Resources:
1. https://archive.nptel.ac.in/courses/106/106/106106139/
2. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
4. https://mitsloan.mit.edu/ideas-made-to-matter/machine-learning-explained
5. https://www.andrewng.org/courses/

Scheme of EoSE :
(i)Exercise(s)/ Experiment(s) :50   (ii)Viva Voce:20   (iii)Evaluation of record book: 10

Course Code   : MCA9002P
Title of the course   : Embedded Systems Lab
Level of the Course   : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course   : DCC Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 80
Pre Requisite   : MCA 7011T: Computer Architecture

Objectives:
1. To get familiarize with a Hardware Synthesis Tool
2. To get hands on experience of making Designs and test the behavior by Simulations

The faculty offering the course can adopt variations in tune with subject MCAT303.

Suggested E-Resources:
1.   Online virtual lab

Scheme of EoSE :
     (i)Exercise(s)/ Experiment(s) :50   (ii)Viva Voce:20   (iii)Evaluation of record book: 10

MCA910XT   Departmental Elective-II

List of Departmental Elective(s) – II

Code of the course   : MCA9106T
Title of the course   : Software Testing
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture
Total Lectures   :60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Familiarity with using computers and basic software applications is essential.
2. Comfortable in different operating systems tools like word processors, spreadsheets, and web browsers.

Objectives of the course
1. Introduced to various testing tools and technologies commonly used in the industry. This includes test management tools, test automation frameworks, bug tracking systems, performance testing tools, and other specialized testing software.

Learning Outcomes
1. To study fundamental concepts in software testing, including software testing objectives, process.
2. To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report
3. define and develop a test tool to support test automation and Defects Testing
4. Able to do Business Intelligence Testing by white and black box testing.
5. Analyze performance related issues and tackle device plans

UNIT-I

Software Testing: Introduction, Importance, Fundamental Principles of Testing SDLC Vs STLC, Manual Testing, Automation Testing, Automated Testing Vs. Manual Testing, Unit Testing, Integration Testing, System Testing, Smoke and Sanity Testing, Regression Testing, Non-Functional Testing.

(
12 lectu res)

UNIT-II

Introduction to Test Formality, Test Scenario, Test Case Specifications, Test Basis, Traceability Matrix, Software Testing Techniques, Equivalence Partitioning & Boundary Value Analysis,

Decision Table Testing, State Transition Diagram, Use Case Testing, Test Management & Control Estimation, Test Plan

(
12 lectu res)

UNIT-III

Defects, Defect Life Cycle, Testing Tools, Agile, Agile Testing Methodology, Scrum Testing, Automation Testing for Agile Methodology, Scaled Agile Framework(SAFe), Waterfall Vs. Agile, Agile Vs Scrum, Scrum Vs. Kanban,

(
12 lectu res)

UNIT-IV

WhiteBox Testing: Loop Testing, Path Testing, Condition testing , Memory Testing Blackbox Testing: Functional Testing, Integration Testing, System Testing, Acceptance Testing, Smoke Testing, Exploratory Testing, Ad hoc Testing.

(
12 lectu res)

UNIT-V

Performance Testing, Load Testing, Stress Testing, Volume Testing, Scalability Testing, Soak Testing, Stability Testing, Spike Testing, Performance Testing vs. Load Testing vs. Stress Testing, Globalization Testing, Compatibility Testing, Static Testing, Cyclomatic Complexity, Testing as a Service (TaaS), Test Maturity Model (TMM)

(
12 lectu res)

Books
1. The Art of Software Testing, Glenford Myers , Wiley
2. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin, Pearson Education
3. Software Testing: Principles and Practice, Gopalaswamy Ramesh and Srinivasan Desikan, Pearson Education
4. Software Testing: A Craftsman's Approach, Paul Jorgensen, CRC Press.

