राष्ट्रसंत तुकडोजी महाराज नागपूर विद्यापीठ

(सेंट्रल प्रोव्हिन्सेस शासन शिक्षण विभागाची अधिसूचना क्रमांक ५१३ दिनांक १ ऑगस्ट, १९२३ द्वारा स्थापित व
महाराष्ट्र सार्वजनिक विद्यापीठ अधिनियम, २०१६ (सन २०१७ चा महाराष्ट्र विद्यापीठ अधिनियम, क्रमांक ६) द्वारा संचालित राज्य विद्यापीठ)

(विद्या विभाग)

राष्ट्रसंत तुकडोजी महाराज नागपूर विद्यापीठ जमनालाल बजाज प्रशासकिय भवन महात्मा जोतिबा फुले शैक्षणिक परिसर, विद्यापीठ कॅम्पस चौक ते अंबाझरी टी–पॉइंट मार्ग, नागपूर – ४४० ०३३

क्र. रातुमनावि/विद्या/२०२०/३४४ दिनांक२८ डिसेंबर,२०२०

:: अधिसूचना ::

सर्व संबंधीतांच्या माहितीकरीता सुचित करण्यात येते की, विज्ञान व तंत्रज्ञान विद्याशाखेअंतर्गत येणारे एम.सी.ए.दोन वर्षिय (चार सेमिस्टर सी.बी.सी.एस.) अभ्यासक्रमाची नवीन अभ्यासक्रमिका व परीक्षा योजनेस दिनांक २८.०८.२०२० रोजी ऑनलाईन संपन्न झालेल्या विद्या परीषदेने बाब क्रमांक १(xxxxvii) अन्वये मान्यता प्रदान केली होती. करीता सदर अभ्यासक्रमिका सत्र २०२०–२०२१ पासुन लागु करण्यात येत आहे. त्यामुळे हा अभ्यासक्रम राबविण्याकरीता निदेश निर्गमित करावयाचा असल्यामुळे विद्यापीठाच्या प्रारूप निदेश समितीने सदर अभ्यासक्रमाचे प्रारूप निदेश तयार करून दिनांक १७.१२.२०२० रोजी मा. कुलगुरू महोदयांकडे सादर केले होते. यास मा. कुलगुरू महोदयांनी मान्यता प्रदान केलेली आहे. करिता सदर निदेश क्र. ३३/२०२० हा महाराष्ट्र सार्वजनिक विद्यापीठ अधिनियम २०१६ च्या कलम १२(८) अंतर्गत सर्व संबंधितांकरिता निर्गमित करण्यात येत आहे.

सदर अभ्यासक्रमिका परीक्षा योजना व निदेश राष्ट्संत तुकडोजी महाराज नागपूर विद्यापीठाच्या. (www.nagpuruniversity.ac.in) या संकेतस्थळावर उपलब्ध करण्यात आलेले आहे.

कृपया संबंधीतानी नोंद घ्यावी

मा.कुलगुरूंच्या आदेशान्वये

(डॉ. निरज खटी)
कुलसचिव(अति.प्रभार)

प्रतिलिपी माहिती व पुढील कार्यवाहीसाठी अग्रेषित:

१. सर्व प्राचार्य, संचालित व संलग्नीत एम.सी.ए. महाविद्यालये राष्ट्संत तुकडोजी महाराज नागपूर विद्यापीठ, नागपूर
२. मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा
३. मा.संचालक,परिक्षा व मुल्यमापन मंडळ
४. उपकुलसचिव (परिक्षा पुर्व/परिक्षा उपरांत/ म.वि.शाखा)
५. सहायक कुलसचिव सामान्य परिक्षा/चौकशी व व्यावसायीक परीक्षा
६. मा. कुलगुरूंचे स्वीय सहाय्यक,
७. मा. प्र.कुलगुरूंचे स्वीय सहाय्यक,
८. मा.कुलसचिवांचे स्वीय सहाय्यक,
९. श्रीमती विना प्रकाशे, माहितीशास्त्रज्ञ

राष्ट्रसंत तुकडोजी महाराज नागपूर विद्यापीठ

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY
'Established by Government of Central Provinces Education Department by Notification No. 513 dated the 1st of August, 1923 & presently a State University governed by Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017)

FACULTY OF SCIENCE AND TECHNOLOGY

DIRECTION NO. 33 of 2020

ADMISSION AND EXAMINATIONS OF STUDENTS LEADING TO THEAWARD OF THE DEGREE OF MASTER IN COMPUTER APPLICATION (SEMESTER PATTERN) (CHOICE BASED CREDIT SYSTEM) (2 YEARS PROGRAMME), DIRECTION

WHEREAS, the Maharashtra Public Universities Act, 2016 (VI of 2017) (hereinafter the "Act") has been made applicable to the Rashtrasant Tukdoji Maharaj Nagpur University (herein after the "University") w.e.f. 1st March 2017;

AND

WHEREAS, as per the provisions of section 73 (1) of the Act an Ordinance is required to be made for laying down the conditions under which students can be admitted to any course of study leading to the award of degrees, diplomas, certificates, and other academic distinctions;

AND

WHEREAS, the Board of Studies in Computer Science in its meeting held on 9 March , 2020 has prepared the syllabi, scheme of examination and absorption scheme for the Master in Computer Application (CBCS) programme and resolved to implement the same from the academic session 2020-21 progressively, discontinuing in a phased manner the existing programme governed by Ordinance No. 16 of 2009;

AND

WHEREAS, the Dean, Faculty of Science & Technology concurring with the recommendations of the Board of Studies in Computer Science, in the Faculty of Science & Technology, recommended to the Vice-Chancellor introduction of the Master in Computer Application (CBCS) programme, with draft direction and other details, from the academic session 2020-21 and the Vice-Chancellor having accorded his consent to the same;

AND

Whereas, making of an Ordinance is a time consuming process and there is an urgency in introducing the degree programme of Master in Computer Application (CBCS), in the faculty of

24/11/2020

Science and Technology, from the academic session 2020-21 necessitating issuance of a Direction by the Vice-Chancellor, in exercise of his powers under section 12(8) of the Act;

Now, therefore, I, Dr. Subhash R. Chaudhari, Vice-Chancellor, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur in exercise of the powers vested in me under Section 12(8) of the Maharashtra Public Universities Act of 2016 do hereby issue the following Directions:-

1. This Direction may be called " **ADMISSION AND EXAMINATIONS OF STUDENTSLEADING TO THEAWARD OF THE DEGREE OF MASTER IN COMPUTER APPLICATION (SEMESTER PATTERN) (CHOICE BASED CREDIT SYSTEM) (2 YEARS PROGRAMME), DIRECTION, 2020."**

2. This Direction shall come into force from the date of its issuance.

3. In this Direction unless the context otherwise requires:-

   a. **"ATKT"** means "Allowed to Keep Term" in the higher semester, as per the rules herein.

   b. **"Board of Studies"** means Board of studies of the University in "computer science".

   c. **"Course"** means a theory or practical (or the combination of theory and practical) subject, prescribed for any semester and carrying maximum and minimum passing marks, which a student, admitted to the programme of the **Master in Computer Application (Semester Pattern) (Choice Based Credit System) (2 Years Programme),** has to study in order to become eligible for the award of the Degree under this Direction.

   d. **"Credit"** means the unit by which the course work is measured. It is measured in terms of weekly class hours assigned to a Course.

   e. **"Credit Point" (CP):** It is the value obtained by multiplying the Grade Point by the Credit i.e. No. of Credits assigned for the course x Grade Points secured for that course.

   f. **"Cumulative Grade Point Average (CGPA)"**: CGPA refers to the Cumulative Grade Point Average weighted across all the semesters. It is obtained by dividing total number of credit points in all the semesters by the total number of credits in all the semesters.

   g. **"Degree"** means the Degree of **Master in Computer Application (Semester Pattern) (Choice Based Credit System)** which is to be awarded to a student admitted to the programme governed by this Direction on successful completion of the programme.

   h. **"Grade Letter"**: It is an index to indicate the performance of a student in a particular course/ Paper. It is the transformation of actual marks secured by a student in a

course/paper. It is indicated by a Grade letter O,A,B,C,D,E and F. There is a range of marks for each Grade.

i. **"Grade Point"** : Grade Point is the weightage allotted to each grade letter depending on the marks awarded in a course/paper.

j. **"Programme"** means the academic programme consisting of four semesters, each semester having one or more than one course (subject), leading to the award of the degree of **Master in Computer Application (Semester Pattern) (Choice Based Credit System) (for short "MCA programme")**.

k. **"Student"** means student admitted to the programme under this Direction.

l. **Semester Grade Point Average (SGPA)**: SGPA indicates the performance of a student in a given Semester. It is based on the total credit points earned by the student in all the courses and the total number of credits assigned to the courses/papers in a Semester.

k. **"University"**: means RashtrasantTukdojiMaharaj Nagpur University, Nagpur

4. The duration of the programme shall be of two academic years consisting of four semesters with the University examinations at the end of each semester namely.

a) M.C.A. Semester I Examination

b) M.C.A. Semester II Examination

c) M.C.A. Semester III Examination

d) M.C.A. Semester IV Examination

5. The theory examination of Semesters-I, II, III and IV shall be conducted by the University and shall be held separately at the end of each semester at such places and dates as may be decided and notified by the University and shall be held as per the schedule given in the Table below.

Sr. No.	Name of the examination	Main Examination	Supplementary Examination
1	Semester I & III	Winter	Summer
2	Semester II &IV	Summer	Winter

6. ELIGIBILITY FOR THE PROGRAMME:

The eligibility criteria for admission for the MCA programme shall be as decided by the Competent Authority (Director, Technical Education-Government of Maharashtra, &/ or AICTE, New Delhi) from time to time.

7. . Subject to their compliance with the provisions of this Direction and other Ordinances in force from time to time, presently the following person shall be eligible for admission to MCA.

a) The candidate should have passed Bachelor Degree in Computer Applications or Science (Information Technology or Computer Science) with Mathematics at l0+2 Level or at Graduation Level / Bachelor Degree in Computer Science Engineering or equivalent degree with at least 50% marks in aggregate or equivalent (at least 45% in case of candidates of backward class categories and Persons with Disability belonging to Maharashtra State only)

OR

The candidate should have Passed B.Sc./ B.Com./ B.A. with Mathematics at l0+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the University) with at least 50% marks in aggregate or equivalent (at least 45% in case of candidates of backward class categories and Persons with Disability belonging to Maharashtra State only)

AND

b) Has obtained non zero positive score in MAH-MCA-CET.

8. Bridge course is compulsory for all the students who are admitted to the MCA programme under criteria that candidate Passed B.Sc./ B.Com./ B.A. with Mathematics at l0+2 Level or at Graduation Level. Bridge Course will be conducted by college at the beginning of session for MCA I students in semester I. Only grade point will be given to this course. Examination to this course will be conducted by college and grade point will be given based on their performance and will be communicated to the university before the start of theory examination of MCA I (Sem I) .

9. The ATKT rules for admission for the MCA programme (Theory, Practical, Seminar and Project as separate passing head and on calculation, fraction, if any, shall be ignored) shall be as given in the following table.

Name of Semester **(1)**	**The candidates should have passed in all the subjects of the following examination of R.T.M. Nagpur University.** **(2)**	**Candidate should have passed at least two third of the passing heads of the following examinations** **(3)**
MCA Semester - I	The qualifying examination mentioned in para - 7 of the Direction.	----------
MCA Semester - II	----------	----------
MCA Semester - III	----------	Semesters -I & Semester-II taken together
MCA Semester –IV	----------	

10. Without prejudice to the other provisions of Ordinance No.6 relating to the Examinations in General, the provisions of Paragraphs 5,7,8,10,26 and 31 of the said ordinance shall apply to every collegiate candidate.

