

DIRECTION

No. 21/2021

Date : 01/04/2021

Subject : Examinations leading to the Degree of Master in Computer Application (Two Year degree Course.... Semester Pattern) (Choice Based Credit System) in the Faculty of Science & Technology, Direction, 2021.

Whereas, Direction Nos. 33/2010 and 28/2019 regarding the examinations leading to the Degree of Master in Computer Application (Three Year Degree Course.... Semester Pattern) as per Credit Grade System and as per Choice Based Credit System in the then Faculty of Engineering & Technology and Faculty of Science & Technology respectively are in existence in the University,

AND

Whereas, the letter from the Member Secretary, A.I.C.T.E., New Delhi has been received on 3.7.2020 regarding change in the duration of M.C.A. program from Three (3) years to Two (2) years to be implemented from the academic session 2020-2021 and onwards,

AND

Whereas, the Hon'ble Vice-Chancellor has constituted a Committee under the Chairmanship of the Chairman, Board of Studies in Computer Science & Engg. regarding preparation of the schemes of teaching & examinations of Semester I to IV of the Two years Course of Master in Computer Application as per A.I.C.T.E. guidelines to be implemented from the academic session 2020-21 and onwards in phase wise manner,

AND

Whereas, the Committee in its series of on-line meetings held on 7.8.20, 11.8.20 & 28.8.2020 has prepared and recommended the Schemes of teaching & examinations of Semester I to IV of the Two years Master in Computer Application (M.C.A.) Course as per A.I.C.T.E. guidelines to be implemented from the academic session 2020-21 and onwards in phase wise manner,

AND

Whereas, the Faculty of Science & Technology in its meeting held on 8/9/2020 vide Item No. 9 (R-1) has considered and accepted the recommendations of the Committee regarding implementation of the Schemes of teaching & examination of Semester I to IV of the Two years Master in Computer Application (M.C.A.) Course as per A.I.C.T.E. guidelines to be implemented from the academic session 2020-21 and onwards in phase wise manner,

AND

Whereas, the Hon'ble Vice-Chancellor has accepted & accorded approval to the recommendation of the Faculty of Science & Technology under Section 12 (7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council on 21.09.2020 regarding implementation of the Schemes of teaching & examination of Semester I to IV of the Two years Master in Computer Application (M.C.A.) Course as per A.I.C.T.E. guidelines to be implemented from the academic session 2020-21 and onwards in phase wise manner,

AND

Whereas, the Scheme of teaching & examination of Semester I to IV of the Two years Course Master in Computer Application (M.C.A.) are to be implemented from the academic session 2020-21 and onwards in phase wise manner,

AND

Whereas, the Scheme of teaching & examinations and other provisions are required to be regulated by an Ordinance / Regulation,

AND

Whereas, matter of making an Ordinance / Regulation are a time consuming process,

Now, therefore, I, Dr. M. G. Chandekar, Vice-Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me, under sub-section (8) of Section 12 of the Maharashtra Public Universities Act, 2016, having issued the following direction:

1. This Direction may be called as "Examinations leading to the Degree of Master in Computer Application (Two Year degree Course.... Semester Pattern) (Choice Based Credit System) in the Faculty of Science & Technology, Direction, 2021.
2. This Direction shall come into force with effect from the date of its issuance.
3. This Direction shall come into force w.e.f. the session :-
 - i) First Year M.C.A. Semester I & II for 2020-2021 and
 - ii) Second Year M.C.A. Semester III & IV for 2021-2022
4. Subject to the compliance with the provisions of this Direction and other ordinances in force from time to time along with the rules/regulations received from the Govt. of Maharashtra, the following persons shall be eligible for admission to MCA :

- (a) The Candidate should be an Indian National,
- (b) i) Passed B.C.A. or Bachelor degree in Computer Science Engineering or equivalent degree and obtained at least 50% marks in aggregate (at least 45% in case of candidates of backward class categories Economically weaker sections and Persons with Disability belonging to Maharashtra State,

OR

- ii) Passed B.Sc. or B.Com. or B.A. with Mathematics at 10 + 2 Level or at Graduation level and obtained at least 50% marks in aggregate (at least 45% in case of candidates of backward class categories Economically weaker sections and Persons with Disability belonging to Maharashtra State with

- (a) Additional Bridge Course as per norms of the University

OR

- (b) Shall successfully complete two (2) SWAYAM NPTEL on-line Certification Courses on
(i) Computer Fundamentals (ii) Programming Language or similar Courses at least (4) weeks each through MOOCs (Massive Open On-line courses) before joining or during the M.C.A. Course as required by the D.T.E.

5. The exemption in the Bridge Course shall be given to the following students :

- i) Who have studied Computer Science /Computer Application subjects as one of the subjects at graduation examination.
- ii) Who have P.G. Diploma in Computer Science / Computer Application / Information Technology recognized by any Statutory University / Board.
- iii) Who have successfully completed and obtained Certificate /s of Online Course/s in the subjects like Computer Fundamentals, Databases, Operating System Programming Language etc. of minimum 60 Hrs. duration from MOOC- SWAYAM / NPTEL.

6. (i) Duration of the course shall be of two (2) academic years.

(ii) The University shall hold the main examination of regular students of Semester I & III in Winter and Semester III & IV in Summer every year. The supplementary examination of Semester I & III shall be held in Summer and the supplementary examination for Semester II & IV shall be held in Summer every year.

7. For purposes of instruction and examination the student shall study sequentially.

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

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

10. Subject to his/her compliance with the provisions of this Direction and of other Ordinances (Pertaining to Examinations in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular term shall be eligible to appear at it, if,

- i) He / She satisfied the condition in the **Table - I** as mentioned below and the provision there-under.

- ii) He / She has prosecuted a regular course of study in the University/College affiliated to the University.

- iii) He/She has in the opinion of the Head of the Department/Principal shown satisfactory progress in his / her studies.

TABLE – I

Name of Exam	The student should have passed the examination of	The student should have completed the session / term satisfactorily
1	2	3
First Year MCA Semester - I	The qualifying Examination mentioned in Sr.No.4 above	First Yr. MCA Semester - I
First Year MCA Semester - II	-----	First Yr. MCA Semester I & II
Second Year MCA Semester -III	-----	Second Year MCA Semester - III
Second Year MCA Semester - IV	-----	Second Year MCA Semester III & IV

11. The Scheme of teaching & examination for M.C.A. Course shall be as provided under “**Appendix-A**” appended with this Direction.

12. The norms for Bridge Course and the Scheme of teaching & examination of Bridge Course for admission to the M.C.A. shall be as provided under “**Appendix-B**” appended with this Direction.

13. Common Instructions for all the Semesters regarding Choice Based Credits (CBC) /Open Electives (OE) are as under :

The Subjects/Modules/Activity to be undertaken by the Student under the Open Electives approved by the Department /Institute. The schedule of approval will be declared by the Department / Institute at the beginning of the Semester (1st July) as per details given below :

One Faculty Member will work as a Coordinator for Open Electives for which 01 Hour of Theory period will be considered as a weekly work load against this work. All Coordinators has to do counseling of respective Open electives, do the Students Registration process and allot them to faculty members (will be working as a mentor). All these electives are internally accessed by respective Coordinators & Guides based on Minimum 03 Class Tests/ Final Objective Test/ Demo/ Report Submission / Certificate issued by competent authority Viva Voce and other methods as decided by the Department / Institute.

The Mentor shall conduct Tutorial Classes for Workload counting purpose, it should be noted that: 01 Tutorial hour is equal to 01 Theory Hour. For Tutorial, Batch of Maximum 20 Students will be considered and the Tutorial Batch should not be comprised of Less than 04 Students.

Coordinator shall take care that the students are not repetitively opting for same type of Electives in every Semester.

Summary of conduction of Choice Based Credits (CBC) /Open Electives (OC) Electives for all Semesters :-

- i) Electives Selection Process starts at beginning of the Semester.
- ii) Declare the names of Coordinator for Open Electives.
- iii) Counseling of Students by Coordinators for selection of Open Electives.
- iv) Registration of Students by Coordinators under respective Open Electives.
- v) Allotment of Registered Students to Mentor from Department.
- vi) Guidance/Counseling to Students by Mentor throughout the Semester.
- vii) General Counseling by Coordinators over the Semester, whenever required.
- viii) Final Assessment of Students by Coordinators & Mentor for Allotment of Final Credits.
- ix) Submission of Credits gained by Students to the Head of Department from Coordinators.

14. i) The scope of the M.C.A. Course is as indicated in the syllabus.

ii) The scope of Bridge Course for admission to M.C.A. Course is as indicated in the syllabus.

15. The medium of instruction and examination of M.C.A. and Bridge Course shall be English.

16. The fees for each M.C.A. Examinations (Theory & Practical) shall be as prescribed by the University from time to time.

17. The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of an examinee shall be as given below :-

The marks will be given in all examinations which will include college assessment marks and the total marks for each Theory / Practical shall be converted into Grades as per **Table II**.

SGPA shall be calculated based on Grade Points corresponding to Grade as given in Table II and the Credits allotted to respective Theory / Practical shown in the scheme for respective semester. SGPA shall be computed for First Year (Semester I & II) and Second Year (Semester III & IV) and CGPA shall be computed in Second Year (Semester IV) based on SGPAs of First Year (Semester I & II) and Second Year (Semester III & IV) :-

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \dots + C_n \times G_n}{C_1 + C_2 + \dots + C_n}$$

Where C_1 = Credit of individual Theory / Practical

G_1 = Corresponding Grade Point obtained in the respective Theory / Practical

$$CGPA = \frac{(SGPA)_{sem 1} \times (Cr)_{sem 1} + (SGPA)_{sem 2} \times (Cr)_{sem 2} + (SGPA)_{sem 3} \times (Cr)_{sem 3} + (SGPA)_{sem 4} \times (Cr)_{sem 4}}{(Cr)_{sem 1} + (Cr)_{sem 2} + (Cr)_{sem 3} + (Cr)_{sem 4}}$$

Where, $(SGPA)_{sem 1 \text{ to } sem 4}$ = SGPA of First Year Semester I & II to Second Year Semester III & IV

$(Cr)_{sem 1 \text{ to } sem 4}$ = Total Credits for First Year Semester I & II to Second Year Semester III & IV

CGPA equal to 6.00 and above shall be considered as equivalent to First Class which shall be mentioned on Grade Card of Second Year Semester III & IV as a foot note.

TABLE II

THEORY

Grade	Percentage of Marks	Grade Points
AA	$80 \leq \text{Marks} \leq 100$	10
AB	$70 \leq \text{Marks} < 80$	9
BB	$60 \leq \text{Marks} < 70$	8
BC	$55 \leq \text{Marks} < 60$	7
CC	$50 \leq \text{Marks} < 55$	6
CD	$45 \leq \text{Marks} < 50$	5
DD	$40 \leq \text{Marks} < 45$	4
FF	$00 \leq \text{Marks} < 40$	0
ZZ	Absent in Examination	—

PRACTICAL

Grade	Percentage of Marks	Grade Points
AA	$85 \leq \text{Marks} \leq 100$	10
AB	$80 \leq \text{Marks} < 85$	9
BB	$75 \leq \text{Marks} < 80$	8
BC	$70 \leq \text{Marks} < 75$	7
CC	$65 \leq \text{Marks} < 70$	6
CD	$60 \leq \text{Marks} < 65$	5
DD	$50 \leq \text{Marks} < 60$	4
FF	$00 \leq \text{Marks} < 50$	0
ZZ	Absent in Examination	—

18. Provisions of Ordinance No.18 of 2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and improvement of Division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the **Direction No. 15 of 2017** and Ordinance No. 18 of 2001 shall apply to each examination under this Direction.
19. An examinee who does not pass or who fails to present himself/ herself for the examination shall be eligible for readmission to the same examination, on payment of fresh fees and such other fees as may be prescribed.
20. As soon as possible after the examination, the Board of Examinations shall publish a result of the examinees. The result of final MCA Examination shall be classified as above and meritlist shall be notified as per Ordinance No.6.
21. Notwithstanding anything to the contrary in this Direction, no person shall be admitted to an examination under this Direction, if he/she has already passed the same examination or an equivalent examination of any statutory University.
22. The Institute shall prepare the certificate of Bridge Course of every successful student in the prescribed format as '**Appendix - C**' appended to this Direction, submit the same along with the examination report and the tabulation record to the University. On receipt of the examination report and the tabulation record, the University shall verify the results as per the procedure laid down in this regard and issue the certificate to the student.
23. (i) The examinees who have passed in all the subjects prescribed for all the examinations shall be eligible for award of the Degree of Master in Computer Application.
(ii) An examinee successful at the examination shall on payment of prescribed fees receive a degree in prescribed form signed by the Vice-Chancellor.
24. The existing Direction Nos. 33 / 2010 & 28 / 2019 regarding examinations leading to the Degree of Master in Computer Application (Three Year Degree Course.... Semester Pattern) as per Credit Grade System in the Faculty of Science & Technology, Direction, 2019 shall be repealed in phase wise and stage wise manner.

