

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR [C.G.]
ORDINANCE NO.

MASTER OF COMPUTER APPLICATIONS (TWO YEARS)

1.	The degree of Master of Computer Applications shall be of two academic years divided into four semesters.
2.	<p>The eligibility for admission shall be as per AICTE Norms or as follows;</p> <p>a. Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree.</p> <p style="text-align: center;">OR</p> <p>Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).</p> <p>b. Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.</p>
3.	The admission procedure shall be as decided by University/Directorate of Technical Education (DTE) Govt. of Chhattisgarh, from time to time.
4.	The medium of instructions and examination will be English.
5.	The examination shall comprise of Theory Examination, Practical Examination and Sessionals, as per the "Scheme of Examination" recommended by the Board of Studies from time to time.
6.	Details of subjects to be taught in four semester curriculum pattern and examination scheme for each year course shall be formed and implemented as per recommendation of Board of Studies from time to time.
7.	Requirement for examination: i) Examination will be conducted by Pt. Ravishankar Shukla University, Raipur; ii) Examination shall be in Theory, Practical and Sessional as stipulated; iii) A candidate will be permitted to appear for the examination only if the candidate has put up a minimum attendance of 75% of the lectures and practical classes. University may condone shortfall as required by rules.
8.	The provisions of this course in respect of examination, results and grades are subject to alteration by the Board of studies from time to time and shall also conform to guidelines of AICTE/UGC/MHRD/Govt. of India / Statutes and Ordinance of this University.
9.	In case of an examinee for Master of Computer Applications, who is not a regular student of the department/college, the sessional marks obtained during the period in which the candidate pursued the course for the examination in the department/college shall be taken into account for the purpose of determining their result at the examination.
10.	The minimum passing marks which an examinee shall have to obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each sessional and (iii) 50% in each practical/project examination.
11.	A candidate shall be eligible to be promoted and appear in the succeeding semester examination only if he/she fails in not more than two (theory/practical/project/seminar) papers in any one semester examination.
12.	A candidate failing in not more than two (theory/practical/project/seminar) papers of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination.
13.	If a candidate fails in more than two (theory/practical/project/seminar) papers in any one

Handwritten signatures of university officials are placed over the ordinance table, including:

- Xavi (Signature)
- Suresh (Signature)
- P. S. (Signature)
- G. R. (Signature)
- S. C. (Signature)
- Ramendra (Signature)

Dates visible on the signatures:

- 04-3-20
- 04-3-20
- 04-3-20
- 04-3-20
- 04-3-20
- 04-3-20

	semester examination he/she will be year back and he/she will be appearing in the failing papers only.										
14.	A candidate will be permitted to appear in the examination of the course for a maximum period of 5 years including the year of admission. If he/she fails to clear the course within the period of 5 years, he/she will be dropped out of the course.										
15.	A candidate, who fails to obtain minimum marks in sessional of any subject, will be treated as failed and will have to repeat the whole semester. He/she will have to attend the classes of all the subjects of the respective semester to earn requisite sessional marks and again appear in all theory and practical/project/seminar papers in the next year examination.										
16.	The result of the Fourth semester shall not be declared until the candidate has passed all theory and practical/project/seminar papers of all semesters (First, Second, Third and Fourth).										
17.	The weightage of marks in each semester will be as follows:										
	<table border="1"> <thead> <tr> <th>Semester</th><th>Weightage of Marks</th></tr> </thead> <tbody> <tr> <td>First Semester</td><td>20%</td></tr> <tr> <td>Second Semester</td><td>20%</td></tr> <tr> <td>Third Semester</td><td>30%</td></tr> <tr> <td>Fourth Semester</td><td>30%</td></tr> </tbody> </table>	Semester	Weightage of Marks	First Semester	20%	Second Semester	20%	Third Semester	30%	Fourth Semester	30%
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18.	<p>(a) There shall be no classification of the examinees successful in each semester of the examination.</p> <p>(b) Division shall be awarded only after the fourth semester examination, based on the performance of the candidate for all the four semesters according to the weightage table given above.</p> <ul style="list-style-type: none"> (i) The examinees who have obtained 75% or more marks in the aggregate considering all the examination taken together shall be placed in First Division with Honours. (ii) The examinees who have obtained 65% or more marks but less than 75% in the aggregate considering all the examination taken together shall be placed in the First Division. (iii) The examinees who have obtained less than 65% marks and more than or equal to 48% in the aggregate considering all the examination taken together shall be placed in the Second Division. (iv) An examinee must secure minimum 48% of the total aggregate to be declared successful in any examination, otherwise he/she will be declared "FAIL" 										
19.	Recalculation, Revaluation and any matter related to examination not covered in this ordinance will be covered as per University Ordinance no. 5 and 6.										
20.	For the rules not defined here or in case of any conflict the Board of Studies shall be empowered to take the decision accordingly. The final decision shall be taken by the Hon'ble Vice-Chancellor based on the recommendations of the Board of Studies.										
21.	On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit to be admitted or not fit to appear in the examination. The reason for such exclusion shall be recorded.										

Handwritten signatures of the Executive Council members are present over the asterisks at the bottom of the page. The signatures include:

- A signature that appears to be "Kumar" dated "04-3-2020".
- A signature that appears to be "Gaurav" dated "04-3-2020".
- A signature that appears to be "Dutta" dated "04-3-2020".
- A signature that appears to be "Brahm" dated "04-3-2020".
- A signature that appears to be "Jitendra" dated "04-3-2020".
- A signature that appears to be "Paragam" dated "04-3-2020".

प्रपत्र-दो

1. विश्वविद्यालय का नाम : पं. रविशंकर शुक्ल विश्वविद्यालय, रायपुर
2. अधिनियम /अध्यादेश/ परिनियम क्रमांक : REVISED ORDINANCE No. 85
3. अधिनियम /अध्यादेश/ परिनियम का नाम : MASTER COMPUTER APPLICATIONS
4. अनुशंसा के प्राधिकारी का नाम एवं अनुशंसा की तिथि धारा 52 (4) की स्थिति में कुलपति द्वारा अनुशंसा की तिथि : विद्यापरिषद् की स्थायी समिति की बैठक दिनांक में अनुशंसित एवं कार्यपरिषद् की बैठक में अनुमोदित

अधिनियम /अध्यादेश/ परिनियम क्रमांक	वर्तमान प्रावधान	प्रस्तावित संशोधन	औचित्य	Remarks
85.	<p>1. There shall be the following six examinations for the Degree of Master in Computer Applications as stated below :-</p> <p>Master of Computer Applications (First Semester)</p> <p>Master of Computer Applications (Second Semester)</p> <p>Master of Computer Applications (Third Semester)</p> <p>Master of Computer Applications (Fourth Semester)</p> <p>Master of Computer Applications (Fifth Semester)</p> <p>Master of Computer Applications (Sixth Semester)</p> <p>2. i) MCA First, Second, Third, Fourth and Fifth</p>	<p>1. The degree of Master of Computer Applications shall be of two academic years divided into four semesters.</p>	Modified in accordance with the new guidelines of the AICTE in which the duration has been updated to two years.	

	<p>Semester Examination will comprise of (a) Written Papers (b) Sessional Work and (c) Laboratory Work.</p> <p>ii) MCA Sixth Semester Examination will comprise of (a) Written papers (b) Sessional Work and (c) Project Work.</p> <p>iii) The examination in written papers shall be held at the end of each semester according to the schemes of Examination given in the appendix 'A'. The detailed scheme of examination and syllabus as may be in force from time to time, shall be published by the University.</p>	Removed	Covered in point 5 of the revised ordinance.	
	<p>3. (a) The duration of the academic years of MCA will be divided into six semesters as follows :-</p> <p>First, Third and i) 1st July to 30th November Fifth Semester ii) Examination for written papers at the end of the Semester : 11th December to 30th December.2</p> <p>Second and i) 1st January to 30th April Fourth Semester ii) Examination for written papers at the end of the Semester : 11th June to 30th June.</p> <p>Sixth semester i) 1st January to 30th June ii) Project Evaluation at the end of the Semester : 11th June to 30th June.</p>	Removed	The duration of the course has been changed to two years.	
	<p>3. (b) After the semester Examination, a candidate may be provisionally admitted to the higher semester till the declaration of the lower semester result. He/She will be permitted to continuing the higher semester only if</p>	Removed	Covered in point 11 of revised ordinance.	

	<p>He/She fulfill the provision of Para 13.</p> <p>4. A candidate seeking admission to the Master of Computer Applications (MCA) Course should be Graduate of any recognized Indian University or Foreign University or Institute recognized by the concerned University as equivalent thereto. Bachelor's Degree must be of minimum three year duration in any discipline with Mathematics as compulsory or additional subject at (10+2) level. The admission procedure shall be as decided by University from time to time.</p>	Removed	Covered in point 2 of the revised ordinance.
	<p>5. A student of college seeking admission to the examination shall : a) Apply for the admission to the examination through the principal of College / Head, School of Study. b) Produce the following certificates from the principal of the college / Head, School of study viz. Certificate. 1) Of Good Conduct. 2) Of fitness to present himself at the Examination. 3) Of having persecuted a regular courses of study and 4) Of possessing the minimum academic qualification prescribed for appearing in the examination.</p> <p>ii) For the purpose of this paragraph, the fitness of a student to present himself at the examination shall be judged by the principal of the College / Head, School of Study :-</p> <p>a) The record of his / her academic work in the college. b) His/her intellectual capacity and c) The time at his disposal before the commencement of the examination for making up the deficiencies of</p>	Removed	Admission process is taken care of by Directorate of Technical Education (DTE) Govt. of Chhattisgarh

	<p>any, in his studies.</p> <p>iii) The certificates required by this paragraph shall reach the Registrar not later than the date preceding by two weeks the date of commencement of the written examination.</p>		
	<p>6. Any deficiency in attendance at the course of study for the examination may be condoned subject to a maximum of 15% in accordance with the provisions of the Ordinance No. 6 relating to condonation of deficiency in attendance.</p>	Removed	Covered in point 7 or the revised ordinance.
	<p>7. On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit person to be admitted thereto. The reason for such exclusion shall be regarded.</p>	Removed	Covered in point 21 or the revised ordinance.
	<p>8. The candidates disobeying the instructions of the Center Superintendent in the Examination Centre of resorting to any sort of unfair means at the examination shall be dealt with according to the provisions of Ordinance No. 5 and 6 of the University.</p>	Removed	Covered in point 19 or the revised ordinance.
	<p>9. i) Every application for admission to the Master of Computer Applications (First, Second, Third, Fourth, Fifth, sixth Semester) Examination shall be in the form prescribed by the Academic Council and shall reach the Registrar not less than four weeks & before the commencement of the examination. It shall be accompanied by such examination and other fee for each semester as may be prescribed by the University from time to</p>	Removed	By default applicable

	<p>time.</p> <p>ii) Every Application of a candidate other than a student of a college seeking readmission to the examination shall be made in the form prescribed by the Academic Council and shall together with the fee as stated in paragraph (i) and such additional fee as may be prescribed by the Academic Council in this behalf, before the commencement of the examination.</p> <p>iii) A candidate who fails to pass or to present himself at the examination shall be entitled to a refund of the fees, but in genuine and hard cases of sickness etc. a part of the fee can be adjusted towards to immediate next examination, if such an application is sent so as to reach the Registrar not later than 30 days from the date of commencement of examination at which the candidate was to appear.</p>		
	<p>10. The scheme of examination for Master of Computer Applications will be prescribed by the University from time to time.</p>	Removed	Covered in point 6 or the revised ordinance.
	<p>11. In case of an examinee for Master of Computer Applications, who is not a regular student of the college, the sessional marks obtained during the period in which he prosecuted the course for the examination in a college shall be taken into account for the purpose of determining his result at the examination.</p>	Removed	Covered in point 9 or the revised ordinance.
	<p>12. The minimum passing marks which an examinee shall obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each</p>	Removed	Covered in point 10 or the

	<p>sessional and (iii) 50% in each laboratory test/viva examination/project evaluation and (iv) 50% of the total aggregate.</p>		revised ordinance.	
	<p>13. A candidate shall be eligible to appear in the succeeding semester examination only after having passed the preceding semester examination provided that if a candidate fails in not more than two (theory/practical) papers in any one-semester examination, he will be promoted to the next semester course. A candidate failing in not more than two (theory/practical) paper of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination. He/She shall be eligible to carry the backlog of maximum two papers of each semester but in any case he/she shall not be permitted to carry backlog of more than four papers (theory/practical) at a time. The candidate will be required to clear the complete backlog of ATKT before appearing in Sixth Semester Examination.</p>	Removed	Divided into 6 points (11 – 16) of the revised ordinance to improve clarity and comprehension	
	<p>14. In each semester examination, at least 50% theory papers shall be internal.</p>	Removed	Ambiguous.	
	<p>15.</p> <p>(a) There shall be no classification of the examinees successful in each semester of the examination.</p> <p>(b) The classification of examinees after having</p>	Removed	Covered in point 18 or the revised ordinance.	