11. For purpose of instructions and examinations the student shall study sequentially.

12. The period of academic session/ term shall be such as may be notified by the University.

13. The Examination shall be held at such places and on such dates as may be notified by the University.

14. The fees for the examination and other fees shall be as prescribed by the University from time to time.

15. The paper and practical in which an examinee is to be examined the maximum marks for these and the minimum pass marks which an examinee must obtain in order to pass in the subjects and the examination shall be as per Appendix-A.

16. (i) The scope of the subject is as indicated in the syllabus.

(ii) The medium of instruction and examination shall be English.

17. The examinee at each of the examination shall have option of not being declared successful at the examination in case he / she does not secure a minimum of grade equivalent to 55% marks at the examination. This option will have to be exercised every time the application is submitted to any of the examinations. Once this option is exercised, the option shall be binding on the examinee and it cannot be revoked under any circumstances.

18. The classification of the examinees successful at the end semester examinations and at the end of final semester examination shall be as per the rules and regulations of Choice Based Credit System as prescribed in appendices, appended with this direction.

19. Any candidate who has obtained less than 55% of marks at the MCA examination of this University shall be eligible to take the examination again under this Direction in the same subject or group of subjects as the case may be for improvement of the percentage. In such cases, the provision of Ordinance No. 4 of 1996, as amended from time to time, relating to the improvement of Division shall apply.

20. The provisions of Direction no. 3 of 2007 (with all its modifications and replacement) for the award of grace marks for passing an examination, securing higher grade in subject(s) shall apply to the examination under this Direction.

21. An examinee who does not pass or who fails to present himself/ herself for examination shall be eligible for readmission to the same examination, on payment of fresh fees and such other fees as may be prescribed by the University.

22. The names of the successful examinee passing the examination as a whole in the minimum prescribed period and securing the grades equivalent to first and second division shall be arranged in order of merit as provided in ordinance 6 relating to examination in general.

23. No candidate shall be admitted to an examination under this Direction, if he / she has already passed the same examination of this University or of any other University.

24. Successful examinees at the M. C. A. Semesters I, II, III & IV Examinations shall be entitled to receive a Certificate (mark sheet) signed by the Director, Board of Examination & Evaluation of University and successful examinees at the end of M. C. A. Semester IV examination shall, on payment of prescribed fees, receive a Degree in the prescribed format, signed by the Vice-Chancellor.

25. This programme is based on Choice Based Credit System and therefore, it will be also regulated by guidelines and regulation given in appendices which are part of this Direction.

26. Absorption scheme for failure students:

a) While switching over to Choice Based Credit System, the failure students will be given **Five** chances to clear the examination.

b) The candidates who have cleared first and second semester of MCA Part I of Semester Pattern examination shall get admission to First Semester of MCA Part I of the Choice Based Credit System directly.

c) The candidates who have cleared Third and Fourth semester of MCA Part II of the Semester Pattern examination shall get admission to Third Semester of MCA Part II of the Choice Based Credit System directly. However, candidates who are allowed to keep term will not be eligible for admission to Third Semester of MCA Part II of the Choice Based Credit System unless they clear all the papers and practicals of Third and Fourth semester of MCA Part II of the Semester Pattern examination.

27. Ordinance No.16 of 2009 stands repealed from the date of issuance of this Ordinance.

28. All the actions pertaining to admission of the students prior to the date of issuance of this Direction shall be deemed to have been done in pursuance of the provisions of this Direction and the onward journey of the students admitted to the programme governed by this Direction shall be as per the provisions of this Direction.

29. Any doubt or question arising out of interpretation/implementation of the provisions of this Direction shall be referred to the decision of the Hon'ble Vice-Chancellor whose decision in the matter shall be final and binding on all the concerned parties.

NAGPUR
DATED: 17-12- 2020.

(Dr. Subhash R. Chaudhari)
VICE-CHANCELLOR

Appendix-A

Scheme of teaching and examination under Semester Pattern Choice Based Credit System (CBCS) for M.C.A. (Master in Computer Application) (2 Years)

First Year M.C.A. Semester I(Master in Computer Application) (CBCS)												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
Paper 1 Core	1T1 Advanced Java Programming	4	-	4	4	3	80	20	100	40	-	
Paper 2 Core	1T2 Data Communication and Network	4	-	4	4	3	80	20	100	40	-	
Paper 3 Core	1T3 Open source Web Programming using PHP	4	-	4	4	3	80	20	100	40	-	
Paper 4 Core	1T4 Advanced DBMS and Administration	4	-	4	4	3	80	20	100	40	-	
Paper 5 Core	1T5 Software Engineering	4	-	4	4	3	80	20	100	40	-	
Practical 1	1P1 based on 1T1, 1T2 and 1T3	-	7	7	4	3	100	-	100	-	40	
Practical 2	1P2 based on 1T4 and 1T5	-	7	7	4	3	100	-	100	-	40	
	TOTAL	**20**	**14**	**34**	**28**		**600**	**100**	**700**	**350**		

First Year M.C.A. Semester II (Master in Computer Application) (CBCS)												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract	
Paper 1 Core	2T1 C# and ASP .NET	4	-	4	4	3	80	20	100	40	-	
Paper 2 Core	2T2 Cloud Computing	4	-	4	4	3	80	20	100	40	-	
Paper 3 Core	2T3 Computer Graphics	4	-	4	4	3	80	20	100	40	-	
Paper 4 Core Elective 1	2T4 CE1-1 Computer Architecture and OrganizationCE1-2 Operation Research CE1-3 Cyber Forensics	4	-	4	4	3	80	20	100	40	-	
Paper 5 Core	2T5 Android Programming	4	-	4	4	3	80	20	100	40	-	
Practical 1	2P1 based on 2T1, 2T2 and 2T3	-	6	6	4	3	100	-	100	-	40	
Practical 2	2P2 based on 2T4 and 2T5	-	6	6	4	3	100	-	100	-	40	
Project	Project	-	3	3	4	30 minutes	100	-	100	-	40	
	TOTAL	**20**	**15**	**35**	**32**		**700**	**100**	**800**	**400**		

Second Year M.C.A. Semester III(Master in Computer Application) (CBCS)											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Paper 1 Core	3T1 Big Data Analytics	4	-	4	4	3	80	20	100	40	-
Paper 2 Core	3T2 Data Mining	4	-	4	4	3	80	20	100	40	-
Paper 3 Core	3T3 Python Programming	4	-	4	4	3	80	20	100	40	-
Paper 4 Core Elective 2	3T4 CE2-1 Artificial Intelligence CE2-2 Mobile Computing CE2-3 Machine Learning	4	-	4	4	3	80	20	100	40	-
Paper 5 Core	3T5 Soft Computing	4	-	4	4	3	80	20	100	40	-
Practical 1	3P1 based on 3T1, 3T2 and 3T3	-	7	7	4	3	100	-	100	-	40
Practical 2	3P2 based on 3T4 and 3T5	-	7	7	4	3	100	-	100	-	40
	TOTAL	**20**	**14**	**34**	**28**		**600**	**100**	**700**	**350**	

Second Year M.C.A. Semester IV(Master in Computer Application) (CBCS)												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Marks		Th	Pract	
Project Work - Full Time	Project Work - Full Time	-	-	-	24	3	300	300	600	-	240	
Seminar	Seminar	-	-	-	08	30 minutes	100	100	200	-	80	
	TOTAL	**-**	**-**	**-**	**32**		**400**	**400**	**800**	**-**	**320**	

Note: Th = Theory; Pr = Practical/lab,
The Practical and Project shall be evaluated by both External and Internal Examiner in the respective Department / Center / Affiliated College as per guidelines appended with this direction.

1. Core Elective Papers

Semester II -Elective 1

- Computer Architecture and Organization
- Operation Research
- Cyber Forensics

Semester III - Elective 2

- Artificial Intelligence
- Mobile Computing
- Machine Learning

2. Project Work

Every student is required to carry out a full time project work in semester IV.

3. **Seminar**

In MCA semester IV, the student will have to deliver a seminar on any topic relevant to the syllabus / subject encompassing the recent trends and development in Computer Science/ application. The topic of the seminar will be decided at the beginning of the semester in consultation with the supervising teachers. The student has to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees, and students. The students should submit the seminar report typed and properly bound in two copies to the head of the department. The said shall be evaluated by the concerned supervisor / head of the department. The marks of the seminar shall be forwarded to the university within due period through head of the Department. The record of the seminar should be preserved till the declaration of the final result.

4. Internal Assessment:

i) The internal assessment marks shall be awarded by the concerned teacher.

ii) The internal assessment shall be completed by the College / University at least 15 days prior to thefinal examination of each semester. The Marks shall be sent to the University immediately after theAssessment in the prescribed format.

iii) For the purpose of internal assessment the University Department / College shall conduct one tothree assignments described below. Best two scores of a student in these tests shall be considered toobtain the internal assessment score of that student.

iv) General guidelines for Internal Assessment are:

a) The internal assessment marks assigned to each theory paper shallbe awarded on the basis of assignments like class test, attendance, home assignments, studytour, industrial visits, visit to educational institutions and research organizations, field work,group discussions or any other innovative practice / activity.

b) There shall be one to three assignments (as described above) per Theory paper.

c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shallconduct the Internal assessment activity during the regular teaching days / periods as a part ofregular teaching activity.

d) The concerned teacher / department / college shall have to keep the record of all the aboveactivities until six months after the declaration of the results of that semester.

e) At the beginning of each semester, every teacher / department / college shall inform his / herstudents unambiguously the method he / she propose to adopt and the scheme of marking forinternal assessment.

f) Teacher shall announce the schedule of activity for internal assessment in advance inconsultation with HOD / Principal.

g) Final submission of internal marks to the University shall be before the commencement of theUniversity Theory / Practical examinations whichever is later.

5 Practical Examination

i) Each practical carries 100 marks. For the examination, the distribution of the marks shall be as follows:

a. Record / Journal / Internal assessment : 20 marks – Evaluated by Internal Examiner
b. Practical Performance&Viva-voce:80 marks – Evaluated jointly by External& Internal Examiner.

Note: Practical performance shall be jointly evaluated by the External and InternalExaminer.In case of discrepancy, the External Examiner's decision shall be final.

ii) Practical examination shall be of 3 hours duration.

iii) The Practical Record of every student shall carry a certificate as shown below, duly signed by theteacher-in-charge and the Head of the Department.

iv) If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the PracticalExamination and no Marks shall be allotted to the student.

v) The certificate template shall be as follows:

CERTIFICATE

Name of the college / institution _____

Name of the Department: _____

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri /Shrimati / Kumari _____ of M.C.A. _____ Semester _____ during the academic year _____. The candidate has satisfactorilycompleted the experiments prescribed by RashtrasantTukadojiMaharaj Nagpur University for thesubject _____

Dated ___/___/_____

Signature of the teacher who taught the examinee

1. _____

2. _____

Head of the Department

6. General Rules and Regulations regarding pattern of question paper, absorption scheme andchoice based credit system:

A) Pattern of Question Paper

1. There will be four units in each paper.
2. Maximum marks of each theory paper will be 80.

3. Question paper will consist of five questions, each of 16 marks.
4. Four questions will be on four units with internal choice (One question on each unit).
5. Fifth question will be compulsory with questions from each of the four units having equal weightage and there will be no internal choice

B) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

MCA Program shall consist of four semesters, wherein the student has to complete 120 credits. Eachsubject (or course) has fixed number of credits. The types of subject subheads are: Core , Core Elective,Practical, Seminar and Project.