Date : 31 /03/2021

Sd/-
(Dr.M.G.Chandekar)
Vice-Chancellor

Two Year MCA																		
Curriculum Scheme for First Year MCA																		
Sr.No	Course Category	Subject Code	Subject	Credit	Teaching Scheme				Hours /Week	Examination Scheme								
					LECTURES	TUTORIAL	PRACTICAL	Theory					Practical					
								Duration of Paper(Hrs)		Max Marks Theory Papers	Max Marks Sessional	Total	Min Pass Marks	Duration of Exam (Hrs)	External Marks	Sessional Marks	Total	Min Pass Marks
Semester-I																		
1	Core	MCA20101	Advanced Computer Architecture	3	3		-	3	3	80	20	100	40	-	-	-	-	-
2	Core	MCA20102	Data Structure & Algorithms	4	4		-	4	3	80	20	100	40	-	-	-	-	-
3	Core	MCA20103	Operating System	4	4		-	4	3	80	20	100	40	-	-	-	-	-
4	Core	MCA20104	Data Communication & Networks	4	4		-	4	3	80	20	100	40	-	-	-	-	-
5	Core	MCA20105	Mathematics & Statistical Techniques	4	4		-	4	3	80	20	100	40	-	-	-	-	-
6	Choice based	MCA20106	Open Elective 1	2		2	-	2								50	50	25
7	Skill	MCA20107	Lab1- Object Oriented Programming in JAVA	3	-	2	2	4						3	25	25	50	25
8	Skill	MCA20108	Lab2- Data Structure and Algorithms	1	-	-	2	2	-	-	-	-	-	3	25	25	50	25
9	Skill	MCA20109	Lab3- Operating System	1	-	-	2	2	-	-	-	-	-	3	25	25	50	25
10	Skill	MCA20110	Lab4-Mathematics & Statistical Techniques	1			2	2						3	25	25	50	25
			Total	27	19	4	8	31		400	100	500			100	150	250	
Semester-II																		
1	Core	MCA20201	Client Server Computing	4	4		-	4	3	80	20	100	40	-	-	-	-	-
2	Core	MCA20202	Artificial Intelligence &Applications	4	4		-	4	3	80	20	100	40	-	-	-	-	-
3	Core	MCA20203	Advance Data Base Management Systems	4	4		-	4	3	80	20	100	40	-	-	-	-	-
4	Core	MCA20204	Software Engineering	4	4		-	4	3	80	20	100	40					
5	Elective	MCA20205	Elective 1	4	4		-	4	3	80	20	100	40	-	-	-	-	-
6	Choice Based	MCA20206	Open Elective 2	2		2	-	2							-	50	50	25
7	Skill	MCA20207	Lab 5-Client Server Computing	1	-	-	2	2	-	-	-	-	-	3	25	25	50	25
8	Skill	MCA20208	Lab 6-Artificial Intelligence &Applications	1	-	-	2	2	-	-	-	-	-	3	25	25	50	25
9	Skill	MCA20209	Lab 7- Elective- 1	1	-		2	2	-	-	-	-	-	3	25	25	50	25
10	Skill	MCA20210	Lab 8- Mini Project	1	-	-	2	2						3	25	25	50	25
			Total	26	20	2	8	30		400	100	500			100	150	250	
Elective-1			Mini project - the students needs to complete at the end of the semester in order to strengthen the understanding of fundamentals through effective application of the courses learnt.															
i) Computer Graphics																		
ii) Data Security																		
iii) Optimization Techniques			The Open Elective and Credit Assigned (Open Elective 1, 2)										Credits					
			Successful completion of Online Course of 4 weeks										2					
			Project Activity										2					
Open Elective: Each student shall complete 2 credits			Paper/poster presentation										1					
			Completion of softskill programme of one week										1					
			Internship of 30 Hrs										2					
			Field Visit of 15 Hrs										1					
													2					
			Startup recognized and approved by the department										1					
			Participation in Unnat Bharat Abhiyan 1 for 3 days, maximum 2										1					
			Yoga Meditation camp of 3 days										1					
			Completion of course/activity of similar credits proposed by the department from among the available courses/activities from other department/faculty in the college/university										2					

Curriculum Scheme for Second Year MCA																		
Sr.No	Course Category	Subject Code No.	Subject	Credit	Teaching Scheme				Examination Scheme									
					LECTURES	TUTORIALS	PRACTICALS	Hours /Week	Theory					Practical				
									Duration of Paper(Hrs)	Max Marks Theory Papers	Max Marks Sessional	Total	Min Pass Marks	Duration of Exam (Hrs)	External Marks	Sessional Marks	Total	Min Pass Marks
Semester-III																		
1	Core	MCA20301	Data Analytics	4	4		-	4	3	80	20	100	40	-	-	-	-	-
2	Core	MCA20302	Cloud Computing	4	4		-	4	3	80	20	100	40	-	-	-	-	-
3	Core	MCA20303	Web Technology	4	4		-	4	3	80	20	100	40	-	-	-	-	-
4	Elective	MCA20304	Elective 2	4	4			4	3	80	20	100	40					
5	Elective	MCA20305	Elective 3	4	4			4	3	80	20	100	40		-			
6	Choice Based	MCA20306	Open Elective3	2		2		2							-	50	50	25
7	Skill	MCA20307	Lab 7 Data Analytics using Python/R language	1	-		2	2	-	-	-	-	-	3	25	25	50	25
8	Skill	MCA20308	Lab 8 Web Technology	1	-		2	2	-	-	-	-	-	3	25	25	50	25
9	Skill	MCA20309	Lab 9 Elective 2	1	-		2	2	-	-	-	-	-	3	25	25	50	25
10	Project	MCA20310	Lab10 Elective 3	1			2	2						3	25	25	50	25
			Total	26	20	2	8	30		400	100	500			100	150	250	
Semester-IV																		
1	Skill	MCA20401	Industry Project and Internship/Startup	18	-		-	24	-	-	-	-	-	3	200	50	250	125
2	Skill	MCA20402	Seminar	6	-		0	6	-	-	-	-	-			50	50	25
3	Online	MCA20403	Online Subject	2	2			2								50	50	25
			Total	26	2		0	32							200	150	350	
Elective-2			Elective-3	Online Subject					Online Subject - Department may choose any of the specified subject and conduct it in online mode									
i) Animation & Movie Making			i) Software Testing	i) Management Information System														
ii) Cyber Security & Digital Forensic			ii) Mobile Application Development	ii) Entrepreneurship Development														
iii) Block Chain Technology			iii) Internet of Things	iii) Enterprise Resource Planning														
			iv) Soft Computing	iv) Research Methodology														

Norms & the Scheme of Teaching & Examination of Bridge Course for MCA Admission

Recommendations of the Board of Studies:

- Students who have studied computer science/computer applications subject as one of the subjects at graduation examination.
- Students who have passed P. G. Diploma in Computer Science/Computer Applications/Information Technology recognized by any University/ Board.
- Student who have successfully completed and obtained certificate/s of online course/s in the subjects like computer fundamentals, databases, operating system, programming language etc., of minimum 60 Hrs. duration from MOOC - SWAYAM/ NPTEL.

1. The course shall be named as ‘Computer Proficiency Bridge Course for MCA Admission’.
2. Duration: 60 Hrs. (02 Credits).
3. Course Contents:

1. Introduction to Computers and Programming Methodology – 15 Hrs.
2. Introduction to Data Base Management System – 10 Hrs.
3. Programming in ‘C’ – 20 Hrs.

The contents of this course shall be prepared by the center at the start of the session and declared by notification to the participants and inform to the University along with the list of admitted students.

4. **Admission Process:** Student shall take admission at any Institute running MCA programme in the jurisdiction of SGB Amravati University, Amravati. The Fees for this course shall be as approved by the S.G. B. Amravati University. The Institute shall publish the admission notification in News Paper and on Institute Website whenever wants to run the bridge course. Institute shall submit the list of admitted students to the University well in advance prior to start of the course. Maximum two batches shall be allowed to each Institute in one academic year.
5. **Examination:** Institute will plan and make arrangement for the examination at the end of the course. Prepare and notify the timetable, take examination of the students and submit complete report of examination to the University. Report should contain timetable of examination, students list, and attendance record of the students for examination, marks details and result etc. Institute shall issue the completion certificate to successful students. Marks for passing examination shall be minimum 40%.

6. Scheme of Examination:

Paper	Contents	Duration	Max Marks	Sessional Marks	Minimum Marks	Paper Pattern
Computer Fundamentals	Introduction to Computers and Programming Methodology	3 Hr.	100	--	40	Five questions with internal choice. 20 Marks each.
	Introduction to Data Base Management System					
	Programming in 'C'					
Need Based Technology	Based on contents Designed by Center	2 Hr.	--	50	20	Five questions with internal choice. 10 Marks each.
Practical-1	Programming in 'C'	3 Hr.	--	25	10	One Practical
Practical-2	Based on Need Based Technology	3 Hr.	--	25	10	One Practical

7. **Certification:** The Institute shall prepare the certificate of every successful student; submit the same along with Examination Report and Tabulation Record to the University. Responsible university authority shall verify the result and duly sign the certificates of the students.

Sant Gadge Baba Amravati University , Amravati.

This certificate is awarded to

on successful completion of

“Bridge Course for MCA Admission ”

from < *Name of the Institute* >

with a consolidated score of _____ % .

Signature 1 (Head of the Institute) *Signature 2*(University Authority)

NOTIFICATION

No. 34/2021

Date : 01/04/2021

Subject : Implementation of the Syllabus of Bridge Course for admission to the Master of Computer Application (M.C.A.) (Two Year Semester Pattern) (Choice Based Credit System) Course in the Faculty of Science & Technology from the session 2020-21 and onwards

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of Bridge Course for admission to the Master of Computer Application (M.C.A.) (Two Year Semester Pattern) (Choice Based Credit System) Course in the Faculty of Science & Technology from the session 2020-21 and onwards as per **Appendix 'A'**.

Sd/-
(Dr.H.R.Deshmukh)
I/c Registrar
Sant Gadge Baba Amravati University

Appendix-A

**SYLLABUS OF BRIDGE COURSE FOR ADMISSION TO MASTER OF COMPUTER APPLICATION (M.C.A.)
(TWO YEAR COURSE)**

Introduction to Computers and Programming Methodology

No.	Topic Name	Hrs
I	Introduction to Computers - What is Computer, Basic Applications of Computer; Components of Computer System, Evaluation of computers	1 Hr.
II	Concepts of Hardware and Software; definition of Hardware CPU: Arithmetic Logic Unit (ALU), Control Unit (CU), Memory Unit (MU) , Definition & types of Software , Programming Language, Firmware and Cache Memory	2 Hrs.
III	Number Systems - Binary Number System, Octal Number System, Hexadecimal Number System, Inter Conversions between different numbe systems	2 Hrs.
IV	Concept of Internet - Introduction to the Internet and its services, Applications and tools. Wide Web and its facilities, applications and tools. Browsers and its types, Internet browsing, Searching - Search Engines - Portals - Social Networking sites .	3 Hrs.
V	Basics of Office automation- MS Word - Working with Document , Formatting Documents , MS Excel: Spread Sheet & its Applications, MS Power point: Introduction to presentation , Formatting a Presentation , Adding Effects to the Presentation	3 Hrs.
VI	Object Oriented Programming - object-oriented programming concepts, such as classes, objects, methods, interfaces, packages, inheritance, encapsulation, and polymorphism.	4 Hrs.

Reference Books :

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india.
2. Dimitrios Kalemis - The Fundamental Concepts of Object-Oriented Programming.
3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.

Database Management Systems

Sr.No	Topic	Hours
1	Traditional file approach and comparison with DBMS Architecture of a database system, Purpose of Database Systems	1
2	View of Data, Data Abstraction , Database Users and Administrators, Constraints and keys, Entity- Relationship Model, Entity Relationship Diagram, Basic Concepts	2
3	Introduction to SQL: Components of SQL, data types, operators DDL Commands: CREATE, ALTER, DROP, RENAME, for tables & views. DML Commands: SELECT, INSERT, DELETE & UPDATE; Clauses: ORDER BY, GROUP BY and HAVING; DCL and TCL Statements: Grant, Revoke, Rollback, commit and auto commit, save point, rollback segment.	3

4	Data Integrity, types of integrity constraints. Functions: Number Functions - AVG, MAX, MIN, SUM, COUNT, TO-NUMBER, ABS, MOD, FLOOR, CEIL, TRUNC, SQRT, SIGN, SIN, COS, LOG, EXP. Character Functions: INITCAP, LOWER, UPPER, INSTR, LENGTH, LTRIM, RTRIM, LPAD, RPAD, SOUNDEX. Date functions: ADD_MONTHS, LAST_DAY, MONTH_BETWEEN, NEW_TIME, NEXT_DAY, SYS_DATE Miscellaneous Functions: GREATEST, LEAST, DECODE, NVL, NULLIF Subqueries, Joins and Unions: Self, equi and outer join, unions and intersection.	3
5	Introduction to Normalization, ACID Properties	1

Books Recommended:

1. Database System Concepts (4th Ed) By: Korth, Sudarshan, Silberschatz
2. MySQL The Complete Reference By Vikram Vaswani.