Suggested E-resources

1. https://fall14se.files.wordpress.com/2017/12/software-testing-yogesh-singh.pdf

2. http://www.cse.hcmut.edu.vn/~hiep/KiemthuPhanmem/Tailieuthamkhao/Introduction%20to%20Software%20Testing.pdf
3. https://dahlan.unimal.ac.id/files/ebooks/2006%20[William_E._Perry]_Effective_Methods_for_Software_SANGAT_BAGUS.pdf

Code of the course   : MCA9107T
Title of the course   : Robotics
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites   :MCA 7011T: Computer Architecture

Objectives of the course:
1. To understand the Concept of Robotics
2. To understand how Robotic Systems are Designed

Learning Outcomes

1. Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators.
2. Apply spatial transformation to obtain forward and inverse kinematics
3. Solve robot dynamics problems, generate joint trajectory for path planning
4. Describe working principle of various sensors and program different operations
5. Appreciate applications of robots in industry.

UNIT I

Introduction :Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems Hydraulic, Pneumatic and Electric system.

(12 lectures)

UNIT II

End Effectors and Robot Controls : Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

(12 lectures)

UNIT III

Robot Transformations and Sensors

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

(12 lectures)

UNIT IV

Robot Cell Design and Applications

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions- Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

(12 lectures)

UNIT V

Micro/Nano Robotics System

Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach-Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

(12 lectures)

Books
1. Robotics Technology and flexible automation, S.R. Deb, Tata McGraw-Hill Education.
2. Industrial Robotics, Technology programming and Applications, . Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, McGraw Hill.
3. Robotics Engineering an Integrated Approach, Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, Phi Learning.
4. Engineering foundation of Robotics, Francis N. Nagy, Andras Siegler, Prentice Hall Inc.
5. Robotics and Image Processing an Introduction, P.A. Janaki Raman, Tata McGraw Hill Publishing company Ltd.

Suggested E-resources

1. NPTEL
2. Coursera

Course Code   : MCA9108T
Title of the Course   : Internet of Things
Level of the Course : NHEQF Level 6.5
Credit of the Course : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Must know how systems work.
2. To know about statistics that have to do with Machine Learning.
3. Simultaneous use of artificial intelligence
4. Knowledge of various sensors.
5. Basic Knowledge of Networking protocols.

Objectives:
    To obtain and analyze data from things (devices) that were previously disconnected from most data processing tools

Learning Outcomes:
1. Explain the definition and usage of the term "Internet of Things" in different contexts.
2. Understand the key components that make up an IoT system.
3. Differentiate between the levels of the IoT stack
4. Familiarity with the key technologies and protocols employed at each layer of the IoT stack.
5. Able to build IoT applications
6. Learn to integrate modern technologies such as sensors, communication, and computational processing.

UNIT I

Introduction to IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

(12 lectures)

UNIT II

IoT Architecture M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III

IoT Protocols

Protocol Standardization for IoT,Efforts,M2M and WSN Protocols, SCADA and RFID Protocols, Unified Data Standards, Protocols, IEEE 802.15.4,BACNet Protocol, Modbus– Zigbee Architecture, Network layer,6LowPAN - CoAP - Security

UNIT IV

Building IoT With Raspberry Pi & Arduino

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python,IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V

Case Studies and Real-World Applications

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT, Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

Books
1. Internet of Things, A hands-on approach Arshdeep Bahga, Vijay Madisetti, Universities Press,
2. Architecting the Internet of Things Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Springer.
3. The Internet of Things in the Cloud: A Middleware Perspective Honbo Zhou, CRC Press.
4. The Internet of Things, Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley.

Suggested E-Resources:
1. W3Schools
2. Khan Academy
3. Tutorialspoint
4. SoloLearn

Course Code   : MCA9109T
 Title of the Course   : Compiler Design
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisite:
    Requires basic understanding of at least one programming language such as C, Java etc.

Objectives:
    The objective of the compiler course is to understand the basic principles of compiler design, its various constituent parts, algorithms and data structures required to be used in the compiler.

Learning Outcomes:
1. To acquire basic skills for designing the compilers, as well as the knowledge of compiler design.
2. Able to understand the working of a compiler.
3. Understand the structure of a compiler, and how the source and target languages influence various choices in its design.
4. Give a new appreciation for programming language features and the implementation challenge
5. Understanding the details of typical compilation models
6. Understand some specific components of compiler technology, such as lexical analysis, grammars and parsing, type-checking, intermediate representations, etc

UNIT I
Introduction to translators, compilers, interpreters, compilation process. Programming language grammars, derivations, reductions, regular expression, context free language and grammar.
Lexical analyzer, input buffering, specification and recognition of tokens, introduction to finite automata, regular expressions to NFA, minimization of DFA, keywords and reserved word policies, LEX, the lexical analyzer generator.