	<p>passed all the six semester examinations shall be made as follows</p> <ul style="list-style-type: none"> i) The examinees who have obtained 75% or more marks in the aggregate considering all the six semester taken together shall be placed in First Division with Honours. ii) The examinees who have obtained 65% or more marks but less than 75% in the aggregate considering in all the six semester taken together shall be placed in the First Division. iii) The examinees who have obtained less than 65% marks and more than 50% in the aggregate considering all the six semester taken together shall be placed in the Second Division. iv) An examinee must secure 50% of the total aggregate to be declared successful in any semester examination. 		
	<p>16. (a) As soon as possible after the examination the Executive Council shall publish a list of successful examinee arranged in the three divisions. The names of the examinee who obtain the first ten places in First Division being arranged in order of Merit.</p>	Removed	Covered in point 16 or the revised ordinance.
	<p>16. (b) A candidate who is successful at the sixth semester of the MCA examination shall be awarded the MCA Degree I the form prescribed by the Academic Council in this behalf. Weightage of marks in each semester are as follows :</p>	Removed	Covered in point 17 or the revised ordinance.

	<table border="1"> <thead> <tr> <th>Semester</th><th>Weightage of Marks</th></tr> </thead> <tbody> <tr> <td>First Semester</td><td>5%</td></tr> <tr> <td>Second Semester</td><td>5%</td></tr> <tr> <td>Third Semester</td><td>15%</td></tr> <tr> <td>Fourth Semester</td><td>15%</td></tr> <tr> <td>Fifth Semester</td><td>30%</td></tr> <tr> <td>Sixth Semester</td><td>30%</td></tr> </tbody> </table>	Semester	Weightage of Marks	First Semester	5%	Second Semester	5%	Third Semester	15%	Fourth Semester	15%	Fifth Semester	30%	Sixth Semester	30%		
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	<p>17. SCRUTINY OF MARKS EVALUATION : A candidate whose result has been declared, may apply to the Registrar for the scrutiny of his/her marks in written papers and the rechecking of his result, or for revaluation of his answer books but not more than two within 30 days of declaration of the result. According to the provisions laid down in Ordinance No 5 & 6. The fee for scrutiny of marks and for revaluation shall be as per University rules.</p>	<p style="text-align: center;">Removed</p>	Covered in point 19 or the revised ordinance.														
	—	<p>2. The eligibility for admission shall be as per AICTE Norms or as follows;</p> <p class="list-item-l1">a. Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree. OR Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).</p> <p class="list-item-l1">b. Obtained at least 50% marks (45%)</p>	Similar to point 4 of the old ordinance. Modified to conform to AICTE norms of eligibility.														

		marks in case of candidates belonging to reserved category) in the qualifying Examination.	
	New Point	3. The admission procedure shall be as decided by University/Directorate of Technical Education (DTE) Govt. of Chhattisgarh, from time to time.	There was no point related to the admission procedure in the old ordinance.
	New Point	4. The medium of instructions and examination will be English.	There was no point related to the medium(language) of instructions and examinantion in the old ordinance.
	—	5. The examination shall comprise of Theory Examination, Practical Examination and Sessionals, as per the “Scheme of Examination” recommended by the Board of Studies from time to time.	Similar to point 2 of the old ordinance.
	—	6. Details of subjects to be taught in four semester curriculum pattern and examination scheme for each year course shall be formed and implemented as per recommendation of Board of Studies from time to time.	Similar to point 10 of the old ordinance.
	New Point	7. Requirement for examination: i) Examination will be conducted by Pt. Ravishankar Shukla University, Raipur; ii) Examination shall be in Theory, Practical	To clarify conditions related to the

		<p>and Sessional as stipulated; iii) A candidate will be permitted to appear for the examination only if the candidate has put up a minimum attendance of 75% of the lectures and practical classes. University may condone shortfall as required by rules.</p>	organization of the examination and eligibility of a candidate to appear in the examination.	
	New Point	<p>8. The provisions of this course in respect of examination, results and grades are subject to alteration by the Board of studies from time to time and shall also conform to guidelines of AICTE/UGC/MHRD/Govt. of India / Statutes and Ordinance of this University.</p>	There was no point related to alterations of provisions and the body authorized to do so.	
	—	<p>9. In case of an examinee for Master of Computer Applications, who is not a regular student of the department/college, the sessional marks obtained during the period in which the candidate pursued the course for the examination in the department/college shall be taken into account for the purpose of determining their result at the examination.</p>	Similar to point 11 of the old ordinance.	
	—	<p>10. The minimum passing marks which an examinee shall have to obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each sessional and (iii) 50% in each practical/project examination.</p>	Similar to point 12 of the old ordinance.	
	—	<p>11. A candidate shall be eligible to be promoted and appear in the succeeding semester examination only if he/she fails in not more than two (theory/practical/project/seminar) papers in any one semester examination.</p>	Covers some aspect of the point 13 of the old ordinance.	

	—	12. A candidate failing in not more than two (theory/practical/project/seminar) papers of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination.	Covers some aspect of the point 13 of the old ordinance.	
	—	13. If a candidate fails in more than two (theory/practical/project/seminar) papers in any one semester examination he/she will be year back and he/she will be appearing in the failing papers only.	Covers some aspect of the point 13 of the old ordinance.	
	New Point	14. A candidate will be permitted to appear in the examination of the course for a maximum period of 5 years including the years of admission. If he / she fails to clear the course within the period of 5 years, he /she will be dropped out of the course.	Maximum period of course duration specified .	
	New Point	15. A candidate, who fails to obtain minimum marks in sessional of any subject, will be treated as failed and will have to repeat the whole semester. He/she will have to attend the classes of all the subjects of the respective semester to earn requisite sessional marks and again appear in all theory and practical/project/seminar papers in the next year examination.	There was no point in the old ordinance clarifying what happens if a candidate fails to obtain minimum required marks in sessional of any subject.	
	—	16. The result of the Fourth semester shall not be declared until the candidate has passed all theory and practical/project/seminar papers of all semesters (First, Second, Third and Fourth).	Covers some aspect of the point 13 of the old ordinance.	
	—	17. The weightage of marks in each semester will be	Similar to	

		<p>as follows:</p> <table border="1"> <thead> <tr> <th>Semester</th><th>Weightage of Marks</th></tr> </thead> <tbody> <tr> <td>First Semester</td><td>20%</td></tr> <tr> <td>Second Semester</td><td>20%</td></tr> <tr> <td>Third Semester</td><td>30%</td></tr> <tr> <td>Fourth Semester</td><td>30%</td></tr> </tbody> </table>	Semester	Weightage of Marks	First Semester	20%	Second Semester	20%	Third Semester	30%	Fourth Semester	30%	<p>point 16(b) of the old ordinance. Updated in accordance with the new guidelines of AICTE.</p>
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		48% of the total aggregate to be declared successful in any examination, otherwise he/she will be declared "FAIL"		
	—	19. Recalculation, Revaluation and any matter related to examination not covered in this ordinance will be covered as per University Ordinance no. 5 and 6.	Similar to point 17 of the old ordinance.	
	New Point	20. For the rules not defined here or in case of any conflict the Board of Studies shall be empowered to take the decision accordingly. The final decision shall be taken by the Hon'ble Vice-Chancellor based on the recommendations of the Board of Studies.	To clarify what can be done in any unforeseen circumstances.	
	New Point	21. On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit to be admitted or not fit to appear in the examination. The reason for such exclusion shall be recorded.	To clarify what can be done in any unforeseen circumstances	

कुलसाचिव

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SCHEME OF TEACHING AND EXAMINATIONS 2020-21

MASTER OF COMPUTER APPLICATIONS (2 Years)

FIRST SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit $L+(T+P)/2$	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA101	Object Oriented Programming With 'C++'	3	2	-	4	100	25	-	125	40	15	-	55
MCA102	RDBMS (SQL and PL/SQL)	3	2	-	4	100	25	-	125	40	15	-	55
MCA103	Operating System with Case Study of Linux	3	2	-	4	100	25	-	125	40	15	-	55
MCA104	Computer System Architecture	3	2	-	4	100	25	-	125	40	15	-	55
MCA105	Software Engineering	3	2	-	4	100	25	-	125	40	15	-	55
MCA106	Lab-I : Programming in C++	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA107	Lab-II : Programming in SQL and PL/SQL	-	-	2	1	-	50	50	100	-	30	25	55
MCA108	Lab-III : Programming in Linux	-	-	2	1	-	50	50	100	-	30	25	55
MCA109	Personality Development / Mock Interviews	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	1000	200	180	100	480

Dr. S. R. Patil
 Dr. S. S. Deshpande
 Dr. S. S. Patil
 Date: 04/03/2020

Object Oriented Programming with 'C++'

Subject Code - MCA101

Max Marks : 100

Min Marks : 40

UNIT - I: Language Fundamental

Overview of OOP: The Object Oriented paradigm, Basic concepts of OOP, Benefits of OOP, Object oriented languages, Application of OOP **Overview of C++:** History of C++, Data Types: Built-in data types, User-defined data types, Derived data types. **Constants and Variables:** Symbolic constants, Dynamic initialization of variable, Reference variable. Operators in C++. **Control Structures:** if-else, nested if-else, while, do-while, for, break, continue, switch, goto statement.

UNIT - II: Structure & Function

Structures: A simple structure, defining a structure variable, accessing structures member, enumeration data type. **Function:** Function declaration, calling function, function definition, **Passing Arguments to function:** Passing constant, Passing value, Reference Argument, Structure as argument, Default argument. **Returning values from function:** return statement, returning structure variable, return by reference. Overloaded functions, Inline functions and Templates.

UNIT - III: Object Classes and Inheritance

Object and Class, Defining the class and its member, Making an outside function inline, nesting of member function, array as class member, structure and classes. **Memory allocation:** memory allocation for objects, new and delete operator, static data member, static member functions, object as function argument. **Constructor & Destructor:** Null and default constructor. Parameterized constructor, Constructor with default argument, copy constructor, class destructors, **Inheritance:** Introduction to inheritance, Types of inheritance, function overriding, Constructor in Derived class. **Access specifiers:** public, private, protected.

UNIT - IV: Pointers, Virtual Function and Operator Overloading

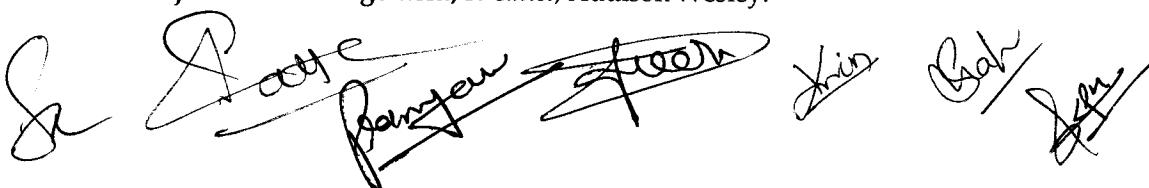
Pointers: Introduction, & and * operator, pointer to object, this pointer, pointer to derived class. **Dynamic polymorphism:** Virtual function, Pure Virtual Function, Abstract class. **Static Polymorphism:** Operator keyword, overloading unary operator (++ (pre increment and post increment),--) using operator function, overloading binary operators (+,-,==,>=,<=, +=,<,>,[]), Friend function, Friend class, overloading binary operators using friend function.