Programming in 'C'

Sr No	Topic	Hours
1	Introduction to C, character set, keywords, identifiers, constants, variables, structure of C program	1
2	basic data types	1
3	Operators & Expressions : Arithmetic, Relational, logical assignment, Increment and decrement, precedence of operators.	1
4	printf (), scanf (), getch (), getche (), getchar (), putch (), putche (), putchar (), gets (), Puts ()	1
5	Control structure : if , if... else, nested if, conditional operator , switch, goto, for, while, do..while, nesting of loops, break, continue.	3
6	Arrays & Strings : Arrays - Declaration and initialization of one and two dimensional array. String - String functions, string operations	3
7	Functions in C : Introduction, definition of function, function prototype, function calling, call by value, call by reference, return value and their types, function parameters, local and global variable	4
8	pointers and functions, pointers as function argument, pointer to functions, function returning, pointers	2
9	Introduction to Structures	2
10	Introduction to File Handling	2

Books Recommended:

- 1) Programming in C : E Balgurusamy, TMH. Publications.
- 2) C Programming With C : Ravichandran
- 3) The C programming language Handbook by FLAVIO COPES Programming tutorial at flaviocopes.com .

NOTIFICATION

No. 35 /2021

Date : 01/04/2021

**Subject : Chances for the Old Course failure students of M.C.A. (Three Years Semester Pattern)
(C.G.S.) in the Faculty of Science & Technology from the academic session 2020-21.
(2010-11 to 2018-19 Batch)**

It is notified for general information of all concerned that the authorities of the University have accepted to give Two (2) chances i.e. Winter-2020 & Summer-2021 for the Old Course failure students of Semester I to IV of M.C.A. (Three Years --- Semester Pattern) (C.G.S.) who had taken admission during the academic session 2010-11 to 2018-19 and still remain failure in the Faculty of Science & Technology to be implemented from Winter - 2020 examinations .

Sd/-
(Dr.H.R.Deshmukh)
I/c Registrar
Sant Gadge Baba Amravati University

NOTIFICATION

No. 36/2021

Date : 01/04/2021

**Subject : Chances for the Old Course failure students of M.C.A. (Three Years Semester Pattern)
(C.G.S.) in the Faculty of Science & Technology from the academic session 2020-21.
(2019 - 20 Batch)**

It is notified for general information of all concerned that the authorities of the University have accepted to give Two (2) chances i.e. Winter - 2020 & Summer - 2021 for the Old Course failure students of Semester I & II of M.C.A. (Three Years --- Semester Pattern) (C.G.S.) who had taken admission during the academic session 2019-20 and remain failure in the Faculty of Science & Technology to be implemented from Winter - 2020 examinations.

Sd/-
(Dr.H.R.Deshmukh)
I/c Registrar
Sant Gadge Baba Amravati University

NOTIFICATION

No. 37/2021

Date : 01/04/2021

Subject : Implementation of new syllabi of Semester I & II of Master in Computer Application (M.C.A.) (Two Year... Semester Pattern) (Choice Based Credit Grade System) in the Faculty of Science & Technology from the session 2020-2021 and onwards..

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of Semester I & II of Master in Computer Application (M.C.A.) (Two Year... Semester Pattern) (Choice Based Credit Grade System) in the Faculty of Science & Technology from the session 2020-2021 and onwards as per **Appendix-A** :

Sd/-
(Dr.H.R.Deshmukh)
I/c Registrar
Sant Gadge Baba Amravati University

Appendix-A

SYLLABUS OF MASTER IN COMPUTER APPLICATION

(M.C.A.) (TWO YEAR... SEMESTER PATTERN) (CHOICE BASED CREDIT GRADE SYSTEM)

**SYLLABUS OF MASTER IN COMPUTER APPLICATION (Two Years C.B.C.S.)
SEMESTER I**

Course Code	MCA20101
Course Name	Advance Computer Architecture
Credits	03
Course Outcomes:	On completion of the course, the students will be able to
	1. Explain fundamentals of parallel processing and pipeline processing
	2. Analyze and classify different pipelined processors
	3. Describe architectural features of advanced processors.
	4. Demonstrate concepts of parallelism in hardware/software.

Units	Contents	Total Hrs
I	Amdahl's law, Von Neumann machine architecture, Program development tools, Operating systems. Design of ALU, Bit slice processors. Concept of instruction formats and instruction set, instruction set types, types of operands and operations, Generation of memory addresses and addressing modes, Subroutine nesting using stacks to implement subroutine calls and calling conventions, Processor organizations, Register organization, Stack based organizations, Encoding of machine instructions, General features of RISC and CISC instruction sets, modern processors convergence of RISK with CISC, Processor microarchitecture-I - Fundamental concepts for data path implementation, Processor microarchitecture-II - Data path implementation, microprogrammed execution, recent innovations in execution unit design.	10
II	Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors. Conventional and EPIC architecture. Evolution of parallel processors, future trends and there architecture. Overview of Parallel Processing and Pipelining Processing Necessity of high performance, Constraints of conventional architecture, Parallelism in uniprocessor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture. Principles of scalable performance: Performance Metrics and Measures, Speedup Performance Laws.	10

III	- Instruction pipeline, instruction pipeline hazards, overcoming hazards using a pipeline with forwarding paths, instruction set design influence on pipelining, example of pipelined CISC processor, example of pipelined RISC processor, VLIW (Very Long Instruction Word) processors, Vector processors, Multithreaded processors, Compilation techniques support to instruction level parallelism, Extracting parallelism.	10
IV	Virtual memory organization, mapping functions for translating the program pages in virtual to physical addresses space, partitioning, segmentation (superpages or page blocks) partitioning of virtual address space in to segment and page address, demand paging and swapping, cache and virtual swapping, cache and virtual memory, inverted page tables concept, protection between programs running on the same system, accessing I/O devices, programmed I/O, interrupts, direct memory access DMA, bus arbitration, interface circuits, I/O interfaces, I/O processors, external I/O devices.	10
V	Multiprocessor Architectures – Objectives, Introduction, Multiprocessor Architectures, Performance Characteristics of Multiprocessors, Multicore Architectures – Single Chip Multiprocessors, Flynn Classification, Interconnection Structures, Interconnection Networks – Dynamic and Static Multiprocessor System Interconnects, Banyan and Delta Networks (Banyan Multistage Networks), Interprocess Arbitration, Interprocess Communication, Memory Organization in Multiprocessors, Shared-memory Multiprocessor Systems, Synchronization – Memory Organization, Contention and Arbitration, Cache Coherence and Synchronization Mechanisms, Cache Coherence, Message Passing Systems, Issues in Cluster Computing	10
VI	Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions. Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.	10
Textbook :		
	1. Computer Architecture and Organization by Nicholas Carter & Rajkamal, Schaum Series Pub. 2. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill International Edition	

Reference Books :

	1. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill 2. V.Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI. 3. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition. 4. Kai Hwang, Scalable Parallel Computing. 5. Harrold Stone, High performance computer Architecture. 6. Richard Y. Kain, Advanced Computer Architecture 7. http://www.intel.com/products/processor (for Intel Itanium Processor)
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Course Code	MCA20102
Course Name	Data Structure & Algorithms
Credits	4
Course Outcomes :	On completion of the course, the students will be able to
	1. Explain and identify fundamental concepts of data structures
	2. Understand various data searching and sorting methods with its complexity
	3. Demonstrate operations such as insertion, deletion, searching and traversing on data structures.
	4. Design algorithms for solving problems with the help of fundamental data structures

Units	Contents	Total Hrs
I	Data structures basics, Mathematical /algorithmic notations & functions, Complexity of algorithms, Sub-algorithms. String processing: storing strings, character data type,string operations, word processing, and pattern matching algorithms.	10
II	Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, Bubble sort, Linear search and Binary search algorithms. Multidimensional arrays, Pointer arrays. Record structures and their memory representation. Matrices and sparse matrices.	10
III	Linked lists and their representation in memory, traversing a linked list, searching a linked list.Memoryallocation & garbage collection.Insertion deletion operations on linked lists.Header linked lists, Two- way linked lists.	10
IV	Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, application of stacks. Implementation of recursive procedures by stacks, Queues. Deques. Priority queues.	10
V	Trees, Binary trees & and their representation in memory,Traversing binary trees. Traversal algorithms using stacks, Header nodes : threads. Heap and heapsort.Path length & Huffman's algorithm.Generaltrees.	10
VI	Graph theory, sequential representations of graphs, Warshalls' algorithm, Linked representation, operations & traversing the graphs. Posets& Topological sorting. Insertion Sort, Selection Sort. Radix sort.	10

Textbook :

	Seymour Lipschutz: "Data Structures with C", Schaum's Outline Series.
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Reference Books :

	1. Forouzan, Gilberg: Data Structures and Algorithms, CENGAGE Learning. 2. ReemaThareja: Data Structures using C, Oxford University Press,2011. 3. Arpita Gopal: Magnifying Data structures, PHI (EEE),2010. 4. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures,CBS Publications.
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Course Code	MCA20103	
Course Name	Operating System	
Credits	4	
Course Outcomes :	On completion of the course, the students will be able to	
	1. Understand the concept of programs & processes along with the need of scheduling in operating systems	
	2. Recognize different states of process and schedulers to apply scheduling algorithms to meet the scheduling objectives and acquire the knowledge of dealing with deadlocks.	
	3. Apply memory management techniques & virtual memory concepts to avoid page faults and computing page replacement strategies	
	4. Analyze and apply various protection and security mechanisms	
	5. Compare different operating system	
Units	Contents	Total Hrs
I	Introduction: OperatingSystem (OS) definition, OS Evolution, OS Components and Services. Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multi-threading Models, Threading Issues, Java Threads.	10

II	CPU Scheduling Concepts, Scheduling Criteria and Algorithms. Process Synchronization: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors. Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock.	10
III	Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation. Virtual Memory Management: Background, Demand Paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing.	10
IV	File-System Interface; Directory structure, File-System Mounting, File Sharing & Protection. File-System Structure, File-System Implementation. Directory Implementation, Allocation Methods, Free- Space Management. File Recovery	10
V	I/O Systems: Overview, I/O Hardware, Application I/O Interface, and Kernel I/O Subsystem. Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap – Space Management, RAID Structure.	10
VI	File protection & security: Goals of Protection, Principles of Protection, Revocation of Access Rights, Security Problem, Program Threats, Classifications, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems	10

Textbook :

	Text Books : Avi Silberschatz, P.B. Galvin, G. Gagne : “Operating System Concepts” (Sixth Edition) John Wiley & Sons Publication.
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Reference Books :

	1. A.S. Tanenbaum, “Modern Operating Systems” Pearson Education. 2. William Stallings, “Operating Systems” Prentice-Hall. 3. D.M. Dhamdhere, “Operating Systems” Tata McGraw-Hill. 4. M. Milankovic, “Operating Systems” McGraw-Hill. 5. Achut Godbole, “Operating Systems” Tata McGraw-Hill.
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Course Code	MCA20104
Course Name	Data Communication & Networks
Credits	4
Course Outcomes :	On completion of the course, the students will be able to
	1. Understand the concepts of Data Communication Systems and its components.
	2. Analyze various types of application layer protocols and its applicability in various domains.
	3. Generalize all transport layer protocols to understand end-to-end communication over a network.
	4. Demonstrate basic understanding of network layer protocols for data routing in network.
	5. Analyze functional & procedural means to transfer data between network entities.
	6. Acquire introductory knowledge about digital wireless communication systems.