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12 lectu res)

UNIT II
Syntax analyzer, context free grammars, top down parsing, brute force parser, recursive descent parser, LL(1) parser, Bottom up parsing, operator precedence parsing, simple precedence parsing, LR parser, LALR parser, YACC, the parser generator.

UNIT III

Syntax directed translation schemes, implementation of syntax directed translators, synthesized attributes, inherited attributes, dependency graph, evaluation order, construction of syntax trees, directed acyclic graph of expression, bottom up evaluation of S- attributed definitions, L attributed definitions, top down translation of L - attributed definitions.

UNIT IV

Errors, lexical phase errors, syntactic phase errors. Intermediate languages, postfix notation, syntax trees, parse trees, three address code, triples and indirect triples. Translation of assignment statements, Symbol tables, operation on symbol tables, and symbol table organization for non-block structured languages, symbol table organization for block, structured languages.

UNIT V

Run time storage management, storage allocation and referencing data in block structured language, storage allocation. Code optimization, sources of optimization, loop optimization, DAG and optimization of basic blocks. Code generation, a machine model, next use information register allocation and assignment, a simple code generator, code generation from DAG's, Peephole optimization.

Books
1. Compilers, Principles, techniques and tools, Aho, Ullman and Sethi, Pearson Education.
2. The Theory and Practice of Compiler Writing, Tremblay, Sorenson, BSP.
3. Compiler Design in C, Holub, PHI.

Suggested E-Resources:
1. W3Schools
2. Khan Academy
3. Tutorialspoint

4. SoloLearn

Course Code   : MCA9110T
Title of the Course   : R Programming
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Must know of the basics of any programming language.
2. Should have a deep knowledge of statistics and mathematics.
3. Must have a good understanding of graphs and plots that are used for data visualization.

Objectives of the course :
1. Students will develop relevant programming abilities.
2. Students will demonstrate proficiency with statistical analysis of data.
3. Students will develop the ability to build and assess data-based models.

Learning Outcomes:
1. Learn to create own customized functions
2. Able to construct tables and figures for descriptive statistics
3. Learn to understand new data sets and functions
4. Clear understanding on how to organize data and analyze data using real time examples

UNIT I

Introduction to R: What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), package Description( ), help( ), find.package( ), library( ) - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.

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12 lectures)

UNIT II

R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if – else if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement

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UNIT III

R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - R-Strings – Manipulating Text in Data, R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting - R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector - R Matrices – Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements

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UNIT IV

Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim( ), nrow( ), ncol( ), str( ), Summary( ), names( ), head( ), tail( ), edit( ) functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind( ) and cbind( ) – Merging Data frames merge ( ) – Melting and Casting data melt( ), cast( ). (3 Lectures)Loading and handling Data in R: Getting and Setting the Working Directory – getwd( ), setwd( ), dir( ) - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary( ), min( ), max( ), range( ), mean( ), median( ), apply( ) - Writing into a CSV File – R -Excel File – Reading the Excel file.

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UNIT V

Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - Spotting Problems in Data with Visualization: visually Checking Distributions for a single Variable - R – Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.

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Books:
1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018.
3. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley

and Sons, Inc, 2015

E- Resources:
1. R Programming, Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf.

MCA910YT   Departmental Elective-III

List of Departmental Elective(s) – III

Code of the course   : MCA9111T
Title of the course   : Ethical Hacking and Digital Forensics
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : Discipline Specific Elective (DSE) Course for Computer Science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Good skills and concepts of Web programming, Operating System and Networking.
2. Sound knowledge of Windows and UNIX operating systems.
3. Good problem-solving skills and analytical skills.
4. Knowledge of Computer Networks and information security.
5. Basic Understanding of Network Security & Threat Mechanisms

Objectives of the Course:
1. Learn the fundamentals of digital forensics.
2. This Course helps students to think like an ethical hacker and at the same time follow the code of professional ethics and the prescribed cyber laws.
3. Students will be aware of the cybercrimes that are taking place in the real world.
4. Learn about the different hacking tools and techniques and practically use these tools to gain a better understanding of the ethical hacking concepts.
5. Students will be provided with a deep understanding of security issues, threats and concerns in the cyber world and provide countermeasures to curb hacking.