UNIT - V: File & Stream

File and Stream: C++ Stream class, unformatted I/O operations, formatted console I/O, manipulators, opening and closing a file, detecting eof, file modes, get(), put(), reading and writing a class object, Updating a file random access.

RECOMMENDED BOOKS:

1. C++: The Complete Reference, *Herbert Schildt*, Tata McGraw-Hill
2. Object Oriented Programming with C++, *E. Balagurusamy*, Tata McGraw-Hill
3. The C++ Programming Language, *Bjarne Stroustrup*, Addison-Wesley.
4. Object Oriented Programming in C++, *Robert Lafore*, Galgotia Publications.
5. Introduction to Object Oriented Programming, *K V Witt*, Galgotia Publications.
6. Object Oriented Programming, *G Blaschek*, Springer Verlag
7. Object Data Management, *R Cattel*, Addison Wesley.



RDBMS (SQL and PL/SQL)

Subject Code - MCA102

Max Marks : 100

Min Marks : 40

UNIT - I: Overview of Database Management

Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management, file oriented approach verses database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases, Introduction to ODBC concept.

UNIT - II: Relational Model & Relational Algebra

Entity - Relationship model as a tool for conceptual design-entities, attributes and relationships. ER diagrams; Concept of keys; Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features. **Relational Algebra:** select, project, cross product different types of joins (inner join, outer joins, self-join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra.

UNIT - III: SQL and Relational Database Design

Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY....), INSERT, DELETE, UPDATE, DROP, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references. Embedded SQL and Application Programming Interfaces. Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce-Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Denormalization.

UNIT - IV: PL/SQL

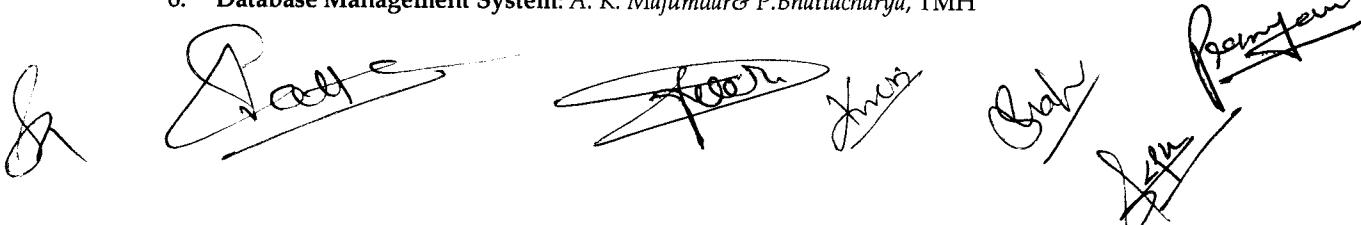
Introduction to PL/SQL variables - literals - data types - advantages of PL/SQL; Control statements : if ; iterative control - loop, while, for , goto ; exit when; Cursors : Types -implicit, explicit - parameterized cursors - cursor attributes; Exceptions: Types - internal , user-defined , handling exceptions - raise statement; PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions -procedures - in, out, inout parameters; purity functions - packages - package specification -advantages of packages - private and public items - cursors in packages.

UNIT - V: Query Processing and Optimization

Query Processing, Protecting Database and Data Organization -Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL. **Data Organization-File Organization:** Fixed length records, variable length records, Organization of records in files.

BOOKS RECOMMENDED:

1. **Database System Concept:** A. Silberschatz , H.F. Korth and S. Sudarshan, TMH
2. **Fundamentals of Database Systems:** Elmasri & Navathe, Pearson Education
3. **An Introduction to Database Systems:** C. J. Date, AWL Publishing Company
4. **SQL, PL/SQL:** Ivan Bayross, BPB Publication
5. **An Introduction to database systems:** Bipin Desai, Galgotia Publication.
6. **Database Management System:** A. K. Majumdar & P. Bhattacharya, TMH



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- A signature that looks like "S. Korth"
- A signature that looks like "K. Nair"
- A signature that looks like "B. Desai"
- A signature that looks like "A. K. Majumdar"
- A signature that looks like "P. Bhattacharya"

Operating System with Case Study of Linux

Subject Code - MCA103

Max. Marks: 100

Min Marks : 40

UNIT - I: Introduction

Defining operating system, History and Evolution of operating system, **Basic Concepts:** batch processing, spooling, multiprogramming, multiprocessor system, time sharing, real time systems, Functions and Goals of operating system, Operating system as resource manager, Operating system as an abstract machine.

UNIT - II: Process Management

Process concept, Process Control Block, **Process State:** State Transition Diagram, **Scheduling Queues:** Queuing Diagram, Types of schedulers-context switching and dispatcher, various types of CPU scheduling algorithms and their evaluation, multilevel queues and multilevel feedback queues, Thread life cycle, multithreading,

UNIT - III: IPC and Dead Locks

Inter Process Communication: competing and co-operating processes, Introduction to concurrent processing, Precedence graphs, Critical section problem, Semaphore concept, Study of classical process synchronization problems: Producer-Consumer, Dining Philosophers. **Deadlocks:** The dead lock problem, dead lock definition, **Deadlock Characterization:** necessary condition, resource allocation graph, **Deadlocks handling:** Deadlock prevention, Deadlock avoidance, Banker's algorithm, Deadlock detection, Recovery from Deadlock.

UNIT - IV: Memory Management

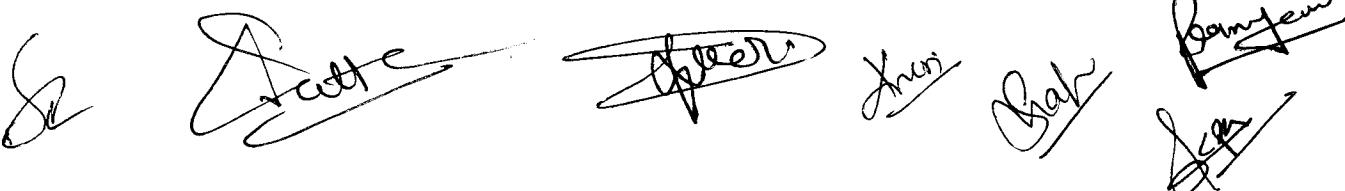
Preliminaries of memory management, Contiguous memory allocation, partitioned allocation MFT, fragmentation, MVT, partition allocation policies, compaction, Non-Contiguous memory allocation, Paging, Structure of page table, Segmentation, **Virtual Memory:** Concepts, demand paging, Swapping, **Page replacement policies:** FIFO, Optimal, LRU, MRU, Thrashing. **Secondary Storage:** Hierarchy, physical characteristics, evaluation of disk access time and data transfer rate, **Scheduling algorithms:** FCFS, SCAN etc.

UNIT - V: File and Device Management

File concept: file types, file directory maintenance, File sharing, Basic file system structure, access methods-sequential and direct access, free space management contiguous, linked allocation and indexed allocation and their performances. **Protection and Security:** principle of protection, domain structure, access matrix, access control, the security problems. **Distributed systems:** Introduction& Features, Types of distributed OS.

BOOKS RECOMMENDED:

1. **Operating System Concepts**, Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Wiley India
2. **Modern Operating System**, Andrew .S. Tanenbaum, PHI
3. **Operating System Concepts**, James L. Peterson and Abraham Silberschatz, Addison-Wesley
4. **Operating System Concepts & Design**, Milan Milenkovic, MGH
5. **An Introduction to Operating Systems**, Harvey M. Dietel, Addison Wesley



Computer System Architecture

Subject Code - MCA104

Max Marks : 100

Min Marks : 40

UNIT - I Boolean algebra and H/w component:

Introduction to Boolean Algebra, Logic Gates, Map simplification: K-Map, **Combinational Circuit**: Half and Full Adder, Decoder and Multiplexer; **Sequential Circuit**: Flip-Flop (SR, D, JK, Master-Slave, T), 4 bit Register, Register with parallel load, Shift register, Binary ripple Counter, Binary synchronous counter.

UNIT - II Register transfer language and micro operations

Register Transfer Language (RTL), Concepts of bus, Bus and Memory transfers, **Micro-operation**: Arithmetic, Logic and Shift micro operation, Instruction code, Computer registers, Computer instructions, Timing and control, Instruction Cycle and Interrupt Cycle, Memory reference instructions, Input-output and interrupt, Design of basic computer

UNIT - III Programming Computers and CPU

Machine Language, Assembly Language, Assembler, Program Loops, Input /Output, Programming, General register organization, Stack organization, Instruction format, Addressing modes, Data transfer and manipulation language, Micro-programmed and Hardwired control, RISC Vs. CISC, Pipelining in CPU design:, Parallel Processing, Arithmetic and RISC pipelining.

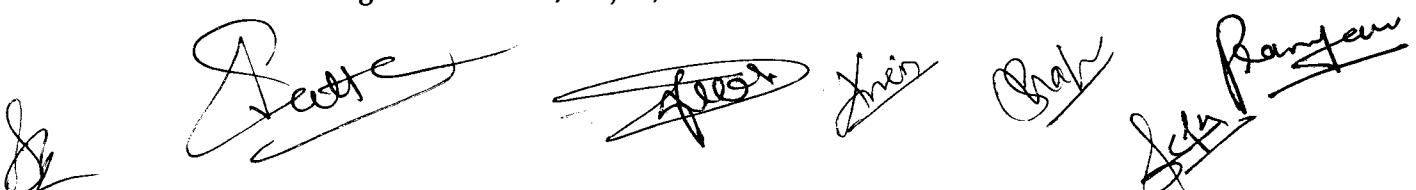
UNIT - IV Computer Arithmetic and I/O Techniques: Addition, Subtraction, Division and Multiplication Algorithm, Input-Output Interface, asynchronous data transfer; **Modes of transfer**: Programmed I/O, Interrupt Mechanism, Direct Memory Access (DMA), I/O Processor. **Memory Organization**: Cache Memory Organization, Virtual Memory.

UNIT - V Introduction to Parallel Processing

Types of parallelism, Degree of parallelism (DOP), Application of parallel processing, Flynn's Classification: SISD, SIMD, MISD, and MIMD.

BOOKS RECOMMENDED:

1. Computer System Architecture,*Morris Mano*, PHI
2. Computer Organization and Architecture, *William Stalling*, PHI
3. Computer organization and Architecture, *J.P.Hayes*, TMH
4. Digital Computer Logic Design, *Morris Mano*, PHI
5. Fundamentals of Microprocessors, *B. Ram*
6. Computer System Architecture and organization, *Dr.M. Usha, T. S. Shrikant*, Wiley publication.
7. Digital Computer Electronics, *Malvino*.
8. Structured Computer Organization, *Andrew M. Tanenbaum*, PHI
9. Modern Digital Electronics, *R.P.Jain*, Tata McGrawHill



Software Engineering Subject Code - MCA105

Max Marks : 100

Min Marks : 40

UNIT - I Software Engineering Fundamentals:

Introduction to Software Engineering; Software Engineering Principles(Layers); Software Process – Process Framework, Umbrella Activities, Process Adaptation; Software Crisis; Process Models-Waterfall Model, Prototype Model, Incremental Model, Spiral Model, RAD Model; Agile Process.

UNIT - II Software Analysis and Design:

Requirement Engineering; Analysis Model-Data Flow Diagram, Data Dictionary, E-R Diagram, Decision Table; Software Requirements Specification(SRS), Structure of SRS; Pseudo code; Software Design; Design Process; Design Concepts-Abstraction, Partitioning, Modularity, Information Hiding, Refinement, Refactoring; Function Oriented Design; Object Oriented Design; Cohesion and Coupling.

UNIT - III Software Quality and Case Tools:

Software Metrics, Categories of Metrics, Function Point Metric; Software Quality; McCall's Quality Factors; Software Maturity Model-CMM,CMMI; Software Quality Assurance; ISO Standards-9000, 9001 and 9126; Software Reliability; Case Tools and its Scope; Case Objectives; Architecture of Case Tools; Case Classification.