Credits:

It is a unit by which the course work is measured. It determines the number of hours of instructionsrequired per week. One credit is approximately equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work per week.If a student is declared pass in a subject,then he/she gets the credits associated with that subject. Depending on the marks scored in a subject,student is given a Grade. Each grade has got certain grade points as follows:

Letter Grade	O	A+	A	B+	B	C	P	F	Ab
Grade Point	10	09	08	07	06	05	04	0	0

A student obtaining Grade F shall be considered failed and will be required to reappear for the examination.

Valuation pattern:

Every credit is for 25 marks and valuation and grade points will be given as per following pattern.

Marks obtained in Theory / Practical of 100 marks	Letter Grade	Grade point
91-100	O	10
81-90	A+	09
71-80	A	08
61-70	B+	07
51-60	B	06
41-50	C	05
= 40	P	04
<40	F	0
Ab	Ab	0

Computation of SGPA and CGPA

Following is the procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. 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, i.e

SGPA (S_i) = $\Sigma(C_i \times G_i) / \Sigma C_i$

where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

Illustration for SGPA

Semester I

Paper	Theory / Practical	Credits	Marks Obtained	Out of	Grade Point	Grade Letter	Credit Point (Credit x Grade Point)
1	Paper 1	4	91	100	10	O	4x10=40
2	Paper 2	4	89	100	9	A+	4x9=36
3	Paper 3	4	50	100	5	C	4x5=20
4	Paper 4	4	78	100	8	A	4x8=32
5	Paper 5	4	60	100	6	B	4x6=24
Practical	Practical 1	4	89	100	9	A+	4x9=36
Practical	Practical 2	4	85	100	9	A+	4x9=36
	Total	**28**					**224**
Thus, **SGPA =224/28 = 8.00**							

Semester II

Paper	Theory / Practical	Credits	Marks Obtained	Out of	Grade Point	Grade Letter	Credit Point (Credit x Grade Point)
1	Paper 1	4	91	100	10	O	4x10=40
2	Paper 2	4	89	100	9	A+	4x9=36
3	Paper 3	4	50	100	5	C	4x5=20
4	Paper 4	4	78	100	8	A	4x8=32
5	Paper 5	4	60	100	6	B	4x6=24
Practical	Practical 1	4	89	100	9	A+	4x9=36
Practical	Practical 2	4	85	100	9	A+	4x9=36
Project	Project	4	91	100	10	O	4x10=40
	Total	**32**					**264**
Thus, **SGPA =264/32 = 8.25**							

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

CGPA = $\Sigma (C_i \times S_i) / \Sigma C_i$

where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Illustration for CGPA

Semester I	**Semester II**	**Semester III**	**Semester IV**
Credit : 28 SGPA: 8.00	Credit : 32 SGPA: 8.25	Credit : 28 SGPA: 9.00	Credit : 32 SGPA: 8.25

Thus,

$$\textbf{CGPA} = \frac{28 \times 8.00 + 32 \times 8.25 + 28 \times 9.00 + 32 \times 8.25}{120}$$

$$= \frac{224 + 264 + 252 + 264}{120} = 1004/120 = \textbf{8.3666 i.e. 8.36}$$

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. Ex. 7.0765 = 7.08 or 6.5168 = 6.52 etc.

Transcript (Format): Based on the above recommendations on Letter grades, grade points and SGPA and CCPA, the HEIs may issue the transcript for each semester and a consolidated transcript indicating the performance in four semesters.

ANNEXURE M. C.A.

Equivalence of Syllabus / papers between Semester pattern & CBCS syllabus for desirous students

M.C.A. Semester Pattern : Semester-III						M.C.A. (CBCS) Pattern : Semester-I					
S.No.	Code No.	Paper	Name of Paper	Total Marks		Sem	Code No.	Paper	Name of Paper	Total Marks	Credits
01	3CSA-1	Paper1	E-Commerce	100		I	1T3	Paper3	Open Source Web Programming using PHP	80+20	4
02	3CSA-2	Paper2	Data Communication & Network	100		I	1T2	Paper2	Data Communication and Net work	80+20	4
03	3CSA-3	Paper3	Design & Analysis of algorithm	100	Equivalence To	I	1T1	Paper1	Advanced Java Programming	80+20	4
04	3CSA-4	Paper4	Operation Research	100		II	2T4 CE1-2	Paper4	Operation Research	80+20	4
05	3CSA-5	Paper5	Database Administration	100		I	1T4 CE1-1	Paper4	Advanced DBMS and Administration	80+20	4
06	3CSA6	Practical-I	(Based on Oracle)	100		I	1P1	Practical -I	Based on 1T1, 1T2 and 1T3	100	4
07	3CSA7	Practical-II	(Based on Operation Research using C++)	100		I	1P2	Practical -II	Based on 1T4 and 2T4	100	4
M.C.A. Semester Pattern : Semester-IV						M.C.A. (CBCS) Pattern : Semester-II					
01	4CSA-1	Paper1	Computer Hardware Interfacing	100		II	2T5	Paper5	Android Programming	80+20	4
02	4CSA-2	Paper2	Distributed Database Management System	100		II	2T2	Paper2	Cloud Computing	80+20	4
03	4CSA-3	Paper3	Computer Graphics	100		II	2T3	Paper3	Computer Graphics	80+20	4
04	4CSA-4	Paper4	Distributed Operating System	100		II	2T4	Paper4	Cyber Forensics	80+20	4
05	4CSA-5	Paper5	C# & Dot Net	100		II	2T1	Paper1	C# & ASP.Net	80+20	4
06	4CSA6	Practical-I	(Based on C# & Dot Net)	100		II	2P1	Practical -I	Based on 2T5, 2T2 and 2T3	100	4
07	4CSA7	Practical-II	(Based on Computer Graphics C++)	100		II	2P2	Practical -II	Based on 2T4 and 2T1	100	4
08	4CSA8	Project	(Using C++, C# or Java & Application area related to one of the subject studies till now)	100		II	Project	Project		100	4

If the candidate has failed in any of the papers mentioned below							Then, the candidate shall appear and clear the paper shown in the respective row as equivalent paper					
M.C.A. Semester Pattern : Semester-V							M.C.A. (CBCS) Pattern : Semester-III					
S.No.	Code No.	Paper	Name of Paper		Total Marks	Equivalence To	Sem	Code No.	Paper	Name of Paper	Total Marks	Credits
01	5CSA-1	Paper1	Data Warehousing and Data Mining		100		III	3T2	Paper2	Data Mining	80+20	4
02	5CSA-2	Paper2	Embedded System		100		III	3T3	Paper3	Python Programming	80+20	4
03	5CSA-3	Paper3	Network Security		100		III	3T1	Paper1	Big Data Analytics	80+20	4
04	5CSA-4	Paper4	Elective-I	(a) Legal Aspects of IT (b) Software Engineering	100		III	3T4 CE2-1	Paper4	Artificial Intelligence	80+20	4
05	5CSA-5	Paper5	Elective-II	(a) VB.NET (b) ASP.NET	100		III	3T5	Paper5	Soft Computing	80+20	4
06	5CSA6	Practical-I	(Based on Embedded Systems, Network Security & Data Warehousing & Data Mining)		100		III	3P1	Practical-I	Based on 3T2, 3T3 and 3T1	100	4
07	5CSA7	Practical-II	(Based on Elective-I or Elective-II)		100		III	3P2	Practical-II	Based on 3T4 and 3T5	100	4
M.C.A. Semester Pattern : Semester-VI							M.C.A. (CBCS) Pattern : Semester-IV					
01	6CSA-1	Project	Project Work - Full Time Project Seminar		450 250		IV	Project	Project	Project Work - Full Time	600	24
02	6 CSA-2	Seminar	Project Seminar		100		IV	Seminar	Seminar	Seminar	200	8

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY,NAGPUR

MCA (2 Years) Syllabus and Scheme

2020-2021 & Onwards

Choice Based Credit System (CBCS) (Semester Pattern)

Faculty of Science and Technology
Rashtrasant Tukdoji Maharaj Nagpur University,Nagpur

Appendix-A

Scheme of teaching and examination under Semester Pattern Choice Based Credit System (CBCS) for M.C.A. (Master in Computer Application) (2 Years)

First Year M.C.A. Semester I(Master in Computer Application) (CBCS)											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Paper 1 Core	1T1 Advanced Java Programming	4	-	4	4	3	80	20	100	40	-
Paper 2 Core	1T2 Data Communication and Network	4	-	4	4	3	80	20	100	40	-
Paper 3 Core	1T3 Open source Web Programming using PHP	4	-	4	4	3	80	20	100	40	-
Paper 4 Core	1T4 Advanced DBMS and Administration	4	-	4	4	3	80	20	100	40	-
Paper 5 Core	1T5 Software Engineering	4	-	4	4	3	80	20	100	40	-
Practical 1	1P1 based on 1T1, 1T2 and 1T3	-	7	7	4	3	100	-	100	-	40
Practical 2	1P2 based on 1T4 and 1T5	-	7	7	4	3	100	-	100	-	40
	TOTAL	**20**	**14**	**34**	**28**		**600**	**100**	**700**	**350**	

First Year M.C.A. Semester II (Master in Computer Application) (CBCS)											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Paper 1 Core	2T1 C# and ASP .NET	4	-	4	4	3	80	20	100	40	-
Paper 2 Core	2T2 Cloud Computing	4	-	4	4	3	80	20	100	40	-
Paper 3 Core	2T3 Computer Graphics	4	-	4	4	3	80	20	100	40	-
Paper 4 Core Elective 1	2T4 CE1-1 Computer Architecture and OrganizationCE1-2 Operation Research CE1-3 Cyber Forensics	4	-	4	4	3	80	20	100	40	-
Paper 5 Core	2T5 Android Programming	4	-	4	4	3	80	20	100	40	-
Practical 1	2P1 based on 2T1, 2T2 and 2T3	-	6	6	4	3	100	-	100	-	40
Practical 2	2P2 based on 2T4 and 2T5	-	6	6	4	3	100	-	100	-	40
Project	Project	-	3	3	4	30 minutes	100	-	100	-	40
	TOTAL	**20**	**15**	**35**	**32**		**700**	**100**	**800**	**400**	

Second Year M.C.A. Semester III(Master in Computer Application) (CBCS)											
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme					
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Pract	Total			External Marks	Internal Ass		Th	Pract
Paper 1 Core	3T1 Big Data Analytics	4	-	4	4	3	80	20	100	40	-
Paper 2 Core	3T2 Data Mining	4	-	4	4	3	80	20	100	40	-
Paper 3 Core	3T3 Python Programming	4	-	4	4	3	80	20	100	40	-
Paper 4 Core Elective 2	3T4 CE2-1 Artificial Intelligence CE2-2 Mobile Computing CE2-3 Machine Learning	4	-	4	4	3	80	20	100	40	-
Paper 5 Core	3T5 Soft Computing	4	-	4	4	3	80	20	100	40	-
Practical 1	3P1 based on 3T1, 3T2 and 3T3	-	7	7	4	3	100	-	100	-	40
Practical 2	3P2 based on 3T4 and 3T5	-	7	7	4	3	100	-	100	-	40
	TOTAL	**20**	**14**	**34**	**28**		**600**	**100**	**700**	**350**	

Second Year M.C.A. Semester IV(Master in Computer Application) (CBCS)												
Code	Theory / Practical	Teaching scheme (Hours / Week)			Credits	Examination Scheme						
						Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks		
		Th	Pract	Total			External Marks	Internal Marks		Th	Pract	
Project Work - Full Time	Project Work - Full Time	-	-	-	24	3	300	300	600	-	240	
Seminar	Seminar	-	-	-	08	30 minutes	100	100	200	-	80	
	TOTAL	**-**	**-**	**-**	**32**		**400**	**400**	**800**	**-**	**320**	

Note: Th = Theory; Pr = Practical/lab,

The Practical and Project shall be evaluated by both External and Internal Examiner in the respective Department / Center / Affiliated College as per guidelines appended with this direction.