Learning Outcomes:
1. Understand the need for digital forensics fundamentals and their role in the real world.
2. Identify different technologies for digital forensics.
3. Make use of various tools and methods used in cybercrime.
4. Understand different investigation methodologies.
5. Able to understand ethical hacking and its type.

UNIT I

Computer network and defense fundamentals, Network security threats, vulnerabilities, attacks. Overview of the Top 20 OWASP Security vulnerabilities. CVSS Scoring system including VAPT techniques.

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UNIT II

Network security controls, protocols, and devices, Network security policy design and implementation, Physical security, Host security, Secure firewall configuration and management, Secure IDS configuration and management, Secure VPN configuration and management

Wireless network defense, Network traffic monitoring and analysis, Network risk and vulnerability management, Data backup and recovery, Network incident response and management.

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UNIT III

Introduction to Ethical Hacking: Information security overview, skills of an ethical hacker, Hacking concepts and phases, Types of attacks, Foot printing and reconnaissance, Scanning networks, Enumeration, Sniffing, System hacking, Malware threats, Social engineering, Denial of service, Session hijacking, Hacking web applications, SQL injection, Hacking wireless networks, Hacking web servers, Hacking mobile platforms, Evading IDS, Firewalls, and Honeypot

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UNIT IV

Introduction to Cyber forensics: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Analyzing malicious software. Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Computer forensics investigation process, Data Acquisition and Duplication, Understanding hard disks and file systems, Defeating anti-forensics techniques, Operating system forensics, Network forensics, Investigating web attacks, Database forensics, Cloud forensics, Malware forensics, Investigating email crimes, Mobile forensics process.

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UNIT V

Mobile OS architecture, boot process, and file systems, Mobile threats and security, Forensics report writing and presentation, encryption and stenography analysis. Investigation process: legal process of investigation, jurisdiction and agencies, internet investigation, IP address and domain names, investigation method, evidence collection.

Legal Issues: Constitutional law, search and seizure guidelines, ECPA, challenges in process, international computer crime law.

(12 lectures)

Books
1. Hacking for Dummies, Kevin Beaver,Wiley
2. Computer Forensics: Incident Response Essentials, Jay G. Heiser and Warren G. Kruse, Pearson
3. Ethical Hacking and Penetration Testing Guide,RafayBaloch,CRC Press
4. Hands-on Ethical Hacking and Network Defence, James Corley
5. Hackers & IT Security Experts, Ali Jahangiri, First edition, 2009

Suggested E-Resources:
1. Code of ethics link https://cert.eccouncil.org/code-of-ethics.html
2. https://arc.bukancoder.co/Certified-Ethical-Hacker-Module-V8/
3. https://www.edureka.co/blog/steganography-tutorial
4. Computer Forensic Training Center Online http://www.cftco.com/ Computer Forensics World
5. http://www.computerforensicsworld.com/ Computer Forensic Services
6. http://www.computer-forensic.com/ 4 Digital Forensic Magazine
7. http://www.digitalforensicsmagazine.com/

Code of the course   : MCA9112T
Title of the course   : Data Mining and Data Warehousing
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:

1. Familiarize yourself with the fundamental concepts of databases, including data models (such as relational, hierarchical, and object-oriented), database design principles, and query languages (such as SQL). Understanding how data is organized and stored will be crucial for data mining and data warehousing.

Objectives of the course

The course aims to provide an understanding of the principles and components of data warehousing. This involves learning about data integration, data cleaning, data transformation, and building data warehouses for efficient data storage and retrieval.

Learning Outcomes
1. Learn Database Management System Concepts and Architecture and data warehouse
2. Able to understand the   Warehouse Implementation and OLAPTechnology for Data Mining
3. Able to Understand Data Preprocessing
4. Learn Data Mining Methods
5. Able to understand Fuzzy Logic Clustering and Introduction to Fuzzy Logic

UNIT I

Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses

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UNIT II

Conceptual Data Architecture, Logical Architectures-star schema, snowflake, constellation, facttable and dimensions tables, Design Techniques. Data Warehouse Implementation Data Warehouse and OLAP Technology for Data Mining, Data Warehouse and OLAP Technology for Data Mining:, Data Marts, Metadata, OLAP, Categorization of OLAP Tools.