Units	Contents	Total Hrs
I	Data Communication: Advantages, Basic Model of Communication System; Data Transmission: Modes: Simplex, Half Duplex, Full Duplex; Methods/Types: Parallel, Serial: Asynchronous, Synchronous, Isochronous; Transmission Media: Guided and Unguided; Modulation: Amplitude, Phase Shift, Frequency, PAM, PCM; Multiplexing: FDM, WDM, TDM; Switching: Circuit, Message, Packet; Delays in Packet Switched Network, Packet Loss; Telephone Networks, Network topologies, Types of Networks: LAN, MAN, WAN; Network Reference Models: ISO-OSI model, TCP/IP model	10
II	Application Layer: Services; Processes: Client-Server Model, Socket Interface; Services required by Application Layer; HTTP: Introduction, RTT, HTTP Handshake, types of HTTP Connections, HTTP Messages, Authentication and Cookies; FTP: Service Model, FTP Commands; Electronic Mail; SMTP; DNS: Services and working	10
III	Transport Layer: Services; Multiplexing and Demultiplexing Applications; Connectionless Transport – UDP; Principles of Reliable of Data Transfer (RDT); Stop-and-wait and Pipelined protocols; GBN protocol; Connection-Oriented Transport: TCP; Flow Control; Principles of Congestion Control; Approaches towards Congestion Control; TCP Congestion Control	10
IV	Network Layer: Services; Network Service Model: Datagram, Virtual Circuit; Routing Principles; Routing Algorithms: Classifications; Hierarchical Routing; Internet Protocol: IP Addressing, IPv4: Classes and Packet format, DHCP; ICMP; Routing in the Internet: RIP, OSPF, BGP; Router; IPv6; Multicast Routing.	10
V	Data Link Layer: Services; Error Detection and Correction; Multiple Access Protocols in LANs: ALOHA, CSMA/CD; LAN Addresses and ARP; Ethernet; Hubs, Bridges and Switches; Point-to-Point Protocol.	10
VI	Wireless Communication: Advantages, Applications; Signals: Characteristics, Propagation, Fading, Multipath Propagation; Spread Spectrum; Frequency Reuse Principle, Cellular System; Medium Access Control: SDMA, FDMA, TDMA, CDMA; Wireless LAN: IEEE 802.11; Bluetooth.	10

Textbook :	
	Data Communication and Networking – Behrouz A. Forouzan (McGrawHill)

Reference Books :	
	1. Computer Networking – James F. Kurose and Keith W. Ross (Pearson) 2. Data Communication and Networking – Behrouz A. Forouzan (McGrawHill) 3. Computer Network & Internet - Douglas E. Comer (Pearson) 4. Data and Computer Communication – William Stallings (Pearson) 5. Computer Networks - Andrew S. Tanenbaum (PHI) 6. Mobile Communications - Jochen Schiller (Addison-Wesley)

Course Code	MCA20105
Course Name	Mathematics & Statistical Techniques
Credits	4
Course Outcomes :	On completion of the course, the students will be able to
	1. Understand the foundations of mathematics.
	2. Apply mathematical ideas to model real-world problems.
	3. Analyze data using Statistical Methods
	4. Identify the type of statistical situation and solve statistical problems

Units	Contents	Total Hrs
I	Linear algebra: Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo- inverse) Norms and spaces, eigenvalues and eigenvectors. Geometric view - vectors, distance, projections, eigenvalue decomposition	10
II	Permutations & Combinations: Factorial Notation, Fundamental Theorem, Definition of Permutations. Definition of Combinations, Simple examples of commercial application of permutations and combinations. Elementary Probability Theory: Concept of random experiment/trial and possible outcomes; Sample Space and Discrete Sample Space; Events their types, Algebra of Events, Mutually Exclusive and Exhaustive Events, Complimentary events. Classical definition of Probability, Addition theorem (without proof), conditional probability. Simple examples	10
III	Functions and Derivatives: Concept of real functions: constant function, linear function, x^n , e^x , a^x , $\log x$. Demand, Supply, Total Revenue, Average Revenue, Total cost, Average cost and Profit function. Equilibrium Point, Break-even point. Derivatives of functions: Constant function, x^n , e^x , a^x , $\log x$. Rules of derivatives: Scalar multiplication, sum, difference, product, quotient (Statements only), simple problems.	10
IV	Measures of central Tendency: Arithmetic mean, Weighted mean, Median, Mode, Quartiles, Deciles and Percentiles. Locating median and quartiles through Ogives. Histogram to locate mode and mean. Numerical problems on central tendency Measures of dispersion: Range, Quartile deviation, Mean deviation from mean, Standard deviation and their coefficients. Numerical problems on Range, quartile deviation, mean deviation.	10
V	Variance: Definition for grouped & ungrouped data, co-efficient of Dispersion, co-efficient of variation. Numerical problems on measures of dispersion. Bivariate Linear Correlation: Scatter Diagram, Computation of Karl Pearson's Coefficient of Correlation, and Computation of Spearman's Rank Correlation Coefficient (case of repeated ranks upto 2 repetitions only) Numerical problems on Bivariate Linear Correlation.	10
VI	Bivariate Linear Regression: Finding Regression lines by method of least squares. Properties of Regression Coefficients- i) $r = \sqrt{b_{yx}b_{xy}}$ ii) $(\bar{x}, \bar{y})$ is the point of intersection of two regression lines. Numerical problems on Bivariate Linear Regression. Time series :Definition of Time series & uses of time series. Components of Time series, Additive & multiplicative models. Methods of estimating trend by moving average method graphical method, semi-average method & by least square methods. Numerical problems on Time Series	10

Textbook :

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| 1. | Linear Algebra and its Applications by David C Lay, Pearson |
| 2. | Business Mathematics by Kashyap Trivedi, Chirag Trivedi, Pearson |
| 3. | Fundamental of Mathematical Statistics by S.C. Gupta & V. K. Kapoor. |
| 4. | Applied Statistics And Probability For Engineers by Uglas Montgomery, Wiley. |

Reference Books :

1.	Higher Engineering Mathematics by B.S. Grewal.
2.	Statistical Methods by S.P. Gupta Fundamentals of Statistics by Goon, Gupta, Dasgupta.
3.	Modern Elementary Statistics by John E. Freund Emeritus, Gary A. Simon.
4.	Fundamentals of Mathematical Statistics by S.C. Gupta V. K. Kapoor, S. Chand & Sons.

Course Code	MCA20107
Course Name	Lab1- Object Oriented Programming in JAVA
Credits	3
Course Outcomes :	Development of skills for implementing core concepts of Java.

TEXT BOOK:

	Herbert Schildt: Java The Complete Reference, Ninth EditionJava 2 (5/e) (Tata- McGraw Hill)
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Units	Contents	Total Hrs
I	Java Basics, implementing concepts of OOPs using Java, Data types and Variables, Operators, Control structures, classes, declaring objects, access control, Inheritance, Polymorphism, Abstract classes, Interfaces, Packages. Arrays: Basics, One - & Multi- dimensional.	10
II	Exception handling: Built-in,checked and unchecked Exceptions, Using try and catch, throw, throws, finally clauses, multiple catch clauses, Multithreaded programming: Java thread model, creating threads, thread priorities & synchronization.	8
III	Java I/O: Stream classes, Byte Stream & Character Streams: Input stream, Output stream, FileInputStream, FileOutputStream Generic Programming:generic classes, generic methods	8
IV	Java Collections Framework: Introduction, Collections Framework hierarchy, List, Set, Map Interface and their implementing classes and methods, Iterator/ListIterator, Utility classes. Introduction To Swing: Hierarchy Of Java Swing Classes,Swing GUI Components, Related Packages, Swing Control Classes & Methods, Handling Events in Swing GUI	8

REFERENCES BOOKS:

	1. Core Java, Volume I — Fundamentals (9th Edition), Cay S.Horstmann, Gary Cornell,Prentice Hall
	2. Effective Java,Second Edition, Joshua Bloch, Addison-Wesley Educational Publishers Inc
	3. S. Chavan “Programming in Java” Shroff Pub.
	4. Java Generics and Collections, by Maurice Naftalin, Philip Wadler, O'Reilly Media, Inc.

	Suggested Practical List
	The sample list of programs is given below. This list can be used as a guideline but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. 1. Write, debug and execute simple JAVA programs that demonstrate programming logic by making use of various control statements . 2. Programs to Demonstrate the understanding and application of classes and objects to real world problems 3. Programs that Demonstrate the understanding and application of interfaces. 4. Programs to Demonstrate the understanding of built in and user defined packages 5. Programs that Demonstrate the understanding and application of Exception handling using real world problems 6. Programs that Demonstrate the understanding and application of Multi-threading using Thread Class/Runnable Interface 7. Programs that Demonstrate the understanding and application of synchronization using multi-threading. 8. Programs that Demonstrate use of streams for File handling, 9. Programs to Demonstrate the use and benefits of generic classes, generic methods, 10. Programs that Demonstrate the use of few Collection classes with real world problems 11. Programs that Demonstrate the use of Swing Control Classes & Methods in GUI application development 12. Programs that Demonstrate the use of Delegation Event model .

Course Code	MCA20108
Course Name	Lab2- Data Structure and Algorithms
Credits	1
Course Outcomes :	On completion of the course, the students will be able to get
	Skill of applying different data structures for solving problem

Sr.No.	Contents	Total Hrs
	The sample list of program is given below. This list can be used as a guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. 1. Write a program to implement Searching Algorithm i) Linear Search ii) Binary Search 2. Write a program to implement Sorting Algorithm i) Bubble Sort ii) Selection Sort iii) Insertion Sort 3. Write a program to perform i) Addition of Matrix ii) Multiplication of Matrix 4. Write a program to implement Linear Linked List (Insertion & Searching operation) 5. Write a program to implement Stack (PUSH, POP, DISPLAY Operations) 6. Write a program to implement Queue (Insertion, Deletion) 7. Write a program to implement Tree Traversal Algorithm (Inorder, Preorder, Postorder) 8. Write a program to implement Graph using Adjacency Matrix.	30

Course Code	MCA20109
Course Name	Lab3- Operating System
Credits	1
Course Outcome	On completion of the course, the students will be able to
	1. Able to understand the Basics of Linux working .
	2. Able to perform the shell scripting programs .
	3. Able to create file handling utilities by using Linux shell environment.

	Contents	Total Hrs
	Linux : Startup, user Accounts, linux logging in logging out, Command line, simple commands, file system and related commands, shell, pipes and redirection, sh, tesh, networking with Linux, file system administration. The sample list of program is given below. 1. Write a shell script program to display list of user currently logged in. 2. Write a shell script program to display “HELLO WORLD”. 3. Shell script program to check whether given file is a directory or not. 4. Shell script program to count number of files in a Directory. 5. Create directory, write contents on that and Copy to a suitable location in your home directory. 6. Use a pipeline and command substitution to set the length of a line in file to a variable. 7. Write a grep/egrep script to find the number of words character, words and lines in a file. 8. Write a shell script for firewall configuration using iptables. 9. Study and write a shell script for samba server for file sharing 10. Write a shell script for editing grub menu in ubuntu linux 11. To simulate First Come First Serve & Shortest Job First process scheduling algorithm 12. To simulate Shortest Job First process scheduling algorithm 13. To simulate Preemptive Shortest Job First process scheduling algorithm 14. To implement Round Robin Process scheduling Algorithm 15. To implement Priority Based Process scheduling Algorithm 16. To simulate paging technique of memory management. 17. To simulate segmentation technique of memory management. 18. To implement the FIFO page replacement policy 19. To implement FCFS Disk Scheduling algorithm 20. To implement SCAN Disk Scheduling algorithm	10

Course Code	MCA20110
Course Name	Lab4- Mathematics & Statistical Techniques
Credits	1
Course Outcomes :	Students will be able to solve the problems of Mathematics and Statistical Techniques using programming logic.

	Contents	Total Hrs
	The following list can be used as guidelines for creating problem statements but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes. Use C/C++/Java language to develop the Programs OR implement the same Mathematical and Statistical Calculations using Data Analytic tools SAS/ R ProgrammingLanguages. 1. Problem on Linearalgebra. 2. Problem on ProbabilityTheory. 3. Problem on Permutations &Combinations. 4. Problem onDerivatives. 5. Problem on graphical & diagrammaticrepresentation. 6. Problem on measures of Central Tendency ordisperssion. 7. Problem on moments, measures of Skewness andKurtosis. 8. Problem on computation of correlation co-efficient for bivariatedata. 9. Problem on Fitting of linear & nonlinear regression lines or computation of rank correlationco-efficient. 10. Problems on timeseries	30

SEMESTER II

Course Code	MCA20201
Course Name	Client Server Computing
Credits	4
Course Outcomes:	On completion of this course, student will be able to:
	1. Acquire knowledge of Server-Side programing by implementing Servlet and JSP.
	2. Acquire the knowledge of J2EE architecture, MVC Architecture.
	3. Distinguish Web Server, Web Container and Application Server
	4. Understand and write the deployment descriptor and enterprise application deployment.
	5. Design and implement components like: Session, Java Beans, JSTL, Tag Extensions.
	6. Gain knowledge of frameworks such as Struts Architecture and Hibernate Architecture
	7. Distinguish JDBC and Hibernate. Design and Develop various application by Integrating any of Servlets, JSPs, Database, Struts,hibernateafteranalyzing requirements and evaluating existing system.
	Pre-requisite of course: Knowledge of Core Java

Units	Contents	Total Hrs
I	Java Database Connectivity: JDBC Concepts, JDBC API, Driver Manager, Connection,Statement,PreparedStatement, CallableStatementand ResultSet classeswith relevant methods, Types of ResultSets.Handling queries, inserts, deletes and updates to database.Displaying the query results. Stored Procedures.	10
II	Servlets in Java: Servlet structure & lifecycle. Servlet A P I basics, various classes & interfaces. Servlet requirements, writing. Running of Servlets, Concepts ofCookies, Servlets & cookies. Session managementwith ServletAPI. Server side includes and request forwarding.Servlet chaining. Jdbc Servlets	10