First Year M.C.A. Semester I(CBCS)

Paper 1 - 1T1 Credits: 4

Advanced Java Programming

Unit 1 :

Java and Internet, Features of java: security, portability, multithreading, etc, Bytecode, Datatypes, variables and Arrays, Operators, Classes : declaring objects, methods, constructor, overloading constructor, garbage collection, finalize() method, static variable and method, final variable, command line argument. Inheritance: super keyword, final with inheritance. Packages and Interfaces,Wrapper classes, Exception handling : Overview, types, Uncaught exception, try - catch block, multiple catch, nested try, throw, throws, finally, bulit-in and user- defined exception.

Multithreading : Life Cycle, Thread class and Runnable Interface, isAlive(), join(),Priorites, Synchronization : sleep() , run(). Interthreadcommunication : wait(), notify(), notifyAll(), deadlock. String Handling.

Unit 2:

Applet: Applet Class, Architecture, Life Cycle, Display methods, HTML APPLET Tag, Passing parameter to Applet

AWT : working with Windows, Controls, Layout Manager, Menus. Swings. Event handling.

Unit 3:

JDBC : Architecture, JDBC-ODBC bridge driver, SQL Package, ResultSet and its methods.

Networking : Socket, Reserve socket, Internet Addressing, InetAddress, TCP/IP client socket, TCP/IP server socket, URL, URL Connection, Datagram.

RMI : Introduction, Architecture, Remote Interface, java.rmi. server package, class naming, creating Rmi server and client ,transmitting files using rmi, client side callback, RMISECURITYMANAGER class, RMI Exception, Stub and Skeleton.

Unit 4:

Servlet : Life Cycle, Tomcat, javax. servlet package, reading servlet parameter, javax.servlet.http package, handling http request and response with HTTPGET and HTTPPOST, cookies,session tracking. JSP : Introduction, Types of JSP tags, Application using JSP and Servlet.

JavaBeans : Advantages of Beans, BDK, JAR files, Introspection, Developing Beans using BDK.

Books:

1. Complete Reference ,HerbertSchildt,TMH
2. Programming with Java , C Muthu ,McGraw Hill
3. Black Book on java

First Year M.C.A. Semester I (CBCS)

Paper 1 - 1T2 Credits: 4

Data Communication andNetwork

Unit 1 :

Introduction: Network structure and architectures and services OSI reference model.

The Physical Layer: theoretical basis for data communication, transmission media. Analog Transmission, Digital Transmission, Transmission and Switching, ISDN.

The Data Link Layer: Design issues, Error detection and correction, Elementary data link protocols, sliding window protocol, protocols performance, protocols specification and verification. Examples of the Data link layer.

Network Layer: Design issues, routing algorithms, Congestion control algorithms, Internet working, Examples of the network layer.

Unit 2 :

The Transport Layer: Design issues, Connection Management.

The session layer: Design issues and remote procedure call.

The Presentation Layer: Design issues, data compression techniques, cryptography.

The Application Layer: Design issues, file transfer, access and management, virtual terminals.

Unit 3 :

Network Security Fundamentals: Introduction, security Vulnerabilities and Threats, Classification of Security Services. Cryptography: Encryption principles, Conventional Encryption DES, IDEA, Algorithms, CBC, Location of Encryption Devices key Distribution.

Unit 4 :

Message Digests and Checksums, Message Authentication, Message Digests, Hash Functions and SHA, CRCs. Public key Systems: RSA Diffie-Heliman, DSS, Key Management.

Intruders: Intrusion Techniques, Intrusion Detection, Authentication, Password- Based Authentication, Address- Based Authentication, Certificates, Authentication Services, Email Security, Firewalls, Design Principles, Packet Filtering, Access Control, Trusted Systems, Monitoring and Management.

Books :

1. Computer Networks , Andrew S Tanenbum,PHI
2. Network Security and Essentials: Application and standers ,Willam Stalling, Pearson
3. Cryptography and network security ,Willam Stalling , Pearson Education.
4. Data Communication and Networking, Behrouz A. Forouzan, TMH.

First Year M.C.A. Semester I (CBCS)

Core

Paper 3 - 1T3 **Credits: 4**

Open Source Web Programming using PHP

Unit 1 :

Introduction:ABriefHistoryofPHP,InstallingPHP,PHP LanguageBasics:LexicalStructure,DataTypes,Variables,ExpressionsandOperators Flow-Control Statements IncludingCode,EmbeddingPHPinWebPages,InstallingandConfiguringPHPonWindows andLinuxPlatforms

Unit 2:

Functions:CallingaFunction,DefiningaFunction,VariableScope,FunctionParameters, Return Values,VariableFunctions,AnonymousFunctions,Strings:QuotingStringConstants,PrintingStrings ,AccessingIndividualCharacters,CleaningStrings,EncodingandEscaping,ComparingStrings,Mani pulating and, SearchingStrings RegularExpressions, POSIX-StyleRegularExpressions, Perl-Compatible Regular Expressions, Arrays: IndexedVersusAssociativeArrays, Identifying Elements of an Array, Storing Data inArrays,Multidimensional Arrays,ExtractingMultipleValues,ConvertingBetweenArraysand variables,TraversingArrays,Sorting,ActingonEntireArrays,UsingArrays

Unit 3 :

ClassesandObjects: Terminology, CreatinganObject,AccessingPropertiesandMethods,Declaring a Class,Introspection, Serialization,WebTechniques:HTTPBasics,Variables,ServerVariables,Server Information,ProcessingForms,Setting ResponseHeaders,Session,cookies,files,MaintainingState,SSL, UsingPHPtoAccessaDatabase: Relational Databases andSQL,Mysqldatabase Basics,Advanced DatabaseTechniques

Unit 4 :

Graphics: Embedding anImageinaPage,TheGDExtension,BasicGraphics concepts,Creatingand DrawingImages,ImageswithText,DynamicallyGeneratedButtons,ScalingImages,ColorHandling, **PDF:**PDFExtensions,DocumentsandPages,Text,ImagesandGraphics,Navigation,OtherPDFFeatu res, **XML:** LightningGuideto XML, GeneratingXML, ParsingXML, TransformingXML withSLT,Web Services,**Security:** Global Variables and Form Data, Filenames, File Uploads, File Permissions, ConcealingPHPLibraries,PHPCode,ShellCommands, SecurityRedux,ApplicationTechniques, Code Libraries,TinplatingSystems,HandlingOutput,ErrorHandling,PerformanceTuning.

Books :

1. PHP5.1forbeginners,EvanBayrossandSharmanShah,SPDPublications

2. ProgrammingPHP,RasmusLerdorfandKevinTatroe,OrillyPublications

First Year M.C.A. Semester I (CBCS)

Core

Paper 4 - 1T4 **Credits: 4**

Advanced DBMS and Administration

Unit 1 :

Relational Database design: Functional dependencies, and Normalization Normal forms based on primary keys (1 NF, 2 NF, 3 NF, BCNF, 4 NF, 5 NF) Loss less joins and dependency preserving decomposition Query Processing: Query Processing Stages, Query Interpretation, Equivalence of Expressions, Query Resource Utilization, Query Execution Plan, Estimation of Query Processing Cost, Multiple Index Access, Methods for Joining Tables (Nested Loop,Multiple Join) Structure of a Query Optimizer

Unit 2 :

Transaction Processing & Concurrency Control: Concept and definition of transaction, ACID properties, serializibility, Prioritization, states of transaction, Types of failure, desirable properties of transaction schedules and recoverability, serial usability of schedules, levels of transaction consistency, deadlocks, long duration transactions, transaction performance, transaction processing as implemented in contemporary database, management system. Concurrency Control, locking techniques, techniques based on time-stamp ordering, multiple granularity. Crash Recovery**:** failure classification, recovery concepts, database backup, recovery concepts based on deferred update and on immediate update. Shadow paging, check points, crash recovery techniques. Client/Server database:Evolution of client concept, Client/Server environment, characterization of Client/Server computing. Functions of clients server , application partitioning, the two-layer and three-layer architectures, communication between clients and servers.

Unit 3 :

Oracle Database Architecture and Administration: Oracle database architecture, Design, Creation, Management of Oracle Databases and related database schemes, Data Dictionary views and standard package Maintaining the control, Redo Log files, Managing Tablespaces and Data Files, Storage structure and relationships, Managing rollback segment, Indexes, Managing data Integrity, Managing password security and resources, Managing users, Privileges, roles. Oracle Backup and Recovery Strategies: Backup and recovery considerations, Oracle recovery structure and processes, Oracle backup and recovery configuration, Physical backup, Complete recovery of an Oracle database, Oracle Export / Import utilities, Oracle standby database.

Unit 4 :

Oracle Tuning and Troubleshooting:Oracle performance tuning methodology,'Oracle alert and trace files, Tuning the shared pool, Buffer Cache, Redo Log buffer, Database configuration and I/O issues, Using Oracle Blocks efficiently, Optimizing sort operations,Rollback segment tuning, Monitoring and detecting lock contention, SQL issues and tuning considerations for different

application. Integrity, Security:Need for Database Integrity, Integrity Constraints, Introduction to Database,Security issues.

Books :

1. Fundamental of Database Systems , R. ElmasriS. Navathe Benjamin Cummings
2. Database system concept ,Korth
3.Oracle 9i Performance Tuning, Joseph C. Johnson
4. DBA Handbook oracle press ,Loney

First Year M.C.A. Semester I (CBCS)

Core

Paper 5 - 1T5 **Credits: 4**

Software Engineering

Unit 1 :

Introduction to Software Engineering : The evolving role of software, Changing Nature of Software, Software myths.

A Generic view of process : Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Process models : The waterfall model, Incremental process models, Evolutionary process models, The Unified process. Requirement Engineering **:**Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

Unit 2 :

Requirements engineering process : Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models : Context Models, Behavioral models, Data models, Object models, structured methods. Modeling with UML .

Design Engineering : Design process and Design quality, Design concepts, the design model.

Creating an architectural design : Software architecture, Data design, Architectural styles and patterns, Architectural Design.

Unit 3 :

Object-Oriented Design : Objects and object classes, An Object-Oriented design process, Design evolution. Performing User interface design : Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Testing Strategies : A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging. Product metrics **:**Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

Unit 4 :

Metrics for Process and Projects **:**Software Measurement, Metrics for software quality.

Risk management **:**Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management : Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

Books :

1.Software Engineering, A practitioner's Approach, Roger S. Pressman, McGrawHill International Edition.
2. Software Engineering,Sommerville, Pearson education.
3. Software Engineering principles and practice,Waman S Jawadekar, McGraw-Hill.

First Year M.C.A. Semester II (CBCS)

Core

Paper 1 - 2T1 **Credits: 4**

C# and ASP .NET

Unit 1:

Introduction to .NET,the origins of .NET, .NET framework overviews (a common substratefor all development,keydesign goals, Mega Data, Multiple language integration andsupport, Name spaces), .NET framework Base classes, User and programinterfaces(userInterface, Windows Forms, Web Forms, Console application), Programinterface,WebServices

Introduction to Common Language Runtime (CLR) Requirement of .NET application (Assembly, Module, Type), common type systems (Custom types, Boxing & Unboxing value types), Metadata (Attributes, Custom Attributes), Managed Data (Managed Heap, Garbage collector), Garbage collector, optimization, pinning objects.