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UNIT III

Data Pre processing(ETL Process): Data Cleaning, Data Integration and Transformation, Data Reduction, Data Mining Primitives, Concept Description, Mining Association Rules and Algorithms.

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UNIT IV

Data Mining Methods Data Mining Methods –Correlation Analysis, Classification and Prediction - Basic Concepts, Statistical based classification, Decision Tree Induction, K Nearest Neighbors, Rule Based Classification, Classification by Backpropagation, Support Vector Machines

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UNIT V

Clustering and Introduction to Fuzzy Logic Clustering and Introduction to Fuzzy Logic: Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Outlier Analysis, Data Mining Applications. Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicate logic

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Books
1. Fundamentals of Database Systems, Elmasri, Navathe: Addison Wesley, Pearson Education.
2. Data Warehousing, Data Mining & OLAP, Alex Berson and Stephen J. Smith, Tata McGraw,Hill
3. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Elsevier.
4. Introduction To Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Person Education.
5. Insight into Data mining Theory and Practice, K.P. Soman, Shyam Diwakar and V. Ajay, Prentice Hall of India.
6. Introduction to Data Mining with Case Studies, G. K. Gupta,Prentice Hall of India

Suggested E-resources

1. https://ia800702.us.archive.org/7/items/datamining_201811/DS-book%20u5.pdf
2. https://textbooks.elsevier.com/manualsprotectedtextbooks/9780123814791/Instructor's_manual.pdf
3. https://dl.ebooksworld.ir/motoman/Cambridge.University.Press.Data.Mining.and.Data.Warehousing.www.EBooksWorld.ir.pdf

Code of the course   :MCA9113T
Title of the course   : Soft Computing
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.
Prerequisites: None

Objectives of the Course:
1. Expose the students to soft computing, various types of soft computing techniques, and applications of soft computing.
2. Learn soft computing techniques and their applications.
3. Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution.
4. Analyze various neural network architectures

Learning Outcomes:
1. Neural Networks, architecture, functions and various algorithms involved.
2. Define the fuzzy systems, and their functions.
3. Genetic algorithms, its applications and advances.

UNIT I

Introduction:
Definition of Soft Computing, Conception of Soft Computing, Importance of Soft Computing, The Soft Computing – development history. Difference between Hard and Soft computing, Requirement of Soft computing, Major Applications Areas of Soft Computing.

(**12 lectures**)

UNIT II

Neural Networks
Neural Network, Applications of ANN, Learning rules and various activation functions, Single layer Perceptron's, Back Propagation networks, Architecture of Back propagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

(**12 lectures**)

UNIT III

Fuzzy Systems

Introduction to Fuzzy logic, Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification, Fuzzy membership functions, Operations on Fuzzy sets. Fuzzy relations, Fuzzy proposition, Fuzzy implications, Fuzzy inferences Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method.

(12 lectures)

UNIT IV

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Solving optimization problems, Multi-level Optimization.

(12 lectures)

UNIT V

Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them. Multi-Objective Evolutionary Algorithm (MOEA). Recent Trends in various classifiers, Swarm Optimizations algorithms: ant colony , Bee colony. Introduction to basic Particle Swarm Optimization (PSO) algorithm – Swarm intelligence.

(12 lectures)

Books
1. Genetic Algorithm in Search Optimization and Machine Learning, David E. Goldberg, Pearson Education India.
2. Neural Networks Comprehensive Foundation, Simon Haykin, Pearson Education.
3. Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
4. Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
5. S, Rajasekaran& G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009
6. Suggested E-Resources:
7. Principles of Soft Computing, S.N.Sivanandam and S.N.Deepa, Wiley India Pvt Ltd.
8. Clerc, Maurice, "Particle swarm optimization", John Wiley & Sons, 2010.