III	Introduction to JSP: Simple JSP concepts, Environment set up for JSP, Life cycle of a JSP, Elements involved with development of JSP: Scripting Elements, Directives, Implicit Objects. Java beans: Concept of Beans, Properties, Bean instances & serialization, Bean Scopes, Writing Beans, Deploying a bean, JDBC bean. Jsp Actions, Using a bean in a JSP. Java Standard Tag Library (JSTL/Advanced JSP): Types of tags, core and SQL tags in detail.	10
IV	Introduction to Javascript: What is Javascript?, Values, Types and Operators, Expressions and statements, control flow statements, Functions, Arrow Functions, HTTP and Forms, Event handling, data structures, objects	10
V	Introduction to Hibernate: Why Hibernate?, Architecture of Hibernate, Hibernate Query language, Hibernate O/R Mapping, Setting up the Development Environment, Creating Database Table Writing-> Hibernate Configuration File, Java Bean, and Hibernate Mapping File, Developing Controller Component, Developing view Component.	10
VI	Introduction to Struts: Explaining MVC 2 Design Pattern for Struts 2, The Need for Struts 2, Processing Request in Struts 2, Struts 2 Architecture, Actions in Struts 2, Interceptors, OGNL Support, Performing Validation in Struts 2, Internationalizing Struts 2 Applications, Implementing Plugins in Struts 2, Integrating Struts 2 with Hibernate	10

Textbook :

	1 Java Server Programming Java EE 7 (J2EE 1.7) Black Book (2014), Kogent Learning Solutions Inc. Core Servlets and Java Server Pages: Core Technologies by Marty Hall and Larry Brown, Java 2 Platform Enterprise Edition series, Prentice Hall
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Reference Books :

	1) 1 Java EE cookbook, Elder Moraes, Packt Publishing Limited (9 April 2018) Reference URLs: www.docs.oracle.com www.tutorialspoint.com www.javatpoint.com
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Course Code	MCA20202
Course Name	Artificial Intelligence & Applications
Credits	4
Course Outcomes:	On completion of the course, the students will be able to
	1. Adopt an approach in view of Problem solving with AI.
	2. Identify and apply suitable 'Intelligent Agents for various AI applications.
	3. Identify knowledge statement and represent it.
	4. Empower students for path planning of a robotic system.
	5. To develop and survey embedded systems applications using machine learning

Units	Contents	Total Hrs
I	Introduction to Artificial Intelligence: What is an AI, Introduction of Intelligent systems, The Foundations of Artificial Intelligence, Applications of A.I. Problem solving with AI, AI models, Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents, How the components of agent programs work.	10
II	Knowledge, Reasoning, and Planning: Knowledge based agents, The Wumpus World, Logic, propositional logic, Representation of knowledge using rules, Predicate logic, Unification and lifting, inference in FOL, Forward Chaining, Backward Chaining, Resolution, Logic Programming. Planning problem, Planning, Algorithms for Planning as State-Space Search, Planning Graphs, simple planning agent, planning languages, blocks world problem, goal stack planning.	10
III	Logical Agents: Knowledge representation structures: Frames, semantic net, Scripts, Logic: Propositional Logic, Propositional Theorem Proving, Inference and proofs, Proof by resolution, Conjunctive normal form, Horn clauses and definite clauses, Syntax and Semantics of First-Order Logic, Symbols and interpretations, Knowledge Engineering in First-Order Logic, Unification, Resolution, and Introduction to logic programming (PROLOG).	10
IV	Problem Decomposition and Planning: Problem Decomposition: Goal Trees, Rule Based Systems, Rule Based Expert Systems. Planning: STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework for Planning. Constraint Satisfaction : N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies.	10
V	Natural Language Processing and Robotics: Natural Language Processing: Language Models, Steps in NLP, Syntactic Analysis (Parsing), Semantic interpretation, Discourse and pragmatic Processing, Text Classification. Discourse and pragmatic Processing, Implementation aspects of Syntactic Analysis (Parsing). Robotics: Fundamentals, path Planning for Point Robot, Sensing and mapping for Point Robot, Mobile Robot Hardware, Non Visual Sensors like: Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, Biological Sensing.	10
VI	Machine Learning: Machine Learning Concepts, methods and models, Supervised Learning, unsupervised and semi-supervised, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Artificial Neural Networks, Non-parametric Models, Support Vector Machines.	10

Textbook:	
	1. Artificial Intelligence: A Modern Approach by Peter and Norvig. 2. Stuart Russell and Peter Norvig (1995), Artificial Intelligence: A Modern Approach, "Third edition, Pearson.

Reference Books:	
	1. Shai Shalev-Shwartz, Shai Ben-David: Understanding Machine Learning from Theory to algorithms, Cambridge University Press 2. Michael Jenkin, Gregory, "Computational Principles of Mobile Robotics", Cambridge University Press. 3. Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH 4. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India). 5. Artificial Intelligence and Intelligent Systems by Padhy, Oxford University Press.

Course Code	MCA20203
Course Name	Advance Data Base Management Systems
Credits	4
Course Outcomes:	On completion of the course, the students will be able to
	1. Describe the fundamental elements of relational database management systems
	2. Apply the SQL queries on database for intended output.
	3. Analyze the database and remove the redundancy.
	4. Explain basic database storage structures and access techniques
	5. Ensure accuracy and integrity using transaction properties.
	6. Apply the concepts of database for data analytics, big data, parallel and distributed databases.

Units	Contents	Total Hrs
I	Database System Applications, Purpose of Database System, View of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Database Users and Administrators, Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, The Relational Algebra.	10
II	Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Index Definition in SQL, Authorization, Accessing SQL from a Programming Language, Functions and Procedures, Triggers	10
III	Database Design Using the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Complex Attributes, Mapping Cardinalities, Primary Key, Removing Redundant Attributes in Entity Sets, Reducing E-R Diagrams to Relational Schemas, Extended E-R Features, Entity-Relationship Design Issues RelationalDatabaseDesign:Featuresof GoodRelationalDesigns, Decomposition Using Functional Dependencies, Normal Forms, Functional-DependencyTheory,AlgorithmsforDecompositionUsingFunctionalDependencies, Decomposition Using Multivalued Dependencies,More Normal forms	10
IV	Physical Storage Systems: Overview of Physical Storage Media, Storage Interfaces, Magnetic Disks, Flash Memory, RAID, Disk-Block Access Data Storage Structures: Database Storage Architecture, File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer, Column-Oriented Storage, Storage Organization in Main-Memory Databases Indexing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Hash Indices, Multiple-Key Access, Creation of Indices, Write-Optimized Index Structures, Bitmap Indices	10
V	Transactions: Transaction Concept, Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Insert Operations, Delete Operations, and Predicate Reads, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes, Snapshot Isolation Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-Volatile Storage, High Availability Using Remote Backup Systems, Early Lock Release and Logical Undo Operations, ARIES	10

VI	Database-System Architectures: Overview, Centralized Database Systems, Server System Architectures, Parallel Systems, Distributed Systems, Transaction Processing in Parallel and Distributed Systems, Cloud-Based Services Parallel and Distributed Storage: Overview, Data Partitioning, Dealing with Skew in Partitioning, Replication, Parallel Indexing, Distributed File Systems, Parallel Key-Value Stores Big Data & Analytics: Motivation, Big Data Storage Systems, Overview of Analytics, Data Warehousing, Online Analytical Processing, Data Mining	10
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Textbook :	
	Silberschatz, Korth, Sudarshan : Database System Concepts , McGraw Hill, 7th Edition

Reference Books :	
	1. Raghu Ramkrishnan :Database System(TMH) 2. C.J.Date : Database System, 7th ed,.(PearsonEducation) 3. Connolly &Begg, : Database System, Low Price Ed. (PearsonEducation) 4. Navathe&Elmars, Fundamentals of Database Systems. 4/e (PearsonEducation).

Course Code	MCA20204
Course Name	Software Engineering
Credits	4
Course Outcomes :	On completion of the course, the students will be able to
	1. Recognize evolving role of software project management.
	2. Understand and estimate cost for software project.
	3. Identify &analyze aspect in s/w to manage time, process & resources effectively with quality concept.
	4. Estimate software productivity using metrics and indicator & identify important issues for planning a project
	5. Judge different testing techniques used to test software.
	6. Evaluate the role of user and software teams.

Units	Contents	Total Hrs
I	Evolving role of Software. Software crises & myths. Software engineering. Software process & process models : Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts : People, Product, Process, Project. W5HH principle, critical practice.	10
II	Measures, Metrics & Indicators. Metrics in process & project domains- software measurement, Metrics for software quality, small organization. Software projects Planning : Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.	10
III	Project Scheduling : Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.	10
IV	System Engineering: Hierarchy, Business Process & Product engineering : Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model &documentation.	10
V	Software architecture : Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User- interface design : Golden Rule. UTD, Task analysis &modlling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation	10
VI	Software Testing Fundamentals ; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.	10

Textbook :	
	Pressman Roger. S. : Software Engineering, A Practitioner's Approach TMH.

Reference Books :	
	1. Somerville : Software Engineering (Addison-Wesley)(5/e) 2. Fairly R. : Software Engineering (McGrawHill) 3. Davis A. : Principles of Software Development (McGrawHill) 4. Shooman, M.L. : Software Engineering(McGraw-Hill)

Course Code	MCA20205
Course Name	ELECTIVE 1 – Computer Graphics
Credits	4
Course Outcomes:	On completion of the course, the students will be able to
	1. Understand the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two dimensions.
	2. Demonstrate various algorithms for scan conversion and filling of basic objects and their comparative analysis
	3. Interpret the mathematical foundation of the concepts of computer graphics.
	4. Apply geometric transformations, viewing and clipping on graphical objects
	5. Explore solid model representation techniques and projections.
	6. Understand visible surface detection techniques and illumination models.

Units	Contents	Total Hrs
I	An overview of Computer Graphics and Graphics System : Video display devices, Raster-Scan systems, Random-Scan systems, Graphics monitors and workstations, input devices, hard copy devices, Graphics software..	10
II	Output primitives : Point and Lines, Line drawing algorithms, loading the frame buffer, line function, circle and ellipse generating algorithms, curves, parallel curves algorithms, Pixel addressing, filled-area primitives , functions, Cell array, character generation.	10
III	Attributes of output primitives : Line and curve attributes, color and grey scale levels, area fill attributes. Character attributes, bundled attributes, antialiasing.	10
IV	2-D geometric transformations : basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two-Dimensional viewing : viewing coordinates, Window-toviewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior.	10
V	Structures and hierarchical modelling : concepts, editing structures, basic modelling concepts, hierarchical modelling, GUI and interactive input methods : the user dialogue, input of graphical data, functions, initial values for input device parameters, interactive picture - construction techniques, virtual reality environments	10
VI	Three dimensional concepts : display methods, graphics, Bezier curves and surfaces, B-spline curves and surfaces, Beta-splines, three dimensional geometric and modelling transformations : translation, rotation, scaling, three dimensional viewing : viewing pipeline, viewing coordinates, projections.	10

Textbooks :	
	1) D. Hearn, M.P. Baker : Computer Graphics C Version, II edition (Pearson Education)
	2) Ze-Nian, Li, Mark S. Drew "Fundamentals of Multimedia" (Pearson Education)

Reference Books :	
	1. Rajan Parekh "Principles of Multimedia " (TataMcGraw-Hill)
	2. F.S. Hill : Computer Graphics Using Open GL, II edition (Pearson Education)
	3. W. M. Newman & R.F. Sproul : Principles of Interactive Computer Graphics, 2/e, (McGrawHill)
	4. F.S. Hill: Computer Graphics (Macmillan)
	5. Harington : Computer Graphics (McGrawHill)

Course Code	MCA20205
Course Name	ELECTIVE 1 – Data Security
Credits	4
Course Outcomes:	On completion of the course, the students will be able to
	1. Explain different security attacks.
	2. Analyze different security issues related to operating system.
	3. Apply and understand security aspect with respect to database.
	4. Solve network threats including detection of intrusion
	5. Analyze and apply security protocols to improve the administration
	6. Summarize different issues related to computer society and attempt to solve it.