Unit 2:

Introduction to C Sharp, Value type, Default Constructor, Struct type, Enumeration type, Reference type, Class Type, Object Type, String Type, Interface type, Array type, Delegate type, Predefined types, Concept of Boxing & Unboxing, Array types, Variables & Parameters, Operands, Statements. Expression, operators,C Sharp Objects, Classes and Methods, Inheritance, Garbage collector,Class library and Name Space, Method overloading, statements and control.Struct types, Struct declaration, Struct modifier, Struct Interface, Enums, Enumerator Base type, Enum modifiers, Enum Members, Enum values and operations, String operations, converting objects to string, String builder, File and folder operations, reading and writing text files, reading and writing binary files,

Unit 3:

Introduction to ASP .NET - About ASP .NET, Basic difference between C# and VB .NET,

Understanding Namespaces and Assemblies - Importing Namespaces, Assemblies.

Web Server and user - Installing US. US Manager - Creating a virtual Director, Virtual Directories andApplications, Folder Settings, Adding virtual directory to your Neighborhood.

Installing ASP .NET. ASP.NET Applications - ASP .NET file Types, The bin directory, Code-Behind, The Global.asax Code-Behind,Understanding ASP. Net Classes, ASP .NET

Configuration, **Web Form Fundamentals -** A Simple Applets, Improving the Currency Converter, HTML Control classes,Page Class, Assessing HTML Server Controls. **Web Controls -** Basic Web Control classes, Auto PostBack and Web Control Events, A Web page Applets. **Validation and Rich Controls.**

UNIT 4:

State Management Tracing, Logging and Error Handling -Common errors, .NET Exception Object, Handling Exceptions,Throwing your own Exceptions, Logging Exceptions, Error pages, Page tracing.**Advanced ASP. NET -Component-Based Programming -** Components Jargon, Creating Simple Component, Properties andState, Database Components, Using COM Components. Custom Controls-User Controls, Deriving Custom controls. **Cashing and Performance tuning -** Designing fro scalability, Profiling, Caching, output Caching, Data caching. Implementing Security-Determining Security Requirements, The ASP .NET Security Model, Forms Authentication, Windows Authentication, Impersonation.

Books:

1. C#(CSharp) Programming, V. K. Jain, Dreamtech Press, New Delhi.
2. Programming in C# ,Balguruswamy, Tata McGraw Hill.
3. Introduction to DOT NET (.NET), JamesConardet. Al., Shroff Publisher
4. Introducing Microsoft Dot Net , David Platt, PHI Publication.
5. C # (C Sharp) Complete Reference ,Schildt, Tata McGraw Hill

6.The Complete Reference-ASP .NET , Matthew MacDonald,Tata McGraw- Hill.

7. ASP .NET 4.5(Covers C# and VB codes),Black Book, dreamtech Publication

First Year M.C.A. Semester II (CBCS)

Core

Paper 2 - 2T2 **Credits: 4**

Cloud Computing

Unit 1 :

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Unit 2 :

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security

Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core OpenStack Ecosystem.Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, Customer Relationship Management).

Unit 3 :

Basic Terms and Concepts, Threat Agents, Cloud Security Threats and Attacks, Additional Considerations.Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images.

Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability.Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

Unit 4 :

Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Books:

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition.
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation,
Pearson, ISBN :9788131776513.
4. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
5. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security,
and More, Jones and Bartlett, ISBN :9789380853772.
6. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.

First Year M.C.A. Semester II (CBCS)

Core

Paper 3- 2T3 **Credits: 4**

Computer Graphics

Unit 1 :

Introduction of computer Graphics and its applications, Overview of Graphics systems, Video display devices, Raster scan display, Raster scan systems, video controller, Raster scan display processor, Random scan display, random scan systems, color CRT monitor, Flat panel display, Interactive input devices, Logical classification of input devices, Keyboard, mouse, Trackball and spaceball, Joysticks, Image scanner, Light pens, Graphics software, Coordinates representations, Graphics functions.

Unit 2 :

Line drawing algorithms, DDA, Bresenham's, Circle generating, Mid-point circle algorithm, Ellipse generating, Polygon , Scan-line polygon fill, Boundary fill.

Unit 3 :

Basic transformation's, Translation, Rotation, Scaling, Matrix representation's & homogeneous co-ordinates, Composite transformation's, Reflection, Two dimensional viewing, Two dimensional clipping, Line, Polygon, Curve, Text. 3D-transformation, Projection, Viewing, Clipping.
Spline representation, Cubic spline, Bezier curve, Bezier surfaces, Beta spline, B-spline surfaces, B-spline curve, Hidden surfaces, Hidden lines, Z-buffer.

Unit 4 :

Fractal's geometry Fractal generation procedure, Classification of Fractal, Fractal dimension, Fractal construction methods. Color models, XYZ, RGB, YIQ, CMY & HSV, Shading algorithms, Shading model, Illumination model, Gouraud shading, Phong shading**.**

Books :

1. Computer Graphics ,M. Pauline Baker, Donald Hearn, PHI.
2. Mathematical Element for Computer Graphics , David F. Roger, J. Alan Adams, Tata McGHill.
3.Computer Graphics ,Apurva Desai , PHI

First Year M.C.A. Semester II (CBCS)
Core Elective 1(CE1-1)
Paper 4 - 2T4 **Credits: 4**

Computer Architecture and Organization

Unit 1:
Organization of the CPU and main memory of the IAS computer, Structure of the IBM System/360.
Design Methodology: Design Process: Design problem, Computer aided design, Design levels, system hierarchy, **The Gate Level Design:** Four bit ripple carry adder, Four bit stream serial adder.
The Register Level Design: Data and Control, Design of a pipelined 4 bit stream serial adder, Design of a fixed point binary multiplier.
The Processor Level Design: Prototype structures, Performance measurement, Queueing models.

Unit 2:
Datapath Design: n-bit ripple carry adder, n-bit twos complement adder-subtracter, carry-lookahead adder, Booths multiplication algorithm, n-bit arithmetic logic unit.
Control Design: Processor configured to implement add operation, Implementation methods, Hardwired Control: Design methods, State tables, GCD processor, Classical method, One hot method, Microprogrammed control unit, Pipeline Control: m-stage, two-stage, four-stage, Superscalar processing.

Unit 3:
Memory Organization: Memory types, Performance and cost, Access modes, Memory retention, RAM organization, RAM design and examples, Optical memories, Multilevel memories, Locality of reference, Address translation, Translation look-aside buffer, Segments, Pages, Page size, **Cache Memory:** Features, Organization, Operation, Address mapping, Cache types.

Unit 4:
System Organization: Buses, Long distance communication, Computer networks, Interconnection structures, Bus control, Basic features, Bus interfacing, Timing, Bus arbitration, PCI Bus, signal of the PCI standard bus. **IO and System Control:** IO Control methods,

Programmed IO, Direct Memory Access, Interrupts: Selection, Vectored interrupts, PCI Interrupts, Pipeline interrupts. **IO Processor:** Instruction types, Organization, Cache coherence. **Fault Tolerance:** Redundancy, Redundant disk arrays, Reliability.

Book:

1. Computer Architecture and Organization , John P. Hayes, TMH
2. Structured Computer Organization ,Andrew S. Tanenbaum, PHI.

First Year M.C.A. Semester II (CBCS)
Core Elective 1(CE1-2)
Paper 4 - 2T4 **Credits: 4**
Operation Research

Unit 1:

Introduction to Operation Research (OR) - Origin and Development of OR, Nature ofOR, Characteristics of OR, Classification of Problems in OR, Models in OR, Phases of OR, uses and Limitations of OR, Methodologies in OR, Applications in OR. **Linear Programming -** Concept of Linear Programming Model, Mathematical Linear Programming, Formulation of the Simplex Method.

Unit 2:

Transportation Problem - Mathematical Model for Transportation Problem, Types of transportationProblem. **Assignment Problem -** Zero-One programming model for assignment Problem, Types of assignment Problem, Hungerian Method, Branch and Bound technique for Assignment Problem. **GameTheory -** Terminologies of Game Theory, Two person Zero-Sum Games, The Maximin-Minimax Principle,Games without Saddle Points Mixed Strategies, Graphical Solution of 2xn and mx2 Games, Dominance Property.

Unit 3:

Decision Theory –Introduction, Decision under Certainty, Decision under Risk, Decision UnderUncertainty, Decision Tree**. Network Scheduling By CPM/PERT –** Introduction, Basic Concept, Constraints in Network, Critical Path Methods (CPM), PERT Network, PERT Calculation, Time-Cost-Trade-Off Aspects in Network Technique, Advantage of Network.

InventoryControl -Introduction,InventoryControl, Selective Control Techniques, Typesof Inventory, Economic Lot Size Problem,Problem of EOQ with shortage, InventoryControl Techniques-UncertaintyDemand,InventoryControlTechniques-StochasticProblem, Inventory Control with Price Breaks.

Unit 4:

Queuing Theory - Introduction, TerminologiesofQueuingSystem,Characteristics ofQueuing System, Poisson Process and ExponentialDistribution,Classification ofQueues,Definition of Transient and steady States, PoissonQueues, Non-PoissonQueuingSystems,Cost-Profit Models in Queuing, Queuing Control.

Books:

1. Operation Research ,KantiSwarup, P.K.Gupta, Man Mohan Sultan.
2. Operation Research ,Hira Gupta.
3. Operation Research ,R. Panneerselvam [PHI].
4. Operation Research Problems & Solutions , Sharma J.K., Macmillan
5. Operation Research Theory & Application , Sharma J,K, MacMillan

First Year M.C.A. Semester II (CBCS)

Core Elective 1 (CE1-3)

Paper 4 - 2T4 **Credits: 4**

Cyber Forensics

Unit 1 :

Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet

Unit 2 :

Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System

Web Application Tools Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, , HTC-Hydra

Unit 3 :

Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

Unit 4 :

Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

Books:

1. Anti-Hacker Tool Kit (Indian Edition) , Mike Shema, Mc Graw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives , Nina Godbole and SunitBelpure, Wiley
3. The Unofficial guide to Ethical Hacking, Ankit Fadia, LaxmiPubli.

First Year M.C.A. Semester II (CBCS)

Core

Paper 5 - 2T5 **Credits: 4**

Android Programming

Unit 1:

Getting an Overview of Android Introducing Android , Listing the Version History of Android Platform , Discussing Android APIs , Describing the Android Architecture, Application Framework Exploring the Features of Android , Discussing about Android Applications , The Application Components The Manifest File , Downloading and Installing Android , Downloading and Installing the Android SDK Setting up Android Virtual Device , Setting up Android Physical Device , Exploring the Development Environment , The Java Perspective Using Eclipse , The DDMS Perspective , The Command-Line Tools , Developing and Executing the First Android Application, Using Eclipse IDE to Create an Application , Running Your Application , Exploring the Application, Using Command-Line Tools

Unit 2:

Using Activities, Fragments, and Intents in Android

Working with Activities Creating an Activity , Starting an Activity , Managing the Lifecycle of an Activity, Applying Themes and Styles to an Activity , Displaying a Dialog in the Activity , Hiding the Title of the **Using Intents** Exploring Intent Objects, Exploring Intent Resolution, Exploring Intent Filters , Resolving Intent Filter Collision , Linking the Activities Using Intent, Obtaining Results from Intent , Passing Data Using an Intent Object , **Fragments** Fragment Implementation , Finding Fragments ,Adding, Removing, and Replacing Fragments , Finding Activity Using Fragment , Using the Intent Object to Invoke Built-in Application .