UNIT - IV Coding and Testing:

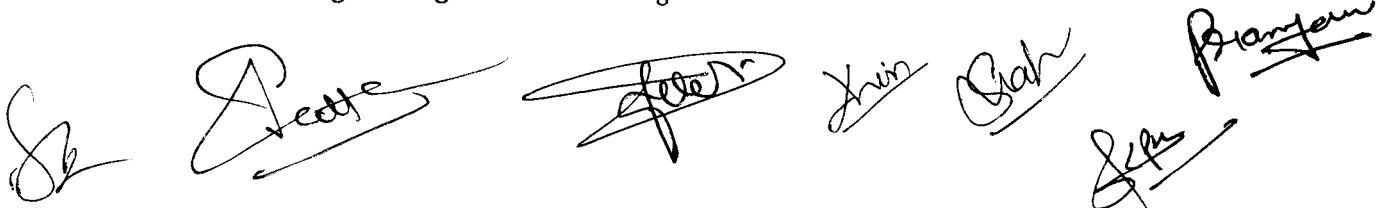
Programming Style; Structured Programming; Coding Standard; Internal Documentation; Software Testing-Verification and Validation; Alpha and Beta Testing; Levels of Testing-Unit, Integration and System Testing; Testing Techniques- White Box, Black Box; Cyclomatic Complexity; Test Plan; Debugging-Debugging Process, Debugging Strategies(Approaches).

UNIT - V Software Maintenance and Project Management:

Risk Management – Software Risk, Risk Identification; Introduction to Software Maintenance, Categories of Maintenance; Belady and Lehman Model; Boehm Model; Project Management Concept - People, Product, Process, Project; Software Team; Software Project Planning; Software Project Estimation; Cost Estimation Model(COCOMO, COCOMO II, Putnam-SLIM, Walston and Felix); Software Reengineering.

RECOMENDED BOOKS:

1. **Software Engineering: A Practitioner's Approach, Roger S. Pressman, TMH**
2. **An Integrated approach to Software Engineering, Pankaj Jalote, Narosa Publications**
3. **Software Engineering, Bharat Bhushan Agarwal.**



SCHEME OF TEACHING AND EXAMINATIONS 2020-21
MASTER OF COMPUTER APPLICATIONS (2 Years)

SECOND SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit $L+(T+P)/2$	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA201	Programming in Python	3	2	-	4	100	25	-	125	40	15	-	55
MCA202	JAVA Programming	3	2	-	4	100	25	-	125	40	15	-	55
MCA203	Data Structure and Algorithms	3	2	-	4	100	25	-	125	40	15	-	55
MCA204	Elective – I	3	2	-	4	100	25	-	125	40	15	-	55
MCA205	Elective – II	3	2	-	4	100	25	-	125	40	15	-	55
MCA206	Lab-IV : Programming in Python	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA207	Lab-V : Programming in JAVA	-	-	2	1	-	50	50	100	-	30	25	55
MCA208	Lab-VI : Programming Based on MCA203	-	-	2	1	-	50	50	100	-	30	25	55
MCA209	Group Discussion	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	1000	200	180	100	480

Sr. No.	Elective –I	Elective -II
1.	Theory of Computations	Data Ware Housing And Mining
2.	Advanced Computer Architecture	Internet of Things
3.	Computer Graphics	Mobile Computing

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- Dr. S. R. Patil
- Dr. A. P. Joshi
- Dr. S. S. Patil
- Dr. S. S. Patil
- Dr. S. S. Patil

Programming in Python

Subject Code - MCA201

Max. Marks: 100

Min Marks : 40

UNIT - I

Introduction to Python Programming: What is a Program, Formal and Natural Languages, Why use Python, Uses of python, Strengths & Drawbacks, The Python Interpreter, Running Python, The IDLE User Interface, The Interactive Prompt, Script Mode, Dynamic Typing , Debugging. **Types, Operators, Expressions & Statements:** Values and Types, Assignment Statement, Variable Names, Expressions & Statements, Order of Operations, String Operations, Comments.

UNIT - II

Conditionals: Boolean Expressions, Logical operators, Conditional & Alternative Execution, Chained and Nested Conditions. **Iterations:** Reassignment, Updating Variables, The "for" and "while" statements, break. **Strings:** String is a sequence, len, Traversal with a for loop, String Slices, Searching, Looping and Counting, String Methods, the "in" operator, String Comparison.

UNIT - III:

Lists: List is a Sequence, Traversing and other Operations, List Slices, List Methods, Map Filter and Reduce, Deleting Elements, Lists and Strings, Objects and Values, Aliasing, List Arguments. **Tuples:** Tuple Assignments, Tuples as Return Values, Variable Length Argument Tuples, Lists and Tuples, Dictionaries and Tuples, Sequence of Sequences. **Dictionaries:** A Mapping and as a Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables. **Sets:** Properties & Operations, Frozen Sets.

UNIT - IV:

Functions: Function Calls, Math Functions, Composition, Adding New Functions, Definitions & Uses, Flow of Execution, Parameters and Arguments, Why Functions, Stack Diagrams, Void and Fruitful Functions, Return Values, Incremental Development, Composition, Boolean Functions, Checking Types. **Recursion:** Stack Diagram for Recursive Functions, Infinite Recursion, Taking Input from Keyboard, More Recursion.

UNIT - V:

Files: Files & Persistence, Reading and Writing, Format Operator, Filenames and Paths.

Miscellaneous Topics: Catching Exceptions, Databases, Pickling, Pipes, Modules. **Object-Oriented Programming:** Programmer defined Types, Attributes, Instances as Return Values, Classes and Functions, Classes and Methods, Inheritance and Polymorphism.

BOOKS RECOMMENDED:

1. Learning Python 5th Edition, Mark Lutz, O'Reilly Publications
2. Core Python Programming, R. Nageshwara Rao, Dreamtech Publications
3. Think Python 2nd Edition, Allen B. Downey, O'Reilly Publications
4. Beginning Python: Using Python 2.6 and Python 3.1, James Payne, Wiley
5. Python Essentials Reference, 4th Edition, David M. Beazley, Addison - Wesley
6. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries et al., Pragmatic Programmers

JAVA Programming

Subject Code - MCA202

Max. Marks: 100

Min Marks : 40

UNIT - I: Introduction to Java Programming

An overview of Java: Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, **Variables:** Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; **Operators:** Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [] and instance of operator. **Control Statements:** Java's Selection statement, Iteration Statement, Jump Statement. **Arrays:** Declaring Array variables, constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

UNIT - II: Define the Class and interface

Introducing Classes: Class Fundamentals, Declaring Object, Assigning Object Reference Variables, **Defining Methods:** method overloading and overriding, Using objects as parameter, Constructors, Garbage collection, finalize () method. **Inheritance:** Inheritance basic, method overloading, object reference this and super, Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, **Package:** Define package, CLASSPATH, importing package, **Interface:** Define an interface, implementing interface, extending interface, variable in interface, **Overview of nested class:** Top level nested class and interface, Non static inner class, Local class, Anonymous class.

UNIT - III: Exception handling and Multithreading

Exception Handling: Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, throws, and finally. **Multithreading:** Creating Thread, Thread Priority, Synchronization, Thread Scheduler, Running & Yielding, Sleeping & Waking Up, Waiting & Notifying, Suspending & Resuming; miscellaneous methods in thread class.

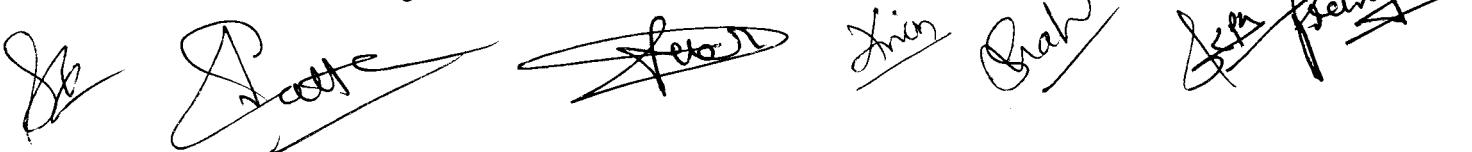
UNIT - IV: Fundamental Library Classes of Java and Input / Output

Object class, String class, String Buffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, Array List class, Liked List class, Tree Set, Comparator, Vector, Stack. **I/O Classes and Interfaces:** File, Buffer Stream, Character Stream, and Random Access for files, Object Sterilization.

UNIT - V: Event Handling: Overview of Event Handling, Event Hierarchy, The Delegation Event Model, Event Classes, KeyEventClass, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Event Adapters. **GUI Programming:** Introduction to Swing, History, Features, Components and Containers, Swing Packages, Painting, Swing Component Classes: JLabel, JTextField, Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox, Trees, JTable, Swing Menus:< Main Menu, PopUp Menu, ToolBar. **JDBC:** Introduction to JDBC, JDBC Drivers Type, Connection, JDBC URLs, Driver Manager, Statement - Creating, Executing, Closing, Result Set - Data Types and Conversions. Prepared Statement, Callable Statement, Mapping SQL and Java Types.

BOOKS RECOMMENDED:

1. Java: The Complete Reference, *Herbert Schildt*, Oracle Press.
2. Core Java: Volume-I & Volume 2, *Cay S. Horstmann & Gary Cornell*, PEARSON
3. Programming with Java, *E. Balagurusamy*, McGraw Hill Education
4. Core Java, *R.Nageshwar Rao*, Dreamtech Press



Data Structure and Algorithms **Subject Code - MCA203**

Max. Marks: 100

Min Marks : 40

UNIT - I Array and Linked Lists

Introduction to data structure, Primitive data structure, Introduction to Algorithm analysis for time and space requirement, Rate of growth and Order notation, Basic time and space analysis of an algorithm. Linear Array, Representations of Array in Memory, Traversing, Insertion and Deletion in Linear Array, Multidimensional Array. Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists, Circular Linked List.

UNIT - II Stack and Queues

Stacks Definition, concepts, operation and application of Stacks, Recursion and Polish notations, Quick sort, tower of Hanoi, Queue, Priority Queue: definition concepts, operation and application of Queue, circular queue and Dequeue. Linked representation of stack and queue.

UNIT - III Trees and their Representations:

Terminologies related to trees, Binary Tree, complete binary tree, almost complete binary tree; Tree Traversals-preorder, in order and post order traversals, their recursive and non-recursive implementations, Expression tree-evaluation, Linked representations of binary tree, operations. Header nodes; threads, **Binary Search Tree**: searching, Inserting and deleting in BST, Heap; Path Lengths; Huffman's Algorithms. Basic idea of AVL Tree.

UNIT - IV Graphs:

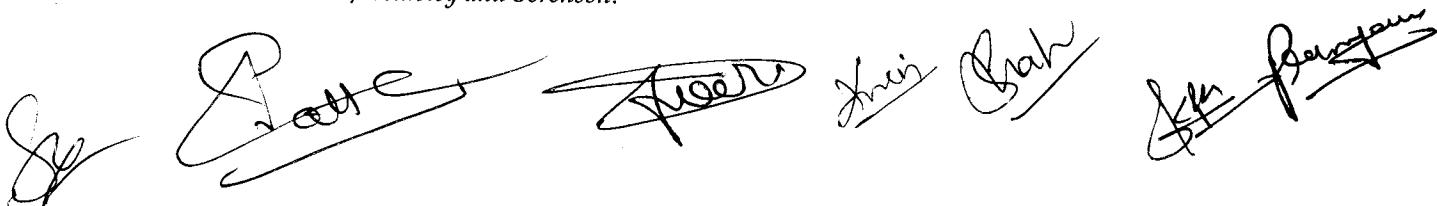
Related definitions; Graph representations- adjacency matrix, adjacency list, adjacency multi-list; Traversal schemes - depth first search, breadth first search; Minimum spanning tree; Shortest path algorithm; Kruskal and Dijkstra's algorithms.

UNIT - V Searching, Hashing and Sorting:

Searching : Linear Search, Binary Search, Searching and data modification Hashing- Basics, methods, collision, resolution of collision, chaining; Internal Sorting, External sorting - Bubble Sort, Insertion Sort, Selection Sort, Merge sort, Radix sort, heap sort.