Units	Contents	Total Hrs
I	Introduction: Security- Attacks- Computer criminals- Method of defense Program Security: Secure programs- Non-malicious program errors- Viruses and other malicious code- Targeted malicious code- Controls against program threats	10
II	Operating System Security: Protected objects and methods of protection- Memory address protection- Control of access to general objects- File protection mechanism- Authentication: Authentication basics- Password- Challenge-response- Biometrics	10
III	Database Security: Security requirements- Reliability and integrity- Sensitive data- Interface, Multilevel database- Proposals for multilevel security	10
IV	Security in Networks: Threats in networks- Network security control- Firewalls- Intrusion detection systems- Secure e-mail- Networks and cryptography- Example protocols: PEMSSL- Ipsec.	10
V	Administering Security: Security planning- Risk analysis- Organizational security policies, Physical security	10
VI	Legal and Ethical Issues in Computer Security - Protecting programs and data- Information and law- Rights of employees and employers- Software failures- Computer crime- PrivacyEthical issues in computer society- Case studies of ethics.	10

Textbook :	
	1. C. P. Pfleeger, and S. L. Pfleeger, Security in Computing, Pearson Education, 4th Edition, 2003
	2. Matt Bishop, Computer Security: Art and Science, Pearson Education, 2003

Reference Books :	
	1. Stallings, Cryptography And Network Security: Principles and practice, 4th Edition, 2006
	2. Kaufman, Perlman, Speciner, Network Security, Prentice Hall, 2nd Edition, 2003
	3. Eric Maiwald, Network Security : A Beginner's Guide, TMH, 1999
	4. Macro Pistoia, Java Network Security, Pearson Education, 2nd Edition, 1999
	5. Whitman, Mattord, Principles of information security, Thomson, 2nd Edition, 2005

Course Code	MCA20205
Course Name	ELECTIVE 1 – Optimization Techniques
Credits	4
Course Outcomes :	On completion of the course, the students will be able to
	1. Understand the importance of optimization of industrial process management
	2. Apply basic concepts of mathematics to formulate an optimization problem
	3. Analyze and appreciate variety of performance measures for various optimization problems

Units	Contents	Total Hrs
I	Introduction: Classification of problems in OR, Mathematical Modeling, Dynamic programming problems: Investment problem, Equipment replacement, stage coach.	10
II	Linear Programming Problems: Introduction, concept of linear programming model, Graphical Method, Simplex Method, Big M Method, Two phase Method. Duality Concept.	10
III	Transportation Problem: Introduction to transportation problem, mathematical model, types of transportation problem, Optimization techniques for transportation problem, methods to find basic solution, Northwest Corner cell Method (NWCM), Least Cost cell Method (LCM), Vogel Approximation Method (VAM). Optimizing the basic feasible solution using U-V method.	10
IV	Assignment Problem: Introduction, zero-one programming model for Assignment problems, type of assignment problems. Sequencing Problem: NJobs and Two machine sequencing Problems, Njob and three machine sequencing problem.	10
V	Decision Theory: Introduction to decision theory, minimax, minimin, maximin and maximax decision procedure, Bayes decision procedure. Regret function versus loss function. Game Theory: minimax, maximin, pure strategies, mixed strategies & expected payoff, solution of $2 \times n$ games, $m \times 2$ games. Brawn's Algorithm.	10
VI	Network Analysis: Critical Path Method (CPM), Critical Path, Time estimates as EST, EFT, LST and LFT and Floats. Project Evaluation and Review Technique (PERT) Network, ET, TE, TL, SE, critical path, probability of completing events on schedule.	10

Textbook :	
	1. B.E Gillett , Introduction to Operation Research TMH Edition 2. R.Panneerselvam “Operation Research” PHI. 3. Operations Research, KantiSwarup, Gupta. P. K. & Man Mohan, S. Chand & Sons.

Reference Books :	
	1. J.K. Sharma “ Operation Research” (2/e) Macmillan. 2. Tata Hamdy, “ Operations Research- An Introduction” (5/e), PHI. 3. Taha H. A. “Operation Research” Macmillan. 4. Operations Research by PK Gupta and D.S Hira. S. Chand Publication

Course Code	MCA20207
Credits	1
Course Name	Lab 5-Client Server Computing
Course Outcomes :	On completion of the course, the students will be able to
	1. Implement Servlets and JSP to understand Server-Side programming.
	2. Design program to understand J2EE architecture, MVC Architecture.
	3. Distinguish Web Server, Web Container and Application Server, Serialization, Internationalization
	4. Design and implement components like: Session, Java Beans, JSTL, Tag Extension and Filter.
	5. Acquire knowledge of frameworks such as Struts and Hibernate
	6. Distinguish between JDBC and Hibernate.
	7. Design and Develop various application by Integrating any of Servlets, JSPs, Database, Spring, hibernate by analyzing requirements and evaluating existing system.

	Contents	Total Hrs
	The sample list of programs is given below. This list can be used as a guideline but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. (Use of JDBC) WAP TO: 1. Create a database using JAVA 2. Create a table, IN THE DATABASE 3. Insert records in the table 4. Update records in database table based on conditions 5. Display the records in database table based on conditions 6. Write a servlet program in Java that calls a stored procedure and displays the values returned by the stored procedure. 7. Create login form and perform state management using Cookies, 8. Perform state management using HttpSession 9. Create a registration form with validations using javascript 10. Create database of student subject-wise data and retrieve all data using JSP 11. Study and implement Hibernate 12. Study and Implement MVC using Struts 13. A mini project using all concepts	30

Course Code	MCA20208
Course Name	Lab 6-Artificial Intelligence & Applications
Credits	1
Course Outcomes:	Students will be able to develop basic Artificially Intelligent, Machine Learning and Robotics Applications

	Contents	Total Hrs
	The following list can be used as guidelines for creating problem statements but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes. 1. At least 6 Practical based on LISLanguage. 2. At least 6 Practical based on PROLOGLanguage. 3. Develop chat-bot application for enquiry purpose. 4. At least 1 practical based on implementation of Natural Language Processing using any of its open source tools. 5. Use any one open source robot simulation software and perform at least 1 program to demonstrate simulate robots (like line follower robot). 6. Practical to demonstrate the use of Machine Learning concept to classify any type of information based on facts as "real" or "fake".	30

Course Code	MCA20209
Course Name	Lab 7- Elective- 1 [Computer Graphics]
Credits	1
Course Outcomes:	Students will be able to apply the core concepts of computer graphics to real world problems

	Contents	Total Hrs
	Minimum Twelve practicals/experiments based on the respective syllabus, covering each of the units. The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes. 1. Study various in build graphics functions in C library. 2. Write a program to draw a line using DDA algorithm. 3. Write a program to draw a line using Bresenham's algorithm. 4. Write a program to draw a circle using midpoint algorithm. 5. Write a program to draw a circle using Bresenham's algorithm. 6. Write a program to draw a rectangle using line drawing algorithm. 7. Write a program to perform 2D Transformation on a line. 8. Write a program to perform shear transformation on a rectangle. 9. Write a program to rotate a circle (alternatively inside and outside) around the circumference of another circle. 10. Write a program to draw a car using in build graphics function and translate it from bottom left corner to right bottom corner of screen. 11. Write a program to draw balloons using in build graphics function and translate it from bottom left corner to right top corner of screen. 12. Write a program to draw a cube using in build library function and perform 3D transformations 13. Translations in x, y, z directions 14. Rotation by angle 450 about z axis, rotation by 600 about y-axis in succession. 15. Scaling in x-direction by a factor of 2, scaling in y- direction by a factor of 3. 16. Write a program to implement line clipping (Cohen Sutherland algorithm). 17. Write a program for making Bezier curve. 18. Implement polygon clipping algorithm (at least one) 19. Program to represent a 3D object using polygon surfaces and then perform 3D transformation. 20. Program to perform projection of a 3D object on Projection Plane : Parallel and Perspective. (*)	30

Course Code	MCA20209
Course Name	Lab 7- Elective- 1 [Data Security]
Credits	1
Course Outcomes:	On completion of the course, the students will be able to:
	Explain different security attacks.
	Analyze different security issues related to operating system.
	Apply and understand security aspect with respect to database.
	Solve network threats including detection of intrusion
	Analyze and apply security protocols to improve the administration
	Summarize different issues related to computer society and attempt to solve it.

	Contents	Total Hrs
	The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes. 1. Study of fundamental of Network Security 2. Study of System threat attacks - Denial of Services. 3. Study of Sniffing and Spoofing attacks. 4. Study of Techniques uses for Web Based Password Capturing. 5. Study of Different attacks causes by Virus and Trojans. 6. Study of Anti-Intrusion Technique 7. Study of Symmetric Encryption Scheme 8. Implementation of any algorithm for data encryption 9. Implementation of any Asymmetric Encryption Scheme 10. Study of IP based Authentication.	30

Course Code	MCA20209
Course Name	Lab 7- Elective- 1 [Optimization Techniques]
Credits	1
Course Outcomes:	Students will be able to solve the problems of Optimization Techniques using programming logic.

	Contents	Total Hrs
	The following list can be used as guidelines for creating problem statements but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes. Use C/C++/Java language to develop the program. 1. Write a program to demonstrate the North West corner method. 2. Write a program to demonstrate the Least Cost Method. 3. Write a program to demonstrate Vogel's Approximation Method. 4. Write a program for game theory. 5. Write a program to find optimal period of replacement. (Equipment replacement problem). 6. Write a program to solve investment problem. 7. Write a program to demonstrate the Critical Path Method. 8. Write a program to prepare the loss-regrettable. 9. Write a program to calculate PERT. Write a program to prepare the payoff table.	30

Course Code	MCA20210
Course Name	Lab 8- Mini Project
Credits	1
	Mini project-the student's needs to complete at the end of the semester in order to strengthen the understanding of fundamentals through effective application of the course.

NOTIFICATION

No. 139 /2021

Date : 2 /12/2021

Subject :- Implementation of new syllabi of Semester III & IV of M.C.A. (Two Years Semester Pattern Course) (C.B.C.S.) as per A.I.C.T.E. Guidelines from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **Semester III & IV of M.C.A. (Two Years Semester Pattern Course)** (C.B.C.S.) as per A.I.C.T.E. Guidelines to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

SEMESTER III & IV OF M.C.A. (TWO YEARS SEMESTER PATTERN COURSE) [C.B.C.S.]

SEMESTER III

Course Code **MCA20301**
Course Name **Data Analytics**
Credits **04**

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

1. Understand the basics of data analytics
2. Demonstrate basics of python programming
3. Analyze and visualize data using different libraries of python.
4. Describe R programming basics and identify the data objects in R.
5. Analyze and summarize data using statistical methods of R

Units	Contents	Total Hrs
I	Introduction of Data Analytics and Data Analysis: The difference between Data Analytics and Data Analysis.The different types of data analysis. The key steps in a data analysis process. Big Data Processing Architectures. The role of Data Engineers, Data Analysts, Data Scientists and Business Analysts. A modern data ecosystem: The different components of a modern data ecosystem. The role of Business Intelligence Analysts in this ecosystem. The role, responsibilities, and skillsets required to be a Data Analyst. Hypothesis and Null Hypothesis.	8
II	Basics of Python Programming: Variables, strings, functions, loops, and conditions in Python. The nuances of collection, lists, sets, dictionaries, conditions and branching. Data in Python: Objects and classes in Python including reading and writing files, loading, working, and saving data with Pandas.	8
III	Python Libraries-I: How to interpret data in Python using multi-dimensional arrays in NumPy, Manipulation of DataFrames in pandas. Implementation and examples on above topics. SciPy and Scikit: Use of SciPy library of mathematical routines, and execution of machine learning using Scikit-Learn. Implementation and examples on above topics.	8
IV	Python Libraries-II Scrapy Python Library for large scale web scrapping. Implementation and examples on above topics. Data visualization: Data visualization libraries in Python; including Matplotlib, Seaborn, Plotly and Folium. Implementation and examples on above topics.	8

- V R Programming Basics:** Introduction of R, Environment Setup, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors. Implementation and examples on above topics. 8
R Programming Data associates: Data Frames, Packages, Data, Reshaping, Data Interfaces, CSV Files, Excel Files, Binary Files, XML Files, JSON Files, Web Data, Database. Implementation and examples on above topics.
- VI Visualization and Charts & Graphs,** Pie Charts, Bar Charts, Boxplots, Histograms, Line Graphs, and Scatterplots. Implementation and examples on above topics. 8
Statistical analysis using R: Mean, Median & Mode, Linear Regression, Multiple Regression, Logistic Regression, Normal Distribution, Binomial Distribution, Poisson Regression, Time Series Analysis, Decision Tree, Random Forest. Implementation and examples on above topics.

Text Books :

- 1: A General Introduction to Data Analytics by João Moreira, Andre Carvalho, TomÁjs Horvath, Publisher- Wiley.
- 2: Python: The Complete Reference by Martin C. Brown, Publisher Mc Graw Hill
- 3: The Python 3 Standard Library by Example | First Edition | by Hellmann Doug, By Pearson
- 4: Python for data analytics by Wes McKinney- Oreilly
- 5: A. Ohri, “R for Business Analytics”, Springer, 2012

Reference Books :

- 1: Neal Krawetz, —Introduction to Network Securityl, Thomson Learning, Boston, 2007.
- 2: Bruce Schneier, —Applied Cryptography, John Wiley & Sons, New York, 2004. 2: Data Science & Analytics 1St Edition 2018 by VK Jain, Khanna Publishing House.
- 3: A Handbook of Statistical Analyses Using R, By Brian S. Everitt, TorstenHothorn · 2006, Publisher- Chapman R Hall/CRC.
- 4: Python Standard Library By Fredrik Lundh · 2001, Publisher- Oreilly
- 5: Modern Python Standard Library, Cookbook by Alessandro Molina, Publisher Packt.