Unit 3:

Working with the User Interface Using Views and ViewGroups

Working with View Groups, The LinearLayout Layout , The RelativeLayout Layout ., The ScrollView Layout , The TableLayout Layout ,The FrameLayoutLayout,TheTabLayout Using the Action Bar , Working with Views , Using the TextView , Using the EditText View , Using the Button View , Using the RadioButton View , Using the CheckBox View ,Using the ImageButton View ,Using the ToggleButton View , Using the RatingBar View, Binding Data

with the AdapterView Class , Using the ListView Class Using the Spinner, Using the Gallery View ,Designing the AutoTextCompleteView ,Implementing Screen Orientation , Anchoring the Views of the Current Activity , Customizing the Size and Position of the Views , Designing the Views Programmatically , **Handling UI Events** Handling User Interaction with Activities, Handling User Interaction with the Views , **Specialized Fragments**ListFragment, DialogFragment , PreferenceFragment , **Creating Menus** The Options Menu , The Context Menu , The SubMenus, **Handling Pictures and Menus with Views,Working with Image Views** , Displaying Images in the Gallery View , Displaying Images in the Grid View , Using the ImageSwitcher View , Designing Context Menu for Image View , Using the AnalogClock and DigitalClock Views , Embedding Web Browser in an Activity , **Notifying the User** ,Creating the Toast Notification , Creating the Status Bar Notification , Creating the Dialog Notification

Unit 4:

Storing the Data Persistently, **Introducing the Data Storage Options** Using Preferences, **Using the Internal Storage**, Exploring the Methods Used for Internal Storage, Developing an Application to Save User Data Persistently in File, **Using the External Storage**, Exploring the Methods Used for External Storage, Developing Application to Save File in SD Card.

Using the SQLite Database, Creating the Database Helper Class, Creating the Layout and Main Activity Class, Creating the Layout and Activity for the Insert Operation, Creating the Layout and Activity to Search a Record, Creating the Activity Class to Fetch All Records, Creating the Layout and Activity for the Update Operation, Creating the Layout and Activity for the Delete Operation., Executing the Database Operations, **Working with Content Providers**, Exploring the android.provider Package, Creating User-Defined Content Provider,Consuming User-Defined Content Provider

Emailing and Networking in Android , Building an Application to Send Email **Networking in Android**, Getting an Overview of Networking Fundamentals , **Checking Network Availability**, Accessing Web Services Using HTTP Post,Accessing Web Services Using the GET Method , Working with Binary Data and Text Files, Consuming JSON Services , Sockets Programming

Book:

1. Android Application Development (with Kitkat Support) Black Book, Pradeep Kothari, DreamTech Press
2. Android Wireless Application Development Volume I: Android Essentials, Third edition, Lauren Darcey, Shane Conder, Pearson.
3. Android, Prasanna Kumar Dixit, Vikas Professional Master-Class Series.

Second Year M.C.A. Semester III(CBCS)

Core

Paper 1 - 3T1 **Credits: 4**

Big Data Analytics

Unit1:

Getting an Overview of Big Data: What is Big Data,History of Data management,Structuring Big data,Elements of Big data,Big data Analytics,Advantages of Big data Analytics Exploring The Use of Big data. **Introducing Technologies for Handling Big data**: Distributed and Parallel Computing in Big Data,Introducing Hadoop,HDFS and Map reduce,Cloud computing and big data, Features of Cloud Computing.

Understanding Hadoop Ecosystem: Hadoop Ecosystem,Hadoop Distributed file system,HDFS Architecture,HDFS Commands,Mapreduce,Hadoop YARM,Introducing HBase,HBase Architecture,Combining HBase and HDFS,Hive,Pig and Pig latin,Sqoop,Zookeeper,Flume,Oozie. **Understanding MapReduce Fundamentals and HBase:** The MapReduce Framework,Exploring the Features of MapReduce,Working of MapReduce,Techniques to Optimize MapReduce Jobs, Uses of MapReduce.

Unit2:

Understanding Big Data Technology Foundation: Exploring The Big data Stack,Data Source Layer,Ingestion Layer,Storage Layer,Physical Infrastructure Layer,Platform Management Layer,Security Layer,Monitoring Layer, Visualization Layer,Big Data Applications, Virtualization and Big Data, VirtualizationApproaches**Storing Data In Data Bases and DataWarehouses:** RDBMS and BigData**,**CAP Theorem,Issues with Relational Model,Non-Relational Database, Issues with Non-Relational Model, Integrating Big Data with Traditional Data Warehouses.

Unit3:

Exploring R: Exploring Basic Features of R,Statistical Features,Packages,Graphical User Interfaces,R Console,Developing a Programme,Exploring R Studio,Basic Arithmetic in R,Variables and Functions in R,Handling Data in R Workspace **Reading DataSets and Exporting Data from R:** Using c() Command,Using scan() Command,Reading Mutiple Data values from Large Files,Reading Data from RStudio,Exporting Data from R. **Manipulating and Processing Data In R:** Creating Data Subsets, Merging Data Sets in R,Sorting Data, Managing Data in R using Matrices,Managing Data in R using Data Frames.**Working withFuctions and Packages in R**:Using Functions instead of Scripts, Using Arguments in Functions,Built in Functions in R,Introducing Packages, Working with Packages.**Performing Graphical Analysis in R**:Using Plots, Saving Graphs to External Files,Advance Features of R.

Unit4:

Data Visualization: Ways ofRepresentingVisual Data,Techniques,Types,Applications,Visualizing Big Data,Tools used in Data Visualization **Social Media Analytics and Text Mining:**Introducing Social Media**,** Introducing Text Mining, Understanding Text Mining Processes,Sentiment Analysis **Mobile Analytics**: Introducing Mobile Analytics, Define Mobile Analytics,Introducing Mobile Analytics Tools,Performing Mobile Analytics,Challenges of Mobile Analytics.

Books:

1. Big Data (Covers Hadoop 2, MapReduce,Hive,YARN,Pig,R and Data Visualization) Black Book, DT Editorial Services, Dreamtech Press.
2. Data Science & Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services, WILEY Publication
3. Beginners Guide for Data Analysis using R Programming, Jeeva Jose, KhannaPubli.
4. Data Analytics, Maheshwari, McGraw
5. Hands-On Programming with R by Grolemund and Garrett
6. Beginning R: The Statistical Programming Language by Mark Gardener

Second Year M.C.A. Semester III(CBCS)

Core

Paper 2 - 3T2 **Credits: 4**

Data Mining

Unit 1:

Introduction to Data Mining: What is Data Mining? Motivating Challenges, Definitions, Origins of Data Mining, Data Mining Tasks, **Data:** Types of Data- Attributes and Measurement and Types of data sets, Data Quality-Measurement and Data Collection Issues, Issues Related to Applications, Data Preprocessing- Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Variable Transformation.

Unit 2:

Exploring Data: The Iris Data Set, Summary Statistics- Frequencies and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Multivariate Summary Statistics,Visualization: Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Visualizing Higher-Dimensional data, OLAP and Multidimensional data Analysis, **Classification: Basic Concepts, Decision Trees, and Model Evaluation**: Preliminaries, General Approach to Solving Classification Problem, Decision Tree Induction, Evaluating the Performance of a Classifier, Methods for Comparing Classifiers.

Unit 3:

Classification: Alternative Techniques: Rule-Based Classifier, Rule Ordering Schemes, Building Rules-Based Classifier, Nearest Neighbor Classifiers, Bayesian Classifiers, Naive Bayes Classifier, Artificial Neural Networks (ANN), Support Vector Machines.

Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Itemset Generation- Apriori Principle, Candidate Generation and Pruning, Support Counting, Computational Complexity, Rule Generation, Compact Representation of Frequent Itemsets, Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm, FP-Tree Representation.

Unit 4:

Cluster Analysis: Basic Concepts and Algorithms: What is Cluster Analysis? Different Types of Clustering, Types of Clusters, Clustering Algorithms: K-means and its variants, Hierarchical clustering, Density based clustering. Graph-Based Clustering, Shared Nearest Neighbor Approach, Jarvis Patrick Clustering, SNN Density-Based Clustering, **Anomaly Detection:**Causes of Anomaly Detection, Approaches to Anomaly Detection, Statistical Approaches, Proximity-Based Outlier Detection, Density-based Outlier Detection, Clustering-Based Techniques.

Books:

1. Introduction to Data Mining , Tan, Steinbach, Kumar.
2. Data Mining: Concepts and Techniques , Jiawei Han, MichelineKamber, Morgan Kaufmann
3. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann
4. Principles of Data Mining: David Hand, HeikkiMannila and Padhraic Smyth, PHP

Second Year M.C.A. Semester III (CBCS)

Core

Paper 3 - 3T3 **Credits: 4**

Python Programming

Unit 1 :

Introducing Python: What is Python? Python History,Similar Languages **Python Fundamentals:Extending Python programms:** Interactively,From a File,Other Methods,Script, program or module? **Components of a python programming:Built – In-Object types:** Python objects and other Languages,Operators basics, Numbers,Strings,Lists,Tuples,Working with Sequences,Dictionaries,Files, object storage, type conversion, type comparisons **Statements:** statement format, comments, assignments,print, control statements, common traps.

Functions: Function definition and execution, **scoping:** making objects global, the LGB Rule, scope traps, **Arguments:** Arguments are Objects, argument calling by Keywords, default arguments, argument tuples, argument dictionaries, function Rules, Return values, **Advanced Function calling:** The apply statement, the Map Statement, indirect function calls, anonymous functions, **Modules:** Importing a modules,Packages.**Object orientation:**Creating a Class **Exceptions and error trapping:** Exception handling, Built in exceptions.

Unit 2 :

Python's Built-In Functions: _import_(name[,globals [,locals [,fromlist]]]), apply(function,args,[,keywords]),getattr(object,name[,default]), hash(object), id(object), isinstance(object,class), list(sequence),setattr(object , name , value) , str(object) , type(object).

Interfacing to the OS : Working with the system(sy module), Working with the Operating system(os module), Multithreading.**Processing Information :** Manipulating numbers,Text Manipulation,Time,Data types and Operator,Unicode strings.

Unit 3:

Working with Files: File processing:Reading,writing to file,changing position,Controlling File I/O:File Control,IO Control,File Locking,Getting File List,Basic File/Directory Management,Access and Ownership:Checking Access,Getting File information,Setting File Permissions,Manipulating File Paths**. Communicating over a network:** Creating a network server, client modulles,Handling internet data.**Using Python for multimedia**: Audio modules, Graphic Modules

Using Python as RAD Tool: What RAD realy is, Why Python **Application development withPython:**Integrated Development Enviornment**,** Python standard Library. **Distributing Python Modules**: Using Distutils,future features.

Unit 4 :

Web Development Basics: Writing HTML,Uniform Resource Locators,Dynamic Websites using CGI, Cookies, **Security Standard Markup Language Processing**: Processing SGML,Processing HTML,Processing XML. **Other Python Web Tools**: Zope,the Z-Objects

Publishing Enviorment,Jython,Python.Net,Python Server Pages,Python And Active Script,MailMan,Grail,Apache and Python,Socket Server and Base HTTP Server,Medusa.

Paths to Cross Platform Development: Basic Platform Support, Execution Enviorntment,Line Termination,Character sets, Files and Pathnames. **The Python Architecture**:**Namespaces,Code blocks and Frames**:Code Blocks,Frames,Namespaces,Tracebacks,putting it together,**Built in types**:Callable object types,Modules,Classes,Class Instances,Internal Types,**Byte Code**:Python bytecode,bytecode disassembly,byte code instructions(opcodes)

Books:

1. The Complete Reference Python, Martin C.Brown , Tata McGraw Hill Publication
2. Programming in Python3, Mark Summerfield
3. Beginning Python From Novice to Professional, Magnus Lie Hetland(Apress)
4. Taming Python by Programming, Jeeva Jose, KhannaPubli.
5. Introduction to Computing and Problem Solving with Python, Jeeva Jose, Khanna Publi.
6. Python Programming, Seema Thareja, Pearson.