BOOKS RECOMMENDED:

1. **Data Structures and Program Design in C**, Kruse R.L, PHI.
2. **Data Structures using C and C++**, Tanenbaum, PHI.
3. **Fundamental of Data Structures**, Horowitz and Sahani, Galgotia Publishers.
4. **Data Structures**, Schaum Series.
5. **Data Structures**, Bhagat Singh.
6. **Data Structures**, Trembley and Sorenson.



Handwritten signatures of faculty members are present at the bottom of the page. From left to right, they appear to be:

- S. Bhatia
- R. K. Srivastava
- A. K. Srivastava
- Z. A. Shah
- J. P. Patel

Elective I: Theory of Computation

Subject Code - MCA204

Max. Marks: 100

Min Marks : 40

UNIT - I:

Alphabet, String and language, Finite state Machines, finite automata with ϵ -moves, Conversion of NDFA to DFA, Removal of ϵ -transition from NDFA, Two way finite automata, finite automata with output, Mealy & Moore machines, Applications of finite automata, minimization of finite automata.

UNIT - II:

Chomsky classification of Languages , Regular Expression and Language, Properties of Regular languages, Pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for Regular sets, Myhill-Nerode theorem.

UNIT - III:

Context free grammars and their properties, derivation tree, simplifying CFG, ambiguity in CFG, Chomsky Normal form, Greibach Normal form, Pumping lemma for CFL, Closure properties of CFL.

UNIT - IV:

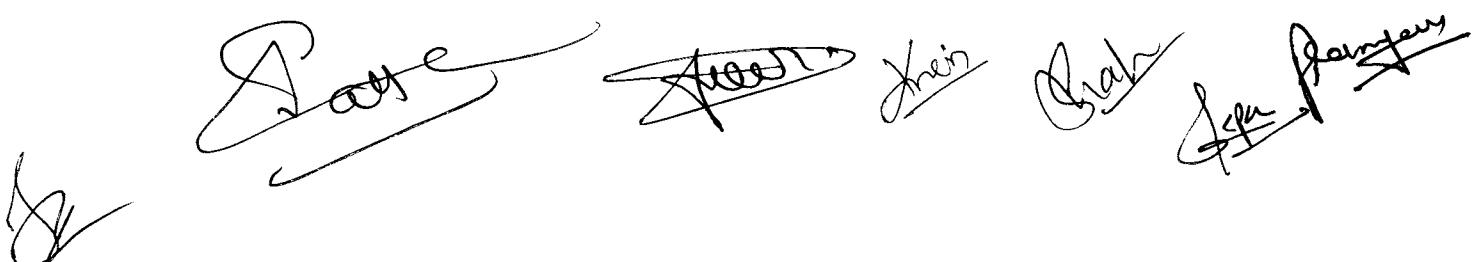
Pushdown automata: Informal description, Definition, Determinism and Non determinism in PDA, Equivalence of PDA's and CFL's. Two way PDA, Concept of Linear Bounded Automata, context sensitive grammars and their equivalence, Turning machine construction, determinism and non-determinism in TM, Multi tape, multi-track TM.

UNIT - V:

Undecidability, Universal turning machine and an undecidable problem, recursive function theory, Recursively enumerable sets, recursive sets, partial recursive sets, Church's hypothesis, post correspondence problem, Russell's paradox.

RECOMMENDED BOOKS:

1. **Theory of Computer Science, Automata Languages & computation**, K.L.P. Mishra, N. Chandrashekharan, PHI.
2. **Introduction to Automata Theory Language and Computation**, John E. Hopcroft and Jeffrey D. Ullman, Narosa Publication house.
3. **Introduction to Formal Languages, Automata Theory and Computation**, Kamala Krithivasan and Rama. R, Pearson.
4. **Introduction to Automata Theory Languages and Computation**, John E. Hopcroft, Jeffrey, D. Ullman and Rajeev Motwani.



A row of five handwritten signatures in black ink, likely belonging to faculty members, are displayed horizontally across the bottom of the page. From left to right, the signatures appear to read: "Batra", "Amit", "Kumar", "Chakraborty", and "Ganguly". Below these signatures, there is a small, partially visible handwritten signature that appears to begin with the letter 'S'.

Elective I: Advanced Computer Architecture

Subject Code - MCA204

Max. Marks: 100

Min Marks : 40

UNIT I:

Introduction - Feng's and Flynn's classification scheme, Multiprocessor and Multicomputer, UMA, NUMA, COMA, NORMA, memory models, parallel computer and its type. Applications of Parallel Computers.

UNIT II:

System Interconnect Architecture - Static and Dynamic, Hypercube Interconnection network, multistage interconnection networks-architecture and routin, design consideration, throughput delay, blocking and non-blocking properties. Performance Metrics and Benchmarks.

UNIT III:

Principle of pipelining-overlapped parallelism, Linear and non-linear pipelining, reservation table, calculation of MAL. Types of Instruction Pipeline. Arithmetic pipeline designs example -Floating point adder, pipelined multiplier.

UNIT IV:

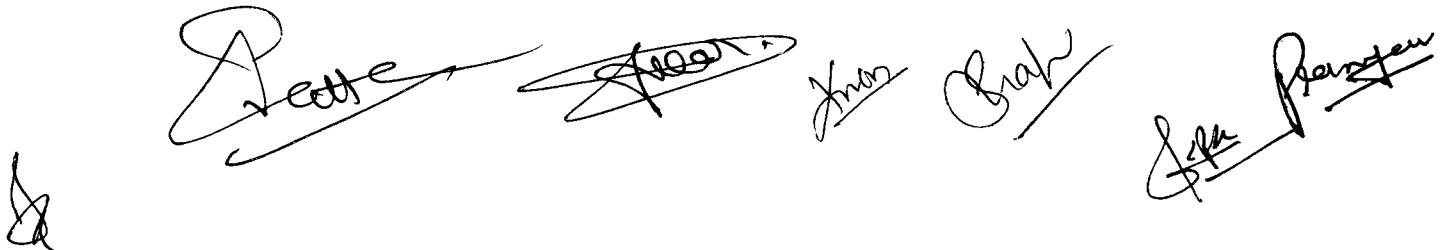
Advanced processor Technology - RISC, CISC, VLIW architectures, Hazard detection and resolution, functional organization of instruction in IBM 360/91.

UNIT V:

Exploring parallelism in program- multidimensional arrays. Parallel Algorithm-Matrix addition, subtraction, multiplication -block and SIMD. Bitonic sort, sorting on linear array processors. Bernstein's condition, ISO efficiency concept.

BOOKS RECOMMENDED:

- 1 Computer Architecture & Parallel Processing,*Kai Hwang and F.A. Briggs*, McGraw Hill.
- 2 Advanced Computer Architecture,*Kai Hwang*, McGraw Hill.
- 3 Parallel Computing, *M.R. Bhujade*, New Age Publication.
- 4 Parallel Computing Theory and Practice,*Michael J. Quinn*, Tata McGraw Hill



Elective I: Computer Graphics

Subject Code - MCA204

Max Marks : 100

Min Marks : 40

UNIT - I: Display Devices

Refresh Cathode-Ray tubes, Random Scan and Raster Scan Display, Color CRT Monitors, Color display techniques: shadow masking and Beam penetration, Direct view storage tubes, Flat Panel display: plasma panel displays, LED & LCD devices. **Interactive Graphics:** Physical Input devices, logical classification, input function, interactive picture construction techniques.

UNIT - II: Output Primitives

Points and Lines, Line drawing Algorithms: DDA Algorithm and Bresenham's Line Algorithm, Antialiasing. Circle generating Algorithms: Bresenham's Circle Algorithms, Midpoint Circle Algorithm, Ellipse Generating Algorithm: Midpoint, Character generation and text display. Output command for various geometrical shapes, Filled Area Primitive: Scan line polygon fill algorithm, Boundary fill algorithm, Flood fill algorithm. Attribute of outputs primitives: line attribute, Area-fill Attribute, Text attribute, Bundled attributes, Area-Fill.

UNIT -III: Two Dimensional Transformation and Viewing

Transformation: Translation, Scaling, Rotation, Reflection, Shearing. Matrix representations of Transformation and Homogenous Coordinates, Composite Transformations and Concatenation of transformation. **Two-Dimensional Viewing Coordinate system:** World/user coordinates, Device coordinate, Normalized device coordinates, Viewing pipeline: windows and viewports, Viewing transformation pipeling, Window-to-Viewport coordinate transformation, Clipping algorithm: point, line clipping algorithm: Cohen-Sutherland, Liang Barsky, Nicholl-Lee-Nicholl, Line Clipping, polygon clipping algorithm : Sutherland-Hodgman, Weiler-Atherton, text clipping.

UNIT - IV: 3-D Transformation and Viewing

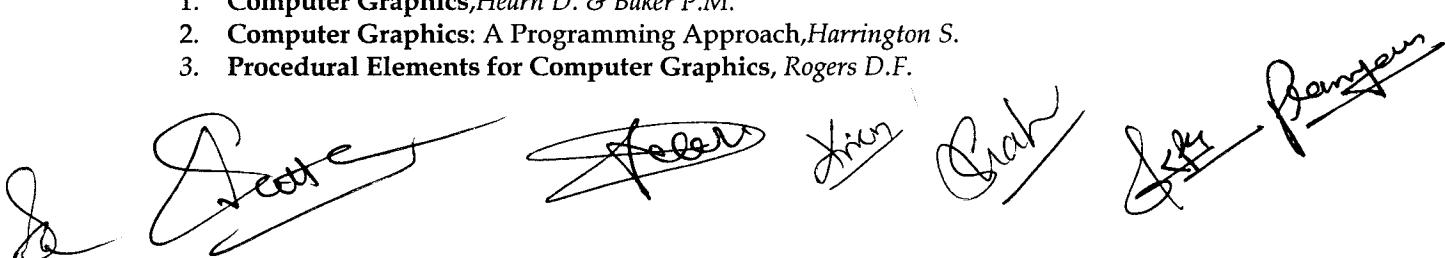
3-D Transformation: Translation, Scaling, Rotation about standard and arbitrary axis, Other Transformation: Reflections and shears, Transformation commands. **Viewing:** Viewing Pipeline, Viewing Coordinates: transformation from world to viewing coordinates.

UNIT - V: 3-D Projection

Projection: Parallel Projection, Perspective Projection, Normalized view volume, viewport Clipping, Clipping in Homogeneous Coordinate. **Visible-Surface detection algorithms:** Back-Face removal, Depth Buffer method, Scan line method, Depth sorting method, Area subdivision and Octree method.

RECOMMENDED BOOKS:

1. **Computer Graphics, Hearn D. & Baker P.M.**
2. **Computer Graphics: A Programming Approach, Harrington S.**
3. **Procedural Elements for Computer Graphics, Rogers D.F.**



Elective II: Data Warehousing and Mining

Subject Code - MCA205

Max. Marks: 100

Min Marks : 40

UNIT - I: Introduction to Data Warehousing and OLAP Technology for Data Mining
What is Data Mining?, Data Mining: On what kind of data?, KDD Process, Data Mining Functionality, Are all the patterns interesting?, Attribute Types, What is Data Warehouse?, Data Cube: A multi-dimensional data model, Data Warehouse Architecture, Data Warehouse Implementation, Data Warehouse Usage(Applications), OLAP Operations, Concept of Transaction, Transactional Database, Distributed Database, Commit Protocols.

UNIT - II: Data Preprocessing, Data Mining Primitive, Languages and System Architecture

Why preprocess the data?, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Concept Hierarchy Generation, Data Mining Primitive, Data Mining Query Language, Architecture of Data Mining System.

UNIT - III: Mining Association Rules in Large Databases

Association Rule Mining, Mining Single-dimensional Boolean Association Rules from Transactional Databases (Apriori algorithm, FP-Tree growth algorithm), Mining Multilevel Association Rules from Transactional Databases, Mining Multi-dimensional Association Rules from Transactional Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-based Association Mining.