Course Code	MCA20302
Course Name	Cloud Computing
Credits	04
Course Outcomes:	On completion of the course, the students will be able to 1. Understand the core concepts of the cloud computing and its benefits along with its various models and services in cloud computing. 2. Use various types of Virtualization techniques using its open-source tools. 3. Explain various types of cloud file systems. 4. Simulate cloud computing environments. 5. Outline various stages of SLA life cycle. 6. Identify various security threats and issues in cloud environments.

Units	Contents	Total Hrs
I	Introduction to Cloud Computing Introduction, Defining Cloud Computing, Understanding Cloud Architecture, Benefits of Cloud Computing SOA, Web services, Web 2.0, Mashups, Grid computing, Utility computing, Hardware virtualization, Essentials of Cloud characteristics, Challenges, Cloud economics, Role of Networks in Cloud Computing: Cloud types and service models, Primary Cloud Service models, Cloud Services brokerage, Primary cloud deployment models, cloud computing reference model, The greenfield and brownfield deployment options.	8
II	Virtualization Introduction, Understanding Abstraction & Virtualization Technologies, Virtualization, Types of Virtualization, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization, Technology examples: Xen, KVM, Vmware, Microsoft Hyper-V, Load Balancing & Virtualization, Understanding Hypervisors, Defining Baseline and metrics, Baseline measurements, System metrics, Load testing, Resource ceilings, Servers and instance types, Network Capacity, Scaling.	8

III	Storage in Cloud Storage system architecture, Big data, Virtualize data center(VDC) architecture, VDC Environment, server, storage, networking, Virtual Machine Components and Process of converting physical to VMs, Block and file level storage virtualization, Virtual Provisioning, VLAN, VSAN and befits, Network traffic management techniques in VDC, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Features and comparisons among GFS, HDFS.	8
IV	Cloud computing platforms & Standards Infrastructure as Service, best-of breed cloud infrastructure components, cloud ready converged infrastructure, Anatomy of Cloud infrastructure, Distributed management of virtual infrastructure, scheduling techniques, SLA Commitment, Google Web Services, Amazon Web Services, Microsoft Cloud services. Cloud Computing Standards Objectives, Best Practices and Standards, Practical Issues- Interoperability, Portability, Integration, Security, Standards Organizations and Groups.	8
V	Cloud monitoring and management Introduction and architecture for federated cloud computing, Performance prediction for HPC on Cloud. SLA management: Types of SLA, Life cycle of SLA, service catalog, cloud portal and its functions, cloud interface standards, system integration and workflow modeling, cloud service life-cycle phases: service planning, service creation, service operation, and service termination Control layer, its functions and benefits,element and unified manager, software defined approach and techniques for managing IT resources.	8
VI	Security in Cloud Computing Introduction, Global Risk and Compliance aspects in cloud environments and key security terminologies, Data security risk, Cloud computing and identity, Digital identity and access management, Content level security, Securing the Cloud, Securing Data, Establishing Identity and Presence. Cloud Applications, Research trend in Cloud Computing, Fog Computing, Open Source and Commercial Clouds, Cloud Simulator.	8

Text Books :

1. Barrie Sosinsky,"Cloud Computing", Wiley India.
2. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication.
3. RajkumarBuyya, "Mastering Cloud Computing", Tata McGraw Hill.

Reference Books :

1. Greg Schulr,"Cloud and virtual data storage networking", CRC Press.
2. Anthony T. Velte, "Cloud Computing, A Practical Approach", TATA Mc Graw Hill
3. Pachghare V. K., "Cloud Computing", PHI Learning
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

Course Code	MCA20303
Course Name	Web Technology
Credits	04

Course Outcomes :	On completion of the course, the students will be able to
	1. Understand the concepts of different web technologies.
	2. Use various types of scripting and markup languages like HTML5, CSS3.
	3. Understand how to work in UI/UX design.
	4. Illustrate Angular environments.
	5. Describe Type Script, Object Oriented features.

Units	Contents	Total Hrs
I	HTML5 and XHTML– Introduction & Basics, Layout, Editors, Heading, Paragraph, Links, Images, Mapping Image, Lists, Text Formatting, Attributes, Iframes, Class Attribute, Id Attributes, style attribute, Color Styles and HSL, Spell Check, Quotations, Geolocation, Drag and Drop, URL Encoding, File Paths, Tables, Audio Tag, Video Tag, Comments, Doctypes, Design Form, Canvas Basics, SVG-Basics, Charsets.	8
II	CSS 3 : CSS3 Introduction, Positioning Elements, Centering Elements, Background, Borders, Links, Fonts, Text Formatting, Height and Width, Overflow, Combinators, flex-wrap property, Pagination, Types of CSS (Cascading Style Sheet), Opacity / Transparency, Advance CSS layout with flexbox, Display property, align-content property, 2D Transforms, empty-cells Property, Units, Gradients, DropDowns, Margins and Padding, Box model, Animations, Counters, Colors, 3D Transforms, Multiple Columns, Attribute Selector, resize Property, align-self Property, word-break Property, Shadow Effect.	8

III	ANGULAR 8 : Introduction to Angular Framework, History & Overview, Environment Setup, Angular CLI, Installing Angular CLI, NPM commands & json, Bootstrapping Angular App, Components, AppModule, Project Setup, Editor Environments, Building Angular App, Directory Structure, Angular Fundamentals, Building Blocks, MetaData Component Basics Templates setup, Creating Components using CLI, Nesting Components, Data Binding – Property & Event Binding, String Interpolation, Style binding, Two-way data binding, Input Properties, Output Properties, Passing Event Data, New features added in Angular11.	8
IV	Introduction to Typescript, Setup and installation, IDE support, Scoping using let and const Keywords (ES6), Template Literals (ES6), Rest and Spread Parameters (ES6), Destructuring (ES6), Introduction to Types: Type inference, Type Annotations, Number, Boolean, String, Array, Tuple, Enum, Any Void, Null and Undefined, Never, Introduction to Functions: Using types in functions, Function as types, Optional and default parameters, Arrow functions.	8
V	Introduction to Classes: Inheritance, Access modifiers, Getters and setters, Read-only & static, Introduction to Interfaces, Optional properties and methods, Strict structural contract, Extending interface, Implementing interface, Introduction to Modules, Import / Export, Default, Decorators.	8
VI	Angular CLI : Anatomy of the project, Setting up a workspace, Updating Angular apps using ng update, Adding support for external libraries using ng add, Directives, Pipes, Routing, Services, Angular Forms, Debugging Angular apps, Working with Augury, Using the Angular Language Service with Microsoft VS Code.	8

Text Book :

HTML 5 Black Book, Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2nd Edition 2016

Reference Book :

Angular 11: by Example 2021 by John & Michael Kocer

Useful Links : 1. <https://angular.io/>

Course Code **MCA20304**

Course Name **Elective 2 - i) Animation & Movie Making**

Credits **04**

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

1. Familiarize the students with various approaches, methods and techniques of Animation Technology.
2. Develop competencies and skills needed for becoming an effective Animator.
3. Exploring different approaches in computer animation.
4. Enable students to manage Animation Projects from its Conceptual Stage to the final product creation.
5. Develop expertise in life-drawing and related techniques.
6. Apply Audio and Video Production Techniques to an Animation Project.

Units	Contents	Total Hrs
I	Introduction to Animation: History of Animation, Introduction to Animation, Terms used in Animation, Types of Animation, Basic Principles of Animation, Animator's Drawing Tools.	8
II	Creating Animations: Explore An Animation program, Create a New Animation, Insert Content in a Frame, Add and Delete Frames and Keyframes, Create Frame-by-Frame Animation, Preview an Animation, Create Motion and Path Animation, Use Layers, Copy and Move a Frame or Frame Series, View multiple Frames, Test a Movie.	8
III	Enhancing Animations: Recoding a sound File, Edit a Sound File, Import and Add Sound in Animations, Add and Animate Text, Insert Buttons in Animation, Use Action Scripts.	8
IV	Publishing an Animation: Analyze a Movie File, Optimize a Movie, Publish a Movie, Publish a Movie for web Delivery, Publish a Movie to Animated or Static Graphics, Publish a Movie to an Executable, Publish a Movie to Quick Time.	8

V	Working with Video : Set Up to Video Project, Capture Video from an External Source, Import Video Sources from other Digital Media, Create and Preview a Video, Edit Video.	8
VI	Enhancing Video: Add Effects, Add Transitions, Add Titles, Add Audio Publishing Video: Publish to a Movie File, Publish to a DVD or VCD, Publish to a Digital Videotape, Publish to an Analog Videotape, Publish a Signal Frame of the Video as a Still Image.	8

Reference Books :

1. The Complete Animation course by Chris Patmore, By – Barons Educational Series (New York).
2. Multimedia and Web Technology, Edition: Second, 2007 by Ramesh Bangia, Firewall Media
3. Multimedia Basics by Weixel, Fulton, Barksdale, Morse, Morse, Thomason Course Technology.
4. The Complete Reference Macromedia Flash MX by Brain Underdahl, Tata McGRAW Hill.

Course Code **MCA20304**

Course Name **Elective 2 - ii) Cyber Security & Digital Forensic**

Credits **04**

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

1. Understand the concepts and foundations of Cyber Security
2. Identify security risks
3. Apply preventive steps
4. Investigate Cyber Crime and analysis of evidences
5. Acquire knowledge of Digital Forensics

Units	Contents	Total Hrs
I	Cyber security concepts, Cyber security Strategy, Current Laws Involving Cyber security, International Comprehensive Cyber security Strategy, Cyber security Policy and Strategy Emerging Challenges, Cyber security, Need of Cyber security Malwares: Viruses, Trojans, and Attacks, Development of Computer Viruses	8
II	Threat Landscape, Attack Classification, Threat Attacks ,Botnets and Cyber Crime Applications , Different types of crimes, Deep Web , Vulnerabilities, Risk Assessment, and Risk Management, Random Stochastic Models ,issues of Time and Sequence , Attack Graphs , Cyber security vulnerabilities, Constraint and Simulations, Optimization and Risk.	8
III	Cyber Threat Spectrum—Cyberspace Attacks and Weapons, Cyber Threat Capability and Cyber Tools, Cyber Digital Arsenal , Rationale of Cyberspace Infrastructure Attacks Framework for Improving Critical Infrastructure Cyber security.	8
IV	Basics of Critical Infrastructure Protection ,Design and Utility of Infrastructures, Evolution of Infrastructures, Impact of Infrastructures on Society ,Random Nature of Faults, Failures, and Engineering Resilience, Fault Intolerance and Fault Tolerance, Fail-Safe.	8
V	Management Methods and Standards, Economic Impact on Regulation and Duties to Protect ,Legal Requirements and Regulations Critical Infrastructure Protection Strategies and Operations ,Physical Security ,Personnel Security, Operational Security Information Warfare Theory and Application Cost of Cyber security Contemporary Cost of Cyber Crime, Cyber security Insurance New Cyber security Models, Future Generations for Cyber security, Transformational Challenges	8
VI	Digital Forensics: Introduction of digital forensics, Need for digital forensics, Forensic process, Investigation, Digital evidence collection, Application, limitations, Legal considerations, Digital evidence, investigation tools.	8

Books :

1. Cyber Security - Edited By Thomas A Johnson CRC Press.
2. CYBER SECURITY By Dr. Krishan Kumar Goyal, Prof Amit Garg
3. The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics by IzzatAlsmadi
4. Computer Forensics and Digital Investigation with EnCase Forensic v7 By Suzanne Widup
5. Digital Forensics for Network, Internet and Cloud computing By Cunt P Garrison

Course Code **MCA20304**

Course Name **Elective 2 - iii) Block Chain Technology**

Credits **04**

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

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
2. Describe secured interaction between blockchain.
3. Design, build, and deploy smart contracts and distributed applications
4. Integrate ideas from blockchain technology into their own projects.

Units	Contents	Total Hrs
I	Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.	8
II	Cryptography : Hash functions, Puzzle friendly Hash, Collision resistant hash Digital Signature - ECDSA, public key crypto, verifiable random functions, Memory Hard Algorithm, Zero Knowledge Proof.	8
III	Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.	8
IV	Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	8
V	Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	8
VI	Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects- Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	8

Text Book :

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, **Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction**, Princeton University Press (July 19, 2016).