Second Year M.C.A. Semester III (CBCS)

Core Elective 2 (CE2-1)

Paper 4 - 3T4 **Credits: 4**

Artificial Intelligence

Unit 1 :

AI problems, AI Techniques, Tic-tac-toe, Question Answering, Problem as a state space search, A water jug problem, production system, Control strategies, Heuristic Search, Problem Characteristics, Production system characteristics, Design of search programs,

AI Search techniques:- Depth-first, Breadth-first search, Generate-and-test, Hill climbing, Best-first search, Constraint satisfaction, Mean-ends-analysis, A* Algorithm, AO* algorithm.

Unit 2 :

Knowledge Representation:- Representations and mappings, Knowledge Representations, Issues in Knowledge Representation, Predicate Logic:- Representing Instance and Isa Relationships, Computable Functions and predicates, Resolution, Natural Deduction, Logic programming, Forward versus Backward Reasoning, Matching, Control knowledge.

Unit 3 :

Games playing: Minimax search procedure , adding alpha-beta cutoffs, additional refinements,

Planning:- Component of a planning system, Goal task planning, Nonlinear planning, Hierarchical Planning.

Unit 4 :

Understanding, Understanding as Constraint satisfaction, Natural Language Processing, Syntactic Processing, Unification grammars, Semantic Analysis, Parallel and Distributed AI, Psychological Modeling, Distributed Reasoning Systems

Books:

1. Artificial Intelligence , Elaine Rich, Mcgrawhill Inc.
2. Lisp Programming,RajeoSangal,TMH
3. Artificial intelligence, Russell, Pearson.
4. Artificial Intelligence and Expert Systems , Jankiraman, Sarukes
5. A first course in Artificial intelligence, Deepak Khemani, McGraw hill.

Second Year M.C.A. Semester III (CBCS)

Core Elective 2 (CE2-2)

Paper 4 - 3T4 **Credits: 4**

Mobile Computing

Unit 1 :

Mobile Communications: An Overview: Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security Mobile Devices and Systems: Mobile Phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems GSM and Similar Architectures: GSM-Services and System, Architecture, Radio Interfaces, Protocols, Localization, Calling Handover, Security, New Data Services, General Packet Radio Service, High-speed Circuit Switched Data, DECT

Unit 2 :

Wireless Medium Access Control and CDMA based Communication: Medium Access Control, Introduction to CDMA-based Systems, Spread Spectrum in CDMA Systems, Coding Methods in CDMA, IS-95 cdma One System, IMT- 20 0 0, i- m o d e , O F D M , Mobile IP Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation Route Optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport, Layer Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP-layer Transmission for Mobile Networks, TCP Over 2.5G/3G Mobile Networks

Unit 3 :

Databases: Database Hoarding Techniques, Data Caching, Client-Server Computing and Adaptation, Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service, Data Dissemination and Broadcasting Systems**:** Communication Asymmetry, Classification of Data-Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques, Digital Audio Broadcasting, Digital Video Broadcasting, Data Synchronization in Mobile Computing Systems**:** Synchronization, Synchronization Software for Mobile Devices, Synchronization Protocols, SyncML Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia ,Markup Language (SMIL)

Unit 4 :

Mobile Devices Server and Management: Mobile Agent, Application Server, Gateways, Portals, Service Discovery, Device Management, Mobile File Systems, Security, Mobile Adhoc and Sensor Networks: Introduction to Mobile Ad-hoc Network, MANET, Wireless Sensor Networks, Applications Wireless LAN, Mobile Internet Connectivity, and Personal Area Network: Wireless LAN (WiFi) Architecture and Protocol Layers, WAP 1.1 and WAP 2.0, Architectures, XHTML-MP (Extensible Hypertext Markup Language Mobile Profile), Bluetooth-enabled Devices Network, Layers in Bluetooth Protocol, Security in Bluetooth Protocol, IrDA, ZigBee Mobile Application Languages XML, Java, J2ME, and Java Card: Introduction, XML, JAVA, Java 2 Micro Edition (J2ME), JavaCard, Mobile Operating Systems : Operating System PalmOS, Windows CE, Symbian OS, Linux for Mobile Devices 530 20

Books :

1. Mobile Computing, Raj Kamal, Oxford University Press
2. Mobile Communications Jochen Schiller, Addison-Wesley.
3. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley,
4. Mobile Computing , Talukdar, TMH
5. Applications with UML and XML, Reza Behravanfar, Cambridge University Press
6. Mobile Computing ,Brijesh K Gupta, Khanna Publi.

Second Year M.C.A. Semester III (CBCS)

Core Elective 2 (CE2-3)

Paper 4 - 3T4 **Credits: 4**

Machine Learning

Unit1 :

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit 2 :

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving BackPropagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

Unit 3 :

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

Unit 4:

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

Books:

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), EthemAlpaydin,Third Edition, MIT Press

2. Machine learning – Hands on for Developers and Technical Professionals, Jason Bell, Wiley

3. Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, Peter Flach,Cambridge University Press.

4. Deep Learning , Rajiv Chopra, Khanna Publi.

5. Machine Learning, V. K. Jain, Khanna Publi.

Second Year M.C.A. Semester III (CBCS)

Core

Paper 5 - 3T5 **Credits: 4**

Soft Computing

Unit 1: Introduction of soft computing, soft computing vs hard computing. Soft computing techniques. Computational Intelligence and applications, problem space and searching: Graph searching, different searching algorithms like breadth first search, depth first search techniques, heuristic searching Techniques like Best first Search, A* algorithm, AO* Algorithms. Game Playing: Minimax search procedure, adding alpha-beta cutoffs, additional refinements, Iterative deepening, Statistical Reasoning: Probability and Bayes theorem, Certainty factors and Rules based systems, Bayesian Networks, Dempster Shafer theorem

Unit 2 : Neural Network: Introduction, Biological neural network: Structure of a brain, Learning methodologies. Artificial Neural Network(ANN): Evolution of, Basic neuron modeling , Difference between ANN and human brain, characteristics, McCulloch-Pitts neuron models, Learning (Supervised & Unsupervised) and activation function, Architecture, Models, Hebbian learning , Single layer Perceptron, Perceptron learning, Windrow-Hoff/ Delta learning rule, winner take all , linear Separability, Multilayer Perceptron, Adaline, Madaline, different activation functions Back propagation network, derivation of EBPA, momentum, limitation, Applications of Neural network**.**

Unit 3 : Unsupervised learning in Neural Network: Counter propagation network, architecture, functioning & characteristics of counter Propagation network, Associative memory, hope field network and Bidirectional associative memory. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Introduction to Support Vector machine, architecture and algorithms, Introduction to Kohanan's Self organization map, architecture and algorithms

Unit 4 : Fuzzy systems: Introduction, Need, classical sets (crisp sets) and operations on classical sets Interval Arithmetics,Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions.
Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic, fuzzification and defuzzification, Fuzzy associative memory. Fuzzy Logic Theory, Modeling & Control Systems

Books :

1. S.N. Shivnandam, "Principle of soft computing", Wiley India.
2. David Poole, Alan Mackworth "Computational Intelligence: A logical Approach" Oxford.
3. Eiben and Smith "Introduction to Evolutionary Computing" Springer
4. E. Sanchez, T. Shibata, and L. A. Zadeh, Eds., "Genetic Algorithms and Fuzzy Logic Systems: Soft Computing Perspectives, Advances in Fuzzy Systems - Applications and Theory", River Edge, World Scientific

Bridge course : M.C.A. (2 Years) (CBCS)

	Bridge course	Hours
Unit I	**Programming in C language**	**10**
Unit II	**Basic Mathematics and Statistics**	**8**
Unit III	**Digital Electronics**	**8**
Unit IV	**Operating System Concepts**	**5**

Unit I :Programming in C language

- Algorithm and Flowcharts
- C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers.,Operators and Expressions , Library functions. : Maths, string handling Functions.,Control Structure: Compound Statement, Selection Statement, Iteration statement Arrays: Need, Types: Single and Two Dimensional, Functions, pointers.

Unit II: Basic Mathematics and Statistics

- Mathematical Logic :Connectives, Negation, conjunction, Disjunction, statement formulas and truth tables, conditional and Bi-conditional, well formed formulas, Tautologies, Equivalence of formulas, duality law, Tautologies implications.
- Set Theory:Set, Subsets operations on set, Venn diagram, algebra on sets, Cartesian product of sets, Binary relations, Properties of binary relation, Relation matrix and the graph of relation.
- Measures of Central Tendency - Frequency Distribution, Continuous Frequency Distribution, Graphic Representation of a Frequency Distribution Average or Measures of Central Tendency or Measures of Locations, Requisites for an ideal Measure of Central Tendency Arithmetic: Mean Median, Mode, Geometric Mean and Harmonic Mean, Weighted Average, Relationship amongst different Averages.

Unit III: Digital Electronics

- Number System: Binary, Octal, Decimal and Hexadecimal number system and their inter-conversion. Binary Codes: BCD, Excess 3, Parity, Gray, ASCII and EBCDIC codes, their advantages and disadvantages.
- Logic gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EX-OR, EX-NOR gates. NOR and NAND gates as a universal gates. Laws and identities of Boolean algebra, DeMorgan's theorem, Use of Boolean algebra for simplification of logic expression, Karnaugh map for 2,3,4 variable, Simplification of SOP and POS logic expression using K-map.

Unit IV: Operating System Concepts

- Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels. CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

.Books :

1. Programming in C by E. Balagurusamy TMH Publications.
2. Discrete Mathematical Structures with applications to computer Science By J,P.Tremblay& R. Manohar, (TMH)
3. Discrete Mathematical Structures by Kolman Busby and Ross (pearson)
4. Fundamental of Mathematical Statistics by Gupta and Kapoor
5. Digital Electronics by Gothman(PHI)
6. Digital and analogue technique by Navaneeth, Kale and Gokhale
7. Operating Systems by P. Balakrishna Prasad [Scitech Publication]

Note :.Bridge course is compulsory for all the students who got the admission in MCA course under criteria that candidate Passed B.Sc./ B.Com./ B.A. with Mathematics at l0+2 Level or at Graduation Level. Bridge Course will be conducted by college at the beginning of session for MCA I students in semester I. Only grade point will be given to this course. Examination to this course will be conducted by college and grade point will be given upon their performance and will be communicating to the university before the start of theory examination of MCA I (Sem I) .