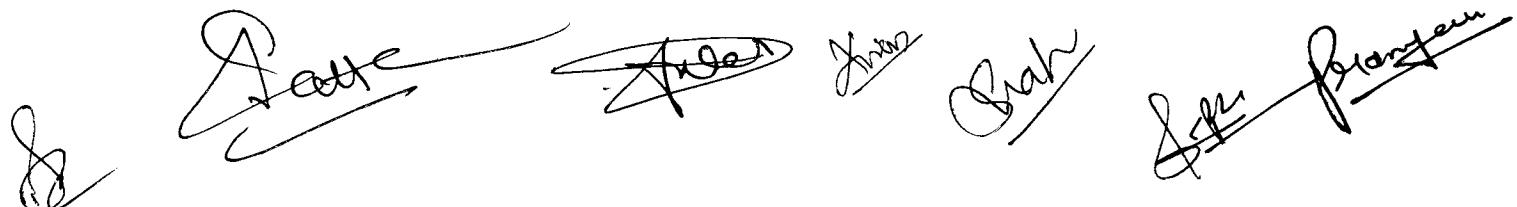
UNIT - IV: Classification, Prediction and Cluster Analysis

What is Classification?, What is Prediction?, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification based on Association, Other Classification Methods, Prediction, Classification Accuracy, What is Cluster Analysis?, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

UNIT - V: Mining Complex Types of Data & Applications and Trends in Data Mining
Mining Time-series and Sequence Data, Mining Spatial Databases, Mining Multimedia Databases, Mining Text Databases, Mining World Wide Web, Data Mining Applications, Social Impact of Data Mining, Trends in Data Mining.

RECOMENDED BOOKS:

1. **Data Mining: Concepts and Techniques**, *Jiawei Han and MichelineKamber*
3. **Data Mining Techniques**, *Arun K Pujari*,
4. **Data Mining Introductory and Advanced Topics**,*Margaret H Dunham*, Pearson

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Elective II: Internet of Things

Subject Code - MCA205

Max Marks : 100

Min Marks : 40

Unit – I OVERVIEW:

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. **M2M and IoT Technology Fundamentals**- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Unit – II REFERENCE ARCHITECTURE:

IoT Architecture – State of the Art – Introduction, State of the art, Reference Model and architecture, **IoT reference Model** – IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Real-World Design Constraints – Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Unit – III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS:

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

Unit – IV TRANSPORT & SESSION LAYER PROTOCOLS:

Transport Layer Transmission Control Protocol (TCP), Multipath Transmission Control Protocol (MPTCP), User Datagram Protocol (UDP), Datagram Congestion Control Protocol (DCCP) , Stream Control Transmission Protocol (SCTP), Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS))

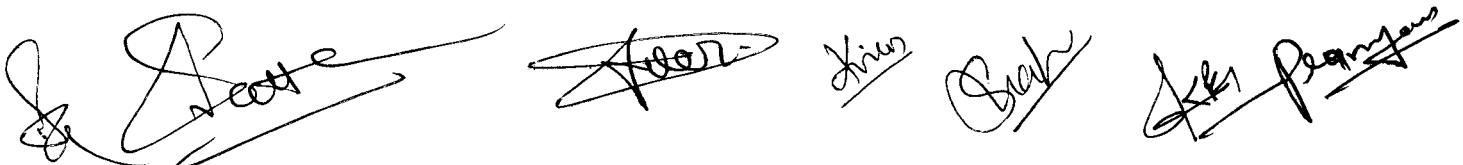
Session Layer- Hyper Text Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Message Queue Telemetry Transport (MQTT)

Unit – V SERVICE LAYER PROTOCOLS & SECURITY:

Service Layer – oneM2M, European Telecommunications Standards Institute (ETSI) M2M (Machine-to-Machine), OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, Routing Protocol for Low-Power and Lossy Networks (RPL), Application Layer

RECOMMENDED BOOKS:

1. **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**, Jan Holler, Vlasisos Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, Academic Press, 2014
2. **Learning Internet of Things**, Peter Waher, PACKT publishing
3. **Architecting the Internet of Things**, Bernd Scholz-Reiter, Florian Michahelles, Springer
4. **Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications**, Daniel Minoli, Willy Publications
5. **Internet of Things (A Hands-on Approach)**, Vijay Madisetti and Arshdeep Bahga, VPT, 2014.

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Elective II: Mobile Computing

Subject Code: MCA205

Max. Marks: 100

Min Marks : 40

UNIT I: Introduction

Introduction to Mobile Communication, Evolution of modern Mobile wireless communication systems, Applications of mobile communication, Need and Requirements of Mobile communication, satellite systems and Applications, Type of satellite systems, characteristics of satellite systems, Global Positioning system (GPS) and Applications, some open research topics in mobile communication

UNIT II: Mobile Communication Systems

Introduction, Cellular System Infrastructure, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign Network, Home Agent , Foreign Agent, Care-of Address, IP Packet Delivery, Agent Discovery, Agent Solicitation , Registration, Tunneling , Dynamic host configuration protocol

UNIT III: Mobility and Frequency Management

Mobility management in wireless Networks, Handoff Techniques, Handoff detection and Assignment, Types of Handoff, channel Reservation for Handoff calls, WLAN transmission technology, Frequency hopping, Direct Sequence Modulation, Frequency division, Orthogonal Frequency Division, Spectrum utilization.

UNIT IV: Wireless LANs and PANs

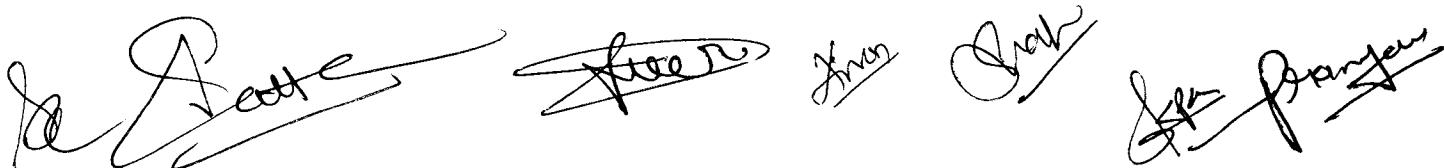
Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet, Home RF, Home RF Technology, Hiper LAN, Bluetooth , Advantages and disadvantages of Wireless LAN, Infra redvs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

UNIT V: Mobile Adhoc Network

Introduction to Mobile Adhoc Network (MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table-Driven Routing Protocol - Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- Adhoc On Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybird Protocol - Zone Routing Protocol.

RECOMMENDED BOOKS:

1. **Mobile Communication:** Jochen H. Schiller, Pearson Education Publication
2. **Introduction to Wireless and Mobile Systems:** D.P. Agrawal, Qing-An Zing, Vikas Publishing House.
3. **Wireless Communication and Networks:** ItiSahaMisra, McGraw Hill education.
4. **Wireless and mobile Communication:** T.G. Palanivelu, R. Nakkeeran, PHI Publication.
5. **Mobile Commerce:** KarabiBandyopadhyay, PHI Publication.

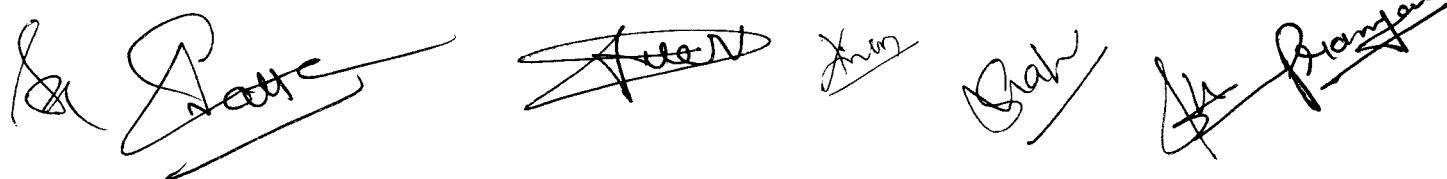
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SCHEME OF TEACHING AND EXAMINATIONS 2020-21
MASTER OF COMPUTER APPLICATIONS (2 Years)

THIRD SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA301	.Net Technology	3	2	-	4	100	25	-	125	40	15	-	55
MCA302	Computer Network & Data Communication	3	2	-	4	100	25	-	125	40	15	-	55
MCA303	Artificial Intelligence	3	2	-	4	100	25	-	125	40	15	-	55
MCA304	Elective – III	3	2	-	4	100	25	-	125	40	15	-	55
MCA305	Elective – IV	3	2	-	4	100	25	-	125	40	15	-	55
MCA306	Lab-VII : Programming in .Net Technology	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA307	Lab-VIII: Networking	-	-	2	1	-	50	50	100	-	30	25	55
MCA308	Lab-IX : Mini Project	-	-	2	1	-	50	50	100	-	30	25	55
MCA309	Seminar	-	-	2	1	-	25	-	25	-	15	-	15
	TOTAL	15	10	12	26	500	300	200	1000	200	180	100	480

Sr. No.	Elective –III	Elective -IV
1.	Compiler Design	Big Data Analytics
2.	Soft Computing	Cloud Computing
3.	Digital Image Processing	Cyber Security



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.Net Technology
Subject Code - MCA301

Max. Marks: 100

Min Marks : 40

UNIT - I : Inside the .NET framework :

Overview of .net framework, Managed Execution process, CLR, common language specification, JIT Compilation , MSIL, Namespaces, Assemblies, metadata, Common Type System, cross language, interoperability, Garbage collection.

UNIT - II : Programming with .NET Framework

Windows form : working with Visual Studio IDE, creating a .NET solution, MDI application, components and controls, Data types, variables, Type conversions, Operators, Control Structures : conditional statements, loops, arrays, types of methods, method data, Introduction to exception handling-exception statements.

UNIT - III : XML, Windows process and File Handling

Types, structures, Enumerations, classes, Interfaces, Working with files-Files and directories, streams, Readers and writers, Reading and writing XML files, XML serialization, processing Transaction, Monitoring and Managing Windows Process, retrieving information about process.

UNIT - IV : Building .NET Framework Applications

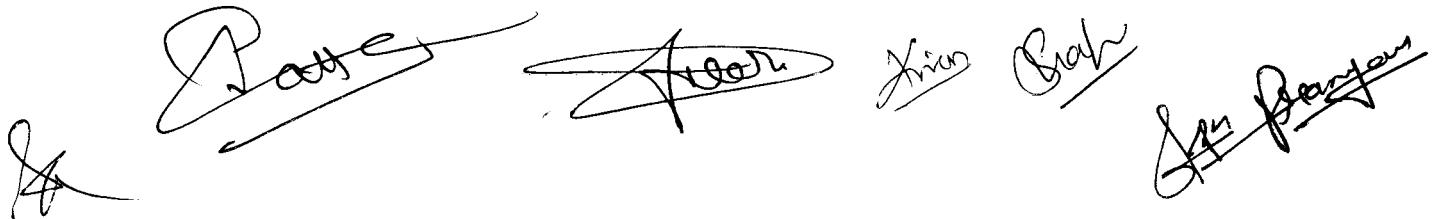
Introduction to ASP .NET, Differentiate classic ASP and ASP .NET, Web application, Web forms, Form validations – Client side, Server side, controls in web forms, Events in Web form.

UNIT - V : Advanced concepts and Database Programming

Delegates, ADO .NET Architecture, .NET dtat provider, dataset components, creating database applications using Window forms and web forms (Database connectivity through ADO .NET), Introduction to web services, web services for Mobile application, Remote overview.

BOOKS RECOMMENDED

1. MSDN online – by Microsoft
2. Visual Basic .NET Complete - By BPB Publications, New Delhi.
3. The Complete Reference VB .NET – By Jeffery R. Shapiro, Tata Mcgraw Hill.
4. Professional VB .NET 2003 – by bill Evjen & others, Wiley Dreamtech India (P) Ltd. New Delhi.



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Computer Networks & Data Communication

Subject Code - MCA302

Max Marks : 100

Min Marks : 40

UNIT – I

Introduction to Computer Networking: The Concept of Networking, Data Communication, Required network elements, The Role of Standards Organization. Line Configuration-Point to Point and Multipoint, Various Topologies- Star, Bus, Ring etc., Transmission Mode- Simplex, Half-duplex and Full-duplex, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks. The OSI and TCP/IP Reference Model.