Suggested E-Resources:
1. W3Schools
2. Khan Academy
3. Tutorialspoint
4. SoloLearn

Semester – III

Code of the course   : MCA9114T
Title of the course   :Ad Hoc Network
Level of the Course   : NHEQF Level 6.5
Credit of the Course   : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture.
Total Lectures   :60(40+20), 40 lectures for content delivery and 20 hours on diagnostic,
                          formative assessment, class activity and problem solving.

Prerequisites: None

Objectives of the Course:
1. Learn concepts of Ad Hoc Network from design through performance issues to application requirements.
2. Characteristics features, applications of ad hoc networks,
3. Learn about Modulation techniques and voice coding.
4. Learn about IEEE 802.11 Wireless LAN and Bluetooth standards.

Learning Outcomes:
1. After successful completion of this course, student will be able to
2. Have gained an understanding of the current topics in MANETs and WSNs,
3. Have an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.
4. Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption

UNIT I

Introduction
Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum –Radio propagation Mechanisms, Characteristics of the Wireless Channel -mobile adhoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

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UNIT II

Mac Protocols for Ad Hoc Wireless Networks
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention Based Protocols
-Reservation and Scheduling Mechanisms - Other Protocols. Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms –Multi channel MAC-IEEE 802.11

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UNIT III

Routing Protocols and Transport Layer in Ad Hoc Wireless Networks
Design Issues and Classifications of unicast and multicast Routing Protocols - proactive routing, reactive routing (on-demand), hybrid routing protocols, Energy Efficient and QoS guaranteed multicast protocols.

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UNIT IV

Routing Protocol: Global State Routing (GSR), Dynamic State Routing (DSR), Fisheye State Routing (FSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance, Vector outing (DSDV). Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

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UNIT V

Wireless Sensor Networks (WSNS) and Mac Protocols
Single node architecture: hardware and software components of a sensor node, WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

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Books
1. Ad Hoc Wireless Networks, C. Siva Ram Murthy and B.S. Manoj
2. Ad Hoc Mobile Wireless Networks: Protocols and Systems, C.K. Toh, Prentice Hall PTR,
3. Ad Hoc Networking, Charles E. Perkins, Addison Wesley,
4. Wireless Communications: Principles and Practice, T.Rappaport, Prentice Hall,
5. Principles of Wireless Networks, K. Pahlavan& P. Krishnamurthy, Prentice Hall

Suggested E-Resources
1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, "Mobile ad hoc networking", Wiley-IEEE press, 2004.
2. Mohammad Ilyas, "The handbook of adhoc wireless networks", CRC press, 2002.

Code of the course   : MCA9115T
Title of the course   : Natural Language Processing
Level of the Course   : 9
Credit of the Course : 4
Type of the Course   : DSE Course for MCA in computer science
Delivery Type   : Lecture
Total Lectures   : 60(40+20), 40 lectures for content delivery and 20 hours on diagnostic, formative assessment, class activity and problem solving.

Prerequisites:
1. Basic computational methods
2. Advanced calculus, linear algebra, probability and statistics, and differential equations.

Objectives of the Course:
1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax, semantics of the language
3. Students capable to describe the application, based on natural language processing

Learning Outcomes:
1. Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.
2. Understand speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis).
3. Analyze the syntax, semantics of a statement written in a natural language.

UNIT I

Overview and Language Modeling
Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages –NLP Applications-Information Retrieval. Language Modeling: Various Grammar-based Language Models - Statistical Language Model.

(12 lectures)

UNIT II

Word Level Analysis: Regular Expressions- Finite-State Automata – Morphological Parsing, Spelling Error Detection and correction - Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

(12 lectures)

UNIT III

Semantic Analysis and Discourse Processing

Semantic Analysis: Meaning, Representation, Lexical, Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion-Reference, Resolution, Discourse Coherence and Structure.

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UNIT IV

Natural Language Generation and Machine Translation

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches- Translation involving Indian Languages.