Program Outcomes

Name of Program: M.C.A. (Master in Computer Applications) (2 Years)(CBCS)

No. Of Courses: 23

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

	Program Outcomes
PSOl	Computational Knowledge: The students will be able to apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualisation of computing models from defined problems and requirements
PSO2	Problem Analysis: The students will be able to think critically for Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines
PSO3	Design /Development of Solutions: The students will be able to design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PSO4	Conduct Investigations of Complex Computing Problems: The students will be able to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions, maintenance and its implementation
PSO5	Modern Tool Usage: The students will be able to create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
PSO6	Professional Ethics: The students will be able to understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
PSO7	Project management and finance: The students will be able to demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Matrix

Name of Program: M.C.A. (Master in Computer Applications) (2 Years)(CBCS)

(Low Correlation = L/1 ; Moderate Correlation =M/2; High Correlation = H/3)

Course Outcomes (COs)		**Program Outcomes (POs)**						
		Domain Specific (PSO)				**Domain Independent (PO)**		
M.C.A. - Semester I								
Course Name: Advanced Java Programming		1	2	3	4	5	6	7
CO1	Facilitates in understanding the concepts of object oriented programming. Skill Enhancing through concepts like multithreading, abstraction , platform independence	M	H	M	M	M	M	H
CO2	Effective to implement platform independence, Applet programming	H	H	H	H	H	H	H
CO3	JDBC Architecture and RMI programming	H	M	M	M	H	H	H
CO4	Design Programs for JAVA Beans and Servlets	H	H	H	H	H	H	H
Course Name: Data Communication and Network								
CO1	To understand and master the fundamentals of data communications through the knowledge of data transmission concepts, media used for data communication	H	M	M	M	H	H	H
CO2	To know the different layer of OSI reference model	H	M	M	H	H	H	H
CO3	To know the different network security algorithms	H	H	H	H	H	H	H
CO4	To know the intrusion detection techniques and Authentication	M	M	H	H	H	H	H
Course Name: Open source Web Programming using PHP								
CO1	To become familiar with client server architecture and able to develop a web application using various technologies.	M	H	M	M	M	M	H
CO2	To understand and develop a web-based application using a framework concept	H	H	H	H	H	H	H
CO3	To gain the skills and project-based experience needed for entry into web application and development careers	H	M	M	M	H	H	H
CO4	Web page development using PHP	H	H	H	H	H	H	H
Course Name:Advanced DBMS and Administration								
CO1	Can explore efficient method for handling multiple types of data	M	M	H	H	H	H	M

CO2	Have a detailed view of handling paralleland distributed database	M	M	M	H	H	H	H
CO3	Ability to normalize the database & understand the internal data structure	M	H	H	M	H	H	H
CO4	Deep visualization of realistic data into physical structure	M	H	H	H	H	H	H
Course Name: Software Engineering								
CO1	To Get detailed knowledge of role of software in daily basis	H	H	H	H	H	H	H
CO2	Student will be identifying different models and find out the best	H	H	H	H	H	H	H
CO3	Test the developed software for high performance and maintainability	M	H	H	H	H	H	H
CO4	Study the software measure parameters for software quality	M	H	H	H	H	H	H
Course Name:1P1 Practical-1								
CO1	Design and program stand-alone Java Applications	H	H	H	M	M	H	H
CO2	Useful in designing web and desktop applications	H	H	H	M	M	H	H
CO3	Analyse And Setup Protocol Designing Issues For Communication Networks	H	H	H	M	H	M	H
CO4	Web development using PHP	H	H	M	H	H	M	H
Course Name:1P2 Practical-2								
CO1	Facilitates in creation of Data Structures and effective management of Database	H	H	H	H	H	M	H
CO2	Ability to normalize the database & understand the internal data structure	H	H	H	H	H	M	H
CO3	To implement Software prototyping for better software development	H	M	M	H	H	H	H
CO4	To acquire skills to think about problems and solution using appropriate method	H	M	M	H	H	H	H
M.C.A. - Semester II								
Course Name:C# and ASP .NET								
CO1	To study simple C# programstructure	H	M	M	M	M	M	H
CO2	To write C# program for classes, arrays, struct, array of objects	M	H	H	H	H	H	H
CO3	To understand ASP.NET structure	H	M	M	M	M	M	H
CO4	Error handling, Component based programming	M	M	M	M	M	H	H
Course Name:Cloud Computing								
CO1	To become familiar with Cloud Computing and its ecosystem and learn basics of virtualization and its importance.	M	M	H	H	H	H	M

CO2	To evaluate in-depth analysis of Cloud Computing capabilitiesand give technical overview of Cloud Programming and Services.	M	M	M	H	H	H	H
CO3	To understand security issues in cloud computing and exposed to Ubiquitous Cloud and Internet of Things	M	H	H	M	H	H	H
CO4	To understand emerging trends in cloud computing.	M	H	H	H	H	H	H
Course Name:Computer Graphics								
CO1	Provides user interfaces, data visualization, television commercials, motion pictures	H	M	H	H	H	H	H
CO2	Hardware devices and algorithms which are necessary for improving the effectiveness, realism, and speed of picture generation	H	M	H	H	H	H	H
CO3	Three dimensional graphic algorithm are incorporated in various streams to better simulate complex interactions	H	H	H	H	M	H	H
CO4	3-d transformations, b-spline surfaces, curves, and hidden surfaces can be explored	H	H	H	H	H	M	H
Course Name:CE1-1 (Elective) Computer Architecture and Organization								
CO1	To explore the fundamentals of Computer Architecture and Organization	H	H	M	H	H	H	H
CO2	To understand the design of control unit	M	H	M	H	H	M	H
CO3	To study the concepts of memory organization and to understand various memory technologies	H	M	M	H	H	M	H
CO4	To understand the concepts of input output processing to interface various I/O devices	H	M	M	H	H	H	H
Course Name:CE1-2 (Elective) Operation Research								
CO1	Understand LPP	H	M	M	H	H	H	H
CO2	Understand Transportation problem, assignment problem	H	H	H	M	H	M	M
CO3	Study of decision theory, CPM/PERT	M	H	M	H	H	H	H
CO4	Study of queuing Theory	H	M	H	M	H	M	H
Course Name:CE1-3 (Elective) Cyber Forensics								
CO1	Understand the different types of vulnerability scanning	M	M	H	M	H	H	H
CO2	To know the different network defense tools and web application tools	M	M	H	M	H	H	H
CO3	To understand the different types of cyber crimes and laws	M	M	H	M	H	H	H
CO4	To understand the different tools for cyber crime investigation	H	M	H	M	H	H	H

Course Name:Android Programming								
CO1	Able to develop apps based on different types of menus	H	M	M	M	M	M	H
CO2	Make decision to solve a problem using package, library and threads Handling Errors and Exceptions	M	H	H	H	H	H	H
CO3	Ability to design and develop database applications	H	M	M	M	M	M	H
CO4	Able to design and develop mobile applications works with internet applications	M	M	M	M	M	H	H
Course Name: 2P1 Practical-1								
CO1	To write C# program for classes, arrays, struct, array of objects	H	M	M	M	M	M	H
CO2	To write ASP.NET Programs and Component based programming	M	M	M	M	M	H	H
CO3	Study the common elements in user interfaces, data visualization, television commercials, motion pictures, and many other applications	H	H	H	H	H	H	H
CO4	Explore the algorithms necessary for basic transformation with respect tocomputer graphics	H	M	M	M	M	H	H
Course Name: 2P2 Practical-2								
CO1	Would gain the knowledge about inside of computer	H	M	M	M	M	H	H
CO2	Transportation problem, LPP problem, Inventory problem	H	M	M	H	H	H	H
CO3	To develop apps based on different types of menus	H	M	M	M	M	M	H
CO4	Design and develop mobile applications works with internet applications	M	M	M	M	M	H	H
Course Name: Project								
CO1	Select the topic for software development	H	H	H	M	H	M	H
CO2	Analysis and design of proposed system	H	H	M	H	H	L	M
CO3	Apply the known language for project programs	M	H	H	M	H	H	L
CO4	Combine the small program to make the integrated software	H	H	M	M	H	M	H
M.C.A. - Semester III								
Course Name:Big Data Analytics								
CO1	To know the structuring the big data, technology for handling the big data, Hadoop, MapReduce.	H	M	H	H	H	H	H
CO2	To understand the big data technology foundation, Storing data in databases and data warehouses.	H	M	H	H	H	H	H
CO3	To get a basic understanding of R and the various ways to create scripts and programs in	H	H	H	H	M	H	H

	R and understand some of the key constructs in R for data handling.							
CO4	To understand and appreciate how to summarize large volumes of data effectively by appropriate use of charts of different types.	H	H	H	H	H	M	H
Course Name: Data Mining								
CO1	To introduce the students, the basic concepts and techniques of Data mining and Warehousing and data pre-processing.	M	M	H	H	H	H	M
CO2	Understand association mining algorithms for discovery of frequent item patterns in large data sets and their Visualizations	M	M	M	H	H	H	H
CO3	Understand classification analysis algorithms for discovery and generation of rules in large data sets and their Visualizations	M	H	H	M	H	H	H
CO4	Understand basic and advanced clustering analysis algorithms and Visualizations in Data Mining.	M	H	H	H	H	H	H
Course Name: Python Programming								
CO1	Understand the data types and structures in python	M	H	M	M	M	M	H
CO2	Ability to understand object oriented programing concepts and write programs in python. Handling Errors and Exceptions	H	H	H	H	H	H	H
CO3	Ability to design and develop database applications	H	M	M	M	H	H	H
CO4	Web development using Python	H	H	H	H	H	H	H
Course Name: CE2-1 (Elective) Artificial Intelligence								
CO1	Understand the various underlying concepts in Artificial Intelligence . Acquire the knowledge of search techniques used in Artificial Intelligence	H	M	M	H	H	H	H
CO2	Acquire the concepts of knowledge representation	H	H	H	M	H	M	M
CO3	Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.	M	H	M	H	H	H	H
CO4	To understand NLP and Distributed reasoning system	H	M	H	M	H	M	H
Course Name: CE2-2 (Elective) Mobile Computing								
CO1	Helps to understand the fundamental requirements for initiating an online business	M	M	M	M	M	H	H

CO2	Helps in process of initiating and funding a start-up, e-Business or large projects	M	H	H	H	H	H	H
CO3	Necessary to describe the issue and methods of transforming an organization into an e-business	H	H	H	H	H	H	H
CO4	Provides deeper knowledge of mobile handheld devices, wireless mediums,palm OS, MANNET	H	M	M	H	H	H	H
Course Name: CE2-3 (Elective) Machine Learning								
CO1	To understand the different machine learning methods	H	M	M	H	H	H	H
CO2	To understand the Multilayer Perceptron, Back Propogation algorithm, Support Vector Machine	H	H	H	M	H	M	M
CO3	To understand the machine learning with trees, different classifier	M	H	M	H	H	H	H
CO4	To understand the concept of dimensionality reduction, Graphical Methods	H	M	H	M	H	M	H
Course Name: Soft Computing								
CO1	To know the soft computing methodology, heuristic search techniques	H	M	H	H	H	H	H
CO2	To understand the Neural Network structure, different types of leaning methods	H	M	H	H	H	H	H
CO3	To understand the different methods of unsupervised learning	H	H	H	H	M	H	H
CO4	To understand the concept of Fuzzification and defuzzification	H	H	H	H	H	M	H
Course Name: 3P1 Practical-1								
CO1	Programs in R for data analysis and visualization	H	M	M	M	M	M	H
CO2	Programming on classification, association and clustering algorithm	M	M	M	M	M	H	H
CO3	Programming in python to design and develop database applications	H	H	H	H	H	H	H
CO4	Programming in python for Web development	H	M	M	M	M	H	H
Course Name: 3P2 Practical-2								
CO1	Programming for AI search techniques	H	M	M	M	M	H	H
CO2	Programs on Mobile Computing	H	M	M	H	H	H	H
CO3	Programs on Neural Network	H	M	M	M	M	M	H
CO4	Programs on Fuzzification and defuzzification	M	M	M	M	M	H	H
M.C.A. - Semester IV								
Course Name: Project Work								
CO1	To use the working knowledge in industry.	H	H	H	H	H	H	H
CO2	To develop software in industry for various clients	H	H	H	H	L	H	H

CO3	To gain awareness about ethical aspects and development work.	H	H	H	H	H	H	H
CO4	Ability to plan and use adequate methods for software development	H	H	H	H	H	H	H