UNIT – II

Transmission of Digital Data: Shannon's and Nyquist theorems for maximum data rate of a channel, Sampling Theorem. Transmission media- Guided Media-Twisted Pair, Coaxial Cable, Fibre Optic. Unguided Media. Analog and digital data Transmission- parallel and serial transmission. Switching- Circuit, Message, Packet switching. Multiplexing- TDM, FDM, WDM and CDM. Modulation- brief overview of classification of modulation. Connectors – RJ45, BNC-T Connetcor.

UNIT – III

Data Link Layer and Routing Algorithms: Line Discipline- ENQ/ACK & Poll/Select, Flow Control- stop and wait, sliding window, Error Detection and Correction- Parity, Checksum, CRC, Hamming Code. Multiple access protocols- ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA. IP address classes and subnet mask. IPv4 and IPv6 header format, Classes of Network, Subnet mask, Routing algorithms- Distance Vector and Link State Routing.

UNIT – IV

Transport Layer, Application Layer, ATM and Congestion Control: TCP and UDP header format, Email- SMTP and POP. Domain Name System, HTTP, WWW
ATM- ATM Cell, ATM Switch, Multistage Switch, ATM Reference Model. Congestion control algorithm- Leaky bucket and token bucket.

UNIT – V

Network Security: Cryptography- Symmetric Key and Asymmetric Key, Components of Network Security- Confidentiality, Authentication, Integrity and Non Repudiation. DES, RSA, Diffie Hellman algorithm, Virus, Worms, Trojan, Digital signature, SSL, IPsec.

BOOKS RECOMMENDED:

1. Computer Networks - A S Tanenbaum
2. Data Communication and Networking - B A Forouzan
3. Data and Computer Communications - William Stallings
4. Computer Networks and Internets - Douglas E. Comer

Handwritten signatures and dates are present in the bottom right corner of the page. The signatures appear to be "Lalit", "Scott", "Kumar", and "Ponsetti". Below each signature is a date: "04-03-2020", "04-03-2020", "04-03-2020", and "04-03-2020" respectively.

Artificial Intelligence Subject Code - MCA303

Max. Marks: 100

Min Marks : 40

UNIT - I

Introduction to AI: Foundations of AI, Philosophy and History; the AI problems, AI technique; The Turing Test. **Intelligent Agents:** Agents and Environments, the Concept of Rationality, the Nature of Environments and the Structure of Agents. **Problem solving & State Space Search:** General problem solving: defining problems as State Space Search, Problem Characteristics; Production Systems & their characteristics.

UNIT - II

Exhaustive Searches: Generate and Test, Breadth First Search, Depth First Search and DFID **Heuristic Search Techniques:** Best first search; A* algorithm; Problem Reduction AND/OR Graphs and AO* algorithm. **Local Searches & Optimizations:** Hill climbing and its variants; Branch and Bound technique. **Constraint Satisfaction Problems:** Definition; Constraint Propagation and Backtracking. **Game Playing:** Mini-Max Search Procedure; Alpha-Beta Cutoffs; Additional Refinements.

UNIT - III

Knowledge Representation: Types of Knowledge; Knowledge Representation Issues; **Logic:** First order Predicate Logic; Representation of facts in FOL; Inference in FOL; Resolution Principle, Clausal Form and Unification; **Inference Mechanisms:** Forward and Backward Chaining; **Slot and Filler Structures:** Semantic Networks; Frame Systems and value inheritance; Conceptual Dependency; Scripts;

UNIT - IV

Reasoning under Uncertainty: Non-monotonic Reasoning, Probabilistic Reasoning and Uncertainty; Probability Theory; Baye's Theorem and Bayesian networks; Certainty Factor; Dempster-Shafer Theory. **Planning:** Overview; The Blocks Word; Component of a Planning System: Goal Stack Planning; Nonlinear Planning; **Natural Language Processing:** Introduction, Overview of Linguistics, Grammars and Languages: context sensitive and context free grammar; Chomsky Hierarchy, Parsing techniques: Recursive Transition Nets, Augmented Transition Nets, Semantic Analysis: Case, Logic and Semantic grammars;

UNIT - V

Expert Systems: Introduction, Characteristics, History and Applications of expert systems; Expert System Shells; Rule Based Systems Architectures, Non Production System Architectures; Knowledge Acquisition and Validation; Case Studies: MYCIN& DENDRAL.

Learning: Rote learning; Learning by Taking Advise; Learning in Problem Solving; Induction; Explanation based learning; Discovery; Analogy.

BOOKS RECOMMENDED:

1. Artificial Intelligence 3rd Edition, Rich E., Knight K. and Nair S. B., McGraw Hill Education
2. Artificial Intelligence: A Modern Approach 3rd Edition, Russell S. J. and Norvig P., Pearson Education
3. Introduction to Artificial Intelligence and Expert Systems, Patterson D. W., PHI
4. Principles Of Artificial Intelligence, Nilson N. J., Narosa Publications
5. Artificial Intelligence3rd Edition, Winston P. H., Pearson Education
6. A First Course in Artificial Intelligence, Khemani D., McGraw Hill Education



Elective III: Compiler Design

Subject Code - MCA304

Max. Marks: 100

Min Marks : 40

UNIT - I

Introduction to Compiling and one pass compiler:

Compilers & translators, Phases of compilers, Compiler writing tools, Bootstrapping; overview of one pass compiler.

Finite Automata and Lexical Analysis:

Role of Lexical Analyzer; specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, DFA and NFA, Implementation of lexical analyzer; tools for lexical analyzer -LEX.

UNIT - II

Syntax analysis & Parsing Technique:

Context free grammars; Bottom up parsing, Shift reduce parsing, Operator Precedence parsing, Top down parsing, elimination of left recursion; recursive descent parsing, Predictive parsing.

Automatic Construction of Efficient parsers:

LR parser, construction of SLR and canonical LR parser table, Using ambiguous grammar, An automatic parser the generator, YACC, Using YACC with ambiguous grammar, creating YACC lexical analyzer with LEX, Error recovery in YACC.

UNIT - III

Syntax Directed Translation:

Syntax directed schema, Construction of syntax tree, Translation with top down parser.

Run Time Environment:

Source Language issues, Storage organization and allocation strategies, Parameter passing, Implementation of block-structured language.

UNIT - IV

Intermediate Code Generation:

Intermediate languages; Postfix notation, Three-address code, Quadruples and triples, Translation of assignment statements, Boolean expression, and Procedure call.

Error Detection & recover:

Lexical & syntactic phase error, semantics error.

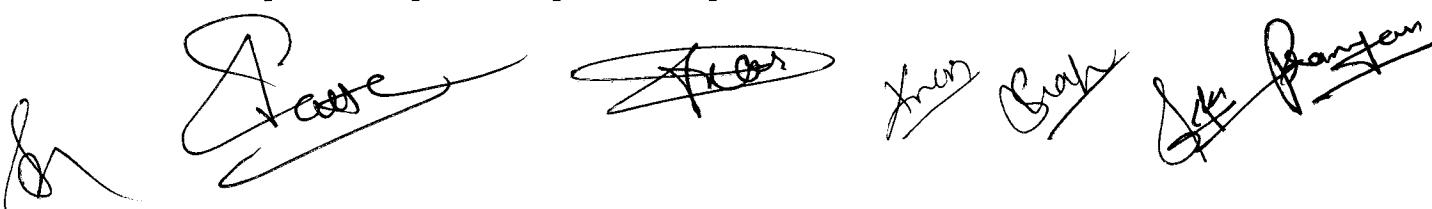
UNIT - V

Code Optimization:

Optimization of basic block, Loop optimization global data flow analysis, Loop invariant computation. **Code Generation:** Issue and design of code generator, the target machine, a simple code generator.

BOOKS RECOMMENDED:

- **Principles of Compiler Designing** - Alfred V. Aho and J.D. Ullman.
- **Principles of Compiler-Principles, Technique and Tools** - Alfred V. Aho, Ravi Sethi



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Elective III: Soft Computing

Subject Code – MCA304

Max. Marks: 100

Min Marks : 40

UNIT - I: Introduction to Fuzzy Logic System

Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System.

UNIT - II: Introduction to Artificial Neural Networks

Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial NeuralNetwork, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network.

UNIT - III: Perceptron and Associative Memories

Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm

UNIT - IV: Evolutionary Computing

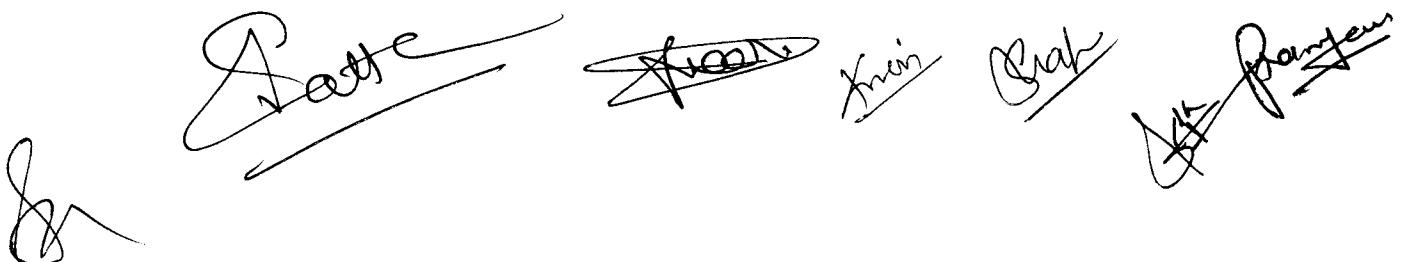
Introduction, overview of evolutionary computing, Genetic algorithms and optimization, The schema theorem: the fundamental theorem of genetic algorithms, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Integration of genetic algorithms with fuzzy logic, Known issues in GAs.

UNIT - V: Soft Computing Tools

Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

RECOMMENDED BOOKS:

1. **Soft Computing**, SarojKaushik, TMH Publications.
2. **Fuzzy systems and Fuzzy Logic**, Klir and Uuna, PHI Publications.
3. **Introduction to Artificial Neural Networks**, S. N. Sivanandam and M. Paulraj, Vikas publication.
4. **Soft Computing and Intelligent systems Design**, Fakhreddine O. Karry and Clarence de Silva
5. **Neural Network Design**, Hagan & Demuth, Vikas Pub. Comp.
6. **Fundamentals of Artificial Neural Networks**, M.A.Hassaoun.
7. **Fuzzy sets, uncertainty and information**, George J. Kir, & TA Folger.
8. **Fuzzy sets, Decision making and Expert system**, HJ Zimmerman, Kluwer, Boston.
9. **Fuzzy set theory and its applications**, H. J. Zimmerman, Kluwer, Boston.



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Elective III: Digital Image Processing

Subject Code - MCA304

Max. Marks: 100

Min Marks : 40

Unit – I: Introduction: Digital Image Fundamentals Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and acquisition Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Unit – II: Image Enhancement Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods; **Frequency Domain:** Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

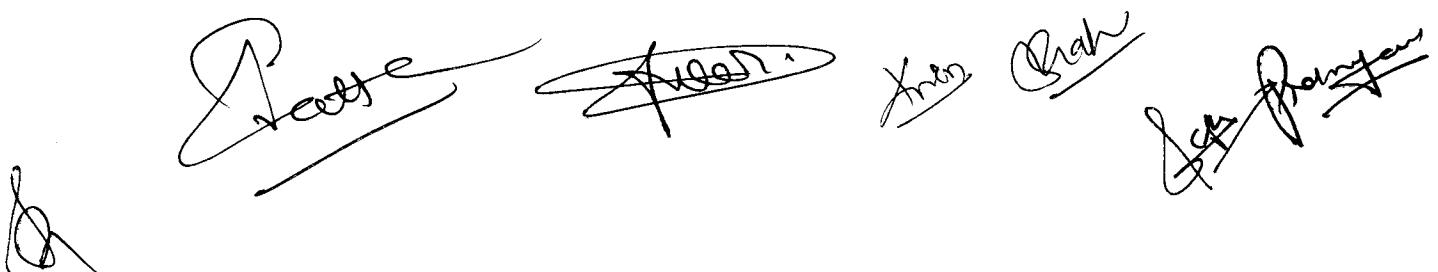
Unit – III: Image Restoration A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

Unit – IV: Image Compression: Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. **Morphological Image Processing:** Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformations, Some Morphological Algorithms.