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UNIT V

Information Retrieval and Lexical Resources

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: WorldNet - FrameNet-Stemmers- POS Tagger - Research Corporation

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Books
1. Natural Language Processing and Information Retrieval, Tanveer Siddiqui, U.S.Tiwary, Oxford University Press.
2. Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Daniel Jurafsky and James H Martin, Prentice Hall.
3. Natural Language Understanding, James Allen, Benjamin/Cummings publishing company,

Suggested E-Resources:
1. https://www.studocu.com/in/document/university-of-madras/computer-application/2021-12-origin-and-challenges-of-nlp/31242013
2. https://www.studocu.com/in/document/university-of-madras/computer-application/2021-21-word-level-analysis-reg-expr/31242057
3. https://www.studocu.com/in/document/university-of-madras/computer-application/2021-

      31-semantic-analysis-meaning-representation/31242121

4. https://www.techtarget.com/searchenterpriseai/definition/natural-language-generation-NLG
5. https://www.javatpoint.com/nlp
6. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_part_of_speech_tagging.htm

Code of the course   : MCA9003P
Title of the course   : Project
Level of the Course   : 9
Credit of the Course   : 24
Type of the Course   : IOJ Course for MCA in computer science

Objectives of the Course:
1. To enhance their skills-set in the area of their expertise.
2. To convert their theoretical learning into practical experience.
3. To make them understand what is expected out of them.
4. To equip them with qualities like integrity and leadership.

The projects submitted by the candidates will be evaluated as per the following guidelines.
1. Project Title/Topic to be selected by the student after end of 3rd semester in accordance with his project guide and the same must be finalized on the commencement of 4th semester
2. The project must be of approximately 360 man hours and should be certified by the supervisor of the project
3. The project must be submitted in the form in consonance with the format enclosed
4. Monthly progress report must be submitted on mail only through supervisor in the enclosed format.
5. Project must be submitted on and before the prescribed last date.
6. Candidates are required to make a presentation of their project work during their project evaluation by examiners.
7. Students whose Projects graded as unsatisfactory will given one more chance to undertake
another project under another supervisor.
8. The project work of the candidates whose monthly progress report is not submitted monthly will be considered as incomplete and may be terminated as per the rules.
9. Students are required to give progress seminar twice during the project work.
10. Examination of the project work will be conducted by a committee consisting of at least
two internal examiners and one external examiner.

Guidelines for Project in partial fulfillment of the requirement of MCA course
(a)   The project will consist of two parts:
1. Documentation   2. Viva-voce

(b) The source-code and the executable code have to be submitted on CD/DVD and student must
demonstrate working of the software.
(c) Project shall be original and not copied from the existing material from any source and a certificate, as per format given will be provided with the Project, duly countersigned

by the supervisor.

(d) Project will be submitted only when the candidate completes all papers though he or she may start the projects earlier.

(e) Presentation of the Project will be in the accepted norms; as laid down in various text- books; IEEE standard/ ISO standards etc., are some models to follow.

(f) As far as possible, the Project should be of Real life problem / Social Impact / Commercially viable solution.

(g) Though the Project is given 360 hours, the student is expected to use his/her discretion to ensure that it is large enough to be of practical value.

PROFORMA FOR THE PROJECT
REPORT

1. Title of the Project
2. Objectives
3. Input to the Project
4. Output generated
5. Details of Hardware Platform used
6. Details of Software Tools used
7. Implementation Issues (Clearly defining the area of Application).
8. Miscellaneous
9. Signature of the Candidature.

GUIDELINES FOR THE CHAPTERS AND SECTIONS

1. Microscopic Summary
2. Details of candidate and Supervisor along with certificates of:
   a. Original Work;
   b. Assistance if any;
   c. Credits.
3. Aims and Objectives
4. Approach to Project and Time Frame
5. Project Design Description with Appendices to cover:
   a. Flow Charts/Data Flow Diagram-Macro/Micro level
   b. Source Code
   c. Hardware Platform
   d. Software Tools
   e. Security measures
   f. Quality Assurance Auditability
6. Test Data and Result.

PERFORMA FOR CERTIFICATE

This   is   to certify that   this   is   a bonafide record   of   the Project entitled
_____

was   done   satisfactory   at   _____   by   Mr./Ms.
_____

in partial fulfillment of MCA course. He/ She has successfully completed all the subjects.

This report had not been submitted for any other examination and does not form part of any other course

Undergone by the candidate.

PLACE:

DATE: SIGNATURE
                                                   NAME:
                                                   DESIGNATION:

                                  (Name & Seal of Supervisor)