Unit – V: Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **Representation and Description:** Representation, Boundary Description and Regional Descriptor.

RECOMMENDED BOOKS:

1. **Digital Image Processing**, Rafel C Gonzalez and Richard E. Woods, PHI 2nd Edition
2. **Computer Vision and Image Processing**, Scott.E.Umbaugh, Prentice Hall

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Elective IV: Big Data Analytics

Subject Code – MCA305

Max Marks : 100

Min Marks : 40

UNIT – I: Introduction to Data Warehousing and OLAP Technology for Data Mining

What is Data Mining?, KDD(Knowledge Discovery from Databases) Process, What Kinds of Data Can Be Mined?, Data Mining Functionality, Are all the patterns interesting?, Attribute Types, What is Data Warehouse?, Data Warehouse Architecture, Data Cube: A multi-dimensional data model, Schemas for Multidimensional Data Models, OLAP Operations, Data Warehouse Usage(Applications). , Data Mining Primitive, Architecture of Data Mining System.

UNIT – II: Introduction Concept of Big Data

Big Data- Define Data, Web Data, Classification of Data- Structured, Semi-Structured, and Unstructured. Big Data Definitions, Challenges of Conventional system, Why We Need Big Data, Difference between Big Data and Small Data, Importance of Big Data. Big Data Characteristics (4V's Volume, Velocity, Variety, and Veracity), Big Data Types, Big Data Handling Techniques. Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value. Big Data Analytics Application. Big Data Challenges and Future Scope.

UNIT – III: INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE

Big Data – Apache Hadoop & Hadoop EcoSystem: Hadoop Core Component, Features of Hadoop, The Hadoop Distributed File System: HDFS data Storage, Hadoop Physical Organization, HDFS Commands, MapReduce Framework, MapReduce Programming Model, MapReduce Map task, Reduce Task and MapReduce Execution, Hadoop YARN, Hadoop2 Execution Model, Hadoop Ecosystem Tools, Hadoop Ecosystem.

UNIT – IV: NoSQL Big Data Management, Mongo DB

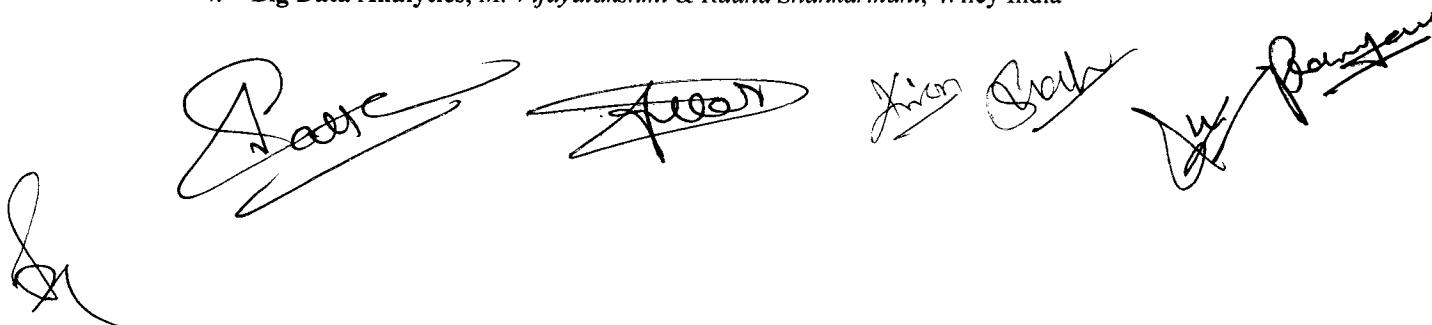
NoSQL: What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NoSQL DataStore, NoSQL Data Architecture pattern, NOSQL to Manage Big Data. **Data Base for the Modern Web**: Introduction to MongoDB, features of MongoDB, Data Types, Mongo DB Query Language and Database Command.

UNIT – V: Hive and Pig:

Pig: Apache Pig, Application of Apache Pig, Feature, Pig Architecture, Pig- Grunt Shell, Installing Pig, Pig Latin Data Model, Pig Latin and Developing Pig Latin Scripts: Apache Pig Execution, Commands. **HIVE AND HIVEQL**. **Hive**: Introduction, Characteristics, limitation, Hive Architecture and Installation, Comparison with Traditional Database (RDBMS), Hive Datatype and File Formats, Hive Data Model, Hive Integration and Workflow Steps, Hive Built-in Functions, HiveQL.

RECOMMENDED BOOKS:

1. **Big Data Analytics**, Raj Kamal and Preeti Saxena, McGraw Hill Education
2. **Big Data: Black Book**, DT Educational Services, Dreamtech Press
3. **Big Data Analytics**, Seema Acharya & Shubhashini Chellappan, Wiley India
4. **Big Data Analytics**, M. Vijayalakshmi & Radha Shankarmani, Wiley India

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Elective IV: Cloud Computing

Subject Code – MCA305

Max Marks : 100

Min Marks : 40

Unit – I

Introduction: Cloud Computing: Vision, Definition, Reference Model, Characteristics, Benefits and Challenges, Historical Developments, Cloud Computing Environments, Cloud Platforms and Technologies; The Evolution of Cloud Computing: Parallel Computing vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing, Introduction of Grid Computing.

Unit – II

Virtualization: Introduction, Characteristics, Taxonomy of Virtualization, Levels of Virtualization, Structure and Mechanism of Virtualization, Virtualization and Cloud Computing, Advantages and Disadvantages, Virtualization Technology Examples: Xen, VMware, Microsoft Hyper-V.

Unit – III

Cloud Computing Architecture: Service Oriented Architecture, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Data Storage as a Service (DSaaS). Types of Clouds; Economics of the Cloud and Open Challenges; **Security and Organizational aspects:** Host Security and Data Security.

Unit – IV

Migration to the Cloud: Adoption and use of Cloud by Businesses (Small and Enterprise), Pace of Adoption, Benefits and Phases of Adoption, Cloud Service Provider's Capabilities and Liabilities, Success factors and Issues. **Migrating Applications:** Key Aspects, Migration Techniques, Phases of Migration. **Service Level Agreement (SLA):** Aspects and Requirements, Availability and Outages, Credit Calculations, SLA Samples.

Unit – V

Industry Platforms: Amazon Web Services, Google AppEngine, Microsoft Azure; **Cloud Applications:** Scientific Applications, Business and Consumer Applications; Advanced Topics: Energy Efficiency in Clouds, Market Based Management, Federated Clouds / InterCloud, Third Party Cloud Services.

RECOMMENDED BOOKS:

1. **Mastering Cloud Computing**, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education
2. **Cloud Computing: Black Book**, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principles and Paradigms**, Rajkumar Buyya et al., Wiley India
4. **Cloud Computing: Concepts, Technology & Architecture**, Erl, Pearson Education India
5. **Cloud Computing Bible**, Barrie Sosinsky, O'Reilly Media
6. **Cloud Computing: A Practical Approach**, Toby Velte, Anthony Vote and Robert Elsenpeter, McGraw Hill
7. **Cloud Application Architectures: Building Applications and Infrastructures in the Cloud**, George Reese, O'Reilly Media.
8. **Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance**, Tim Matherm Subra Kumaraswamy and Shahed Latif, O'Reilly Media.

Elective IV: Cyber Security

Subject Code – MCA305

Max. Marks: 100

Min Marks : 40

UNIT – I: INTRODUCTION

Computer Security Concepts, The Challenges of Computer Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for network Security, **Symmetric Encryption Principal:** Cryptography, Cryptanalysis, Feistel Cipher Structure, DES, Random and Pseudorandom Numbers, Symmetric Block Modes of Operation (ECB, CBC, CFB, CTR).

UNIT – II PUBLIC KEY CRYPTOGRAPHY

Approaches to Message Authentication, **Hash Functions:** Hash Functions Requirement, Security of Hash Functions, The SHA Secure Hash Function, **Public Key Cryptography:** Public –Key Encryption Structure, Applications for Public Key Cryptosystem, RSA, Attacks on RSA, OAEP.

UNIT – III MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION

Message Integrity: Document and Finger Printing, Message and Message Digest, Cryptographic Hash Function Criteria Random Oracle Model, Birthday Problems and Summery of solutions, **Message Authentication:** Modification Detection Code, Message Authentication Code, Introduction of HMAC & CMAC, **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature.

UNIT – IV MALICIOUS SOFTWARE

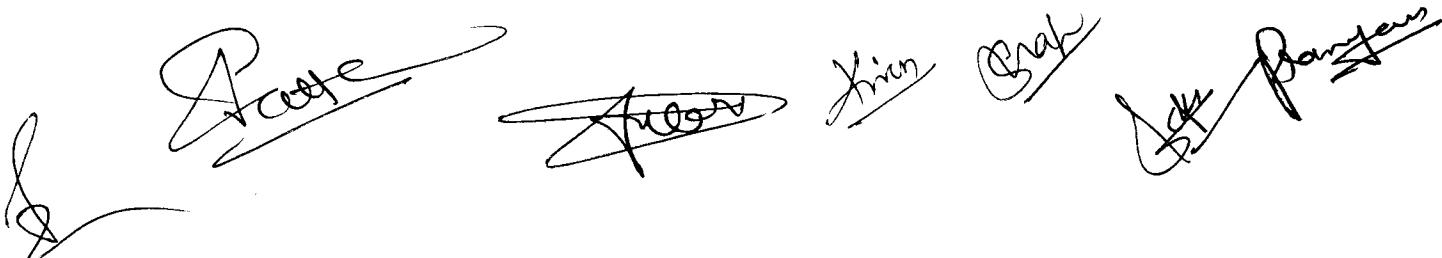
Intruders: Intruder Behavior Patterns, Intrusion Techniques, Intrusion Detection by Audit Records, Statistical Intrusion Detection, Distributed Intrusion Detection, Honeypot Types of Malicious Software, Nature of Viruses, Virus Classification, Antivirus Approaches, Worms and its Propagation model, DDoS Attack.

UNIT – V FIREWALL & SECURITY TOOLS

Firewall: Need & Characteristics of Firewall, Types of Firewall, Firewall Basing, Firewall Location and Configuration, Introduction to Kali Linux ,Tools Available in Kali Linux and Its Usage. Wireshark Packet Analyzer and Its Features. Cyber Security Policy, Domain of Cyber Security Policies.

RECOMMENDED BOOKS:

1. **Network Security Essentials**, *William Stallings*, PEARSON
2. **Cryptography and Network Security**, *William Stallings*, PHI.
3. **Cryptography and Network Security**, *Atul Kahate*, Tata McGraw Hill
4. **Cryptography and Network Security**, *B.A. FOROUZAN*, TMH
5. **Cyber Security policy Guidebook**, *Jennifer Jason Paul, Marcus Jeffery Joseph*. Wiley Publication,2012.
6. **Network Security: The Complete Reference**, Robertra Bragg, Tata McGraw Hill.
7. **Cyber Security Essentials**, *James Graham, Richard Ryan*, CRC press



Handwritten signatures of faculty members are displayed at the bottom of the page. From left to right, the signatures are: **Rajeev**, **Shivam**, **Chaitanya**, **Shivam**, and **Parag Jain**.

SCHEME OF TEACHING AND EXAMINATIONS 2020-21
MASTER OF COMPUTER APPLICATIONS (2 Years)

FOURTH SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit $L+(T+P)/2$	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Sessional Marks of Project Work	Project Viva- Voce	Pr	Total	Sessional Marks of Project Work	Project Viva- Voce	Pr	Total
MCA401	System Development Project (System Design & Implementation) / Research Project.	5	-	30	20	200	200	-	400	120	100	-	220
	TOTAL	5	-	30	20	200	200	-	400	120	100	-	220

Handwritten signatures of faculty members:

- R. Sathish
- A. Selvaraj
- K. Vinod
- B. Ravikumar
- S. Suresh