Reference Books :

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts
5. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017

Course Code **MCA20305**

Course Name **Elective 3- i) Software Testing**

Credits **04**

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

1. Describe fundamentals of testing
2. Explain the role of testing in SDLC
3. Discriminate among static and dynamic testing
4. Understand the test management mechanisms.
5. Design and develop the best test strategies in accordance to the development model.
6. Understand how to test the s/w for object-oriented designs

Units	Contents	Total Hrs
I	Fundamentals of Testing: Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics	8
II	Role of Testing in SDLC: Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)	8
III	Approaches to Testing - Static Testing Structured Group Examinations Static Analysis Control flow & Data flow, Determining Metrics Dynamic Testing: Black Box Testing Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques White Box Testing Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing.	8
IV	Test Management : Test Organization Test teams, tasks and Qualifications Test Planning Quality Assurance Plan, Test Plan, Prioritization Plan, Test Exit Criteria Cost and economy Aspects Test Strategies Preventive versus Reactive Approach, Analytical versus heuristic Approach Test Activity Management, Incident Management, Configuration Management Test Progress Monitoring and Control Specialized Testing: Performance, Load, Stress & Security Testing	8
V	Testing Tools : Automation of Test Execution, Requirement tracker, High Level Review Types of test Tools Tools for test management and Control, Test Specification, Static Testing, Dynamic Testing, Non functional testing Selection and Introduction of Test Tools Tool Selection and Introduction, Cost Effectiveness of Tool Introduction	8
VI	Testing Object Oriented Software Introduction to OO testing concepts, Differences in OO testing. Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing	8

Text Books:

1. Software Testing techniques – BarisBeizer, 2nd edition, Dreamtech.
2. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech.

Reference Books :

1. Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors
2. Foundations of Software Testing, by Aditya P. Mathur – Pearson Education custom edition 2000.
3. The ART of Software Testing, by GlenfordJ. Myers, Wiley India, Second Edition
4. Software Testing: Principles and Practices, by Srinivasan D and Gopalswamy R, PearsonEd, 2006.
5. Software Testing & Quality Assurance Theory &PracticeByKshirasagarNaik&PriyadarshiTripathi, Wiley Student Edition.
6. Software Quality Assurance Principles & Practice, by Nina S. Godbole, Narosa.
7. Stephan H.Kan, Metric and Model in Software Quality Engineering, Addison Wesley, 1995.
8. Roger S. Pressman, Software Engineering – A Practitioners Approach, Fifth Edition ,McGraw Hill, 2001
9. Advanced Software Testing, Vol. 2, Rex Black, SPD.

Course Code **MCA20305**

Course Name **Elective 3- ii) Mobile Application Development**

Credits **04**

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

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

Units	Contents	Total Hrs
I	Introduction to Mobile A brief history of Mobile, The Mobile Ecosystem, Why Mobile?, Types of Mobile Applications, Mobile Information Architecture, Mobile Design, Mobile 2.0, Mobile Web development, Small Computing Device Requirements. J2ME: Overview The World of Java, Inside J2ME, J2ME Architecture, MIDlet Programming, J2ME Wireless Toolkit, Hello World J2ME Style, Multiple MIDlets in a MIDlet Suite.	8
II	Introduction to Android: History of Android, Introduction to Android, Operating Systems, Android Development Tools, Android Architecture.	8
III	Development Tools: Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.	8
IV	User Interface Architecture: Application context, intents, Activity life cycle, multiple screen sizes. User Interface Design: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners(Combo boxes),Images, Menu, Dialog.	8
V	Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. Understanding of SQLite database, connecting with the database.	8
VI	Publishing and Distributing Android Applications : The Android Software Development Process, Assessing Project Risks, Writing Essential Project Documentation, Deploying Mobile Applications, Designing and Developing, Bulletproof Android Applications.	8

Text Books :

1. J2ME: The Complete Reference, James Keogh, Tata McGraw Hill
2. Android application development for java programmers. By James C. Sheusi. Publisher: Cengage Learning, 2013.
3. Lauren Darcey and Shane Conder, - Android Wireless Application Developmentl, Pearson Edn, 2nd edn. (2011)

Reference Books :

- 1) Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
- 2) Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
- 3) Android Application Development All in one for Dummies by Barry Burd, Edition: I

Course Code	MCA20305
Course Name	Elective 3- iii) Internet of Things
Credits	04

Course Outcomes : At the end of the course, the students will be able to

1. Identify the use of IoT from a global context.
2. Design application using IoT.
3. Analyze the IoT enabling Technologies
4. Determine the real world problems and challenges in IoT .

Units	Contents	Total Hrs
I	IoT Architecture – State of the Art Introduction, State of the art, Architecture Reference Model, Introduction, Reference model and architecture, IoT reference model, IoT Reference Architecture, Introduction, Functional view, Information view, Deployment and operational view, Other relevant architectural views.	8
II	IoT Enabling Technologies - Wireless Sensor Networks ,Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems.	8
III	Real-World Design Constraints- Introduction, Technical design Constraints– hardware, Data representation and visualization, Interaction and remote control.	8
IV	Open – Source Prototyping Platforms for IoT- Basic Arduino Programming Extended Arduino Libraries, Arduino – Based Internet Communication, Raspberry PI, Sensors and Interfacing.	8
V	Data Management, Business Process in IoT, IoT Analytics, Creative Thinking Techniques, Modification, Combination Scenarios, Decentralized and Interoperable,Approaches, Object - Information Distribution, Architecture, Object Naming Service(ONS), Service Oriented Architecture, Network of Information.	8

VI	Domain specific Home Automation - Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors Energy-Smart Grids, Renewable Energy Systems ,Prognostics Health &Lifestyle - Health & Fitness Monitoring ,Wearable Electronics ,Agriculture - Smart Irrigation, Green House Control ,Retail- Inventory Management, Smart Payments ,Smart Vending Machines, Cities -Smart Parking, Smart Lighting ,Smart Roads ,Structural HealthMonitoring,Surveillance,Emergency Response.	8
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Reference Books :

- 1) From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler VlasiosTsiatsis Catherine Mulligan Stefan Aves & Stamatis Karnouskos David Boyle.
- 2) VijayMadiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEd., VPT, 2014.
- 3) Getting Started with the Internet of Things by Cuno P fister.
- 4) The Internet of Things: Connecting Objects by HakimaChaouchi.
- 5) FrancisdaCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition ,Apress Publications, 2013.

Course Code **MCA20305**

Course Name **Elective 3- iv) Soft Computing**

Credits **04**

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

1. Describe soft computing concepts and techniques
2. Apply fuzzy logic and neural network to solve various engineering problems
3. Apply genetic algorithms in problem solving.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.

Units	Contents	Total Hrs
I	Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	8
II	Fuzzy Sets and Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	8
III	Models of Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advance in Neural networks.	8
IV	Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	8
V	Application of Soft Computing: Introduction to MATLAB / Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.	8
VI	Recent Trends and Techniques: Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	8

Reference Books :

1. Sivanandam, Deepa, " Principles of Soft Computing", Wiley
2. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall.
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: theory and Applications, Prentice Hall, 1995.

Course Code **MCA20307**

Course Name **Lab 7 Data Analytics using Python/R language**

Credits **1**

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

1. Understand the basics of data analytics
2. Demonstrate basics of python programming
3. Analyze and visualize data using different libraries of python.
4. Describe R programming basics and identify the data objects in R.
5. Analyze and summarize data using statistical methods of R

Contents	Total Hrs
1. Write a program to demonstrate basic data type in python.	30
2. Write a program to demonstrate list and tuple in python using For& while loops.	
3. Write a Python program to demonstrate use Dictionary& related functions.	
4. Write a Python program to demonstrate working of classes and objects Python Libraries.	
5. Write a Python program to read and write data from a file& perform various operations like copy, save.	
6. Using a Numpy module create an array and check the following: a. Type of array b. Axes of array c. Shape of array d. Type of elements in array.	
7. Write a Pandas program to check the number of rows and columns and drop those row if 'any' values are missing in a row of sample DataFrame.	
8. Demonstrate the use of data visualization libraries like matplotlib, seaborn, pandas & folium using a sample DataFrame.	
9. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location&find subset of dataset by using subset (), aggregate () functions on iris dataset.	

Course Code MCA20308
Course Name Lab 8 Web Technology
Credits 1

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

Develop web applications using advanced web technologies i.e HTML5, CSS3, ANGULAR.

Contents	Total Hrs
1. Create a webpage which shows student's general information in a tabular format using table tag.	30
2. Create a registration form using HTML5 input tag.	
3. Create a HTML5 page which shows video using video tag.	
4. Write a HTML5 program to create a circle with canvas tag.	
5. Create a college 5 page college website using HTML5.	
6. Create a web page with red background and opacity 0.5 with the help of internal CSS.	
7. Show simple animation webpage using CSS3	
8. Write a program to add 10 elements in array in type script.	
9. Write a program to concatenate two strings in type script.	
10. Write a program to show data in Upper case and Lower case using Pipe in angular	
11. Create a registration form with component in Angular.	
12. Write a program to create a calculator in Angular.	
13. Design a Login Form using Angular Materials/Bootstrap.	

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - i) Animation & Movie Making**

Credits **1**

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

1. Create on videos using flash
2. Create on movies using action script

Contents	Total Hrs
1. Write, test and debug small applications using Basic Flash concepts using shapes, colors, text and images.	30
2. Write, test and debug small applications with flash layers.	
3. Write, test and debug small applications with Scenes and Frame Labels.	
4. Write, test and debug small applications with flash symbols and instances.	
5. Write, test and debug small applications with flash animation.	
6. Write, test and debug small applications with simple action script.	
7. Write, test and debug small applications of movie using action script.	
8. Write, test and debug small applications of movie using timeline action script.	
9. Write, test and debug small applications with flash & publish it using flash.	

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - ii) Cyber Security & Digital Forensic**

Credits **1**

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

Apply the concepts of Cyber Security to real world problems

Contents	Total Hrs
The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about minimum expected outcomes.	30
1. Case study on cyber attack/crime	
2. Study and implementation of cyber tools.	
3. Identification of Virus infected file	
4. Vulnerability Analysis in Web Application	
5. Perform Port Scanning using Nmap	
6. Perform Data Hiding Technique using OpenStego	
7. Case Study on current cyber security laws in india	
8. Case study on digital evidence collection	
9. Generation of reports by using digital forensic investigation tools	

Course Code **MCA20309**

Course Name **Lab 9 Elective 2 - iii) Block Chain Technology**

Credits **1**

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

1. Write basic Hadoop commands
2. Implement the Hash Table
3. Create simple Blockchain

4. Use Geth to implement Ethereum
5. Prepare Case Studies on Blockchain Applications
6. Study Smart Contract Construction

Contents	Total Hrs
Lab Work –	30
1) To Study Basic Hadoop Commands	
2) To study and implement Hash Table using Hash functions	
3) Create a Simple Blockchain in any suitable programming language	
Using JavaScript Perform following	
4) Creating a Blockchain	
5) Implementing Proof of Work	
6) Miner rewards & transactions	
7) Signing transactions	
Use Geth to Implement Private Ethereum Block Chain	
8) Creation of private Blockchain	
9) Creation of Account	
10) Mining using geth	
11) Create Case study of Block Chain being used in illegal activities in real world	
12) Write a smart contract in solidity to store and get “Hello World”.	

Course Code **MCA20310**

Course Name **LAB 10 ELECTIVE 3 - I) SOFTWARE TESTING**

Credits **1**

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

1. Describe fundamentals of testing
2. Discriminate among static and dynamic testing
3. Understand the test management mechanisms.
4. Design and develop the best test strategies in accordance to the development model.

Contents	Total Hrs
1. How many bugs can you find on buggy windows calculator?	30
2. How many bugs can you find on buggy Calendar?	
3. How many bugs can you find on Weather Forecast screen?	
4. How many bugs can you detect on Google accounts page?	
5. How many test scenarios can you derive for ATM Feature based on Design Spec?	
6. How many test scenarios can you derive for ATM Feature based on Use Case?	
7. What Test Data conditions could you derive for the Test Scenarios identified before?	
8. Would you be able to prepare a Test case you derive for a Test Scenario identified before?	
9. What Test Scenarios can be derived for this feature based on Agile User Stories?	
10. How many defects can you uncover for this Currency Converter App?	
11. What Xpaths can you find for Search Engine (Dynamic Application)?	
12. How do you automate a test case using Selenium WebDriver and Java?	
13. How do you automate a test case using Selenium WebDriver, Java and JUnit?	
14. Can you Prepare Cucumber BDD Steps Definition for feature?	
15. Light Search Engine (Sorting) - Test Application	

Course Code **MCA20310**

Course Name **Lab 10 Elective 3 - ii) Mobile Application Development**

Credits **1**

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

Design and Develop Mobile Application using Android Studio Development tool.

Contents	Total Hrs
The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list is to inform about minimum expected outcomes	30
1. Add two Edit Text. When a number is entered in Edit Text 1, the square of that number should be displayed in Edit Text 2.	
2. Add an Edit Text and a button. When the button is clicked, the text inputted in Edit Text should be retrieved and displayed back to the user	
3. Add two EditText and a button. When the button is clicked, the text inputted in Edit Text 1 should be retrieved and displayed in EditText2.	
4. Program a calculator	
5. Create a Unit convertor for height	
6. Create a Unit convertor for height and weight in the same application. Selection of height/weight can be done using a spinner.	
7. Add a spinner. When the spinner is selected, there should be three options (e.g., android, java, testing). When you click on each option, it should go to another page containing some other components. Each of these pages should have a “back” button, which on pressing will take you back to the page with the spinner.	
8. Create applications to include Action Bar, Menus, Dialogs and Notifications.	
9. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.	
10. Create a camera application, where you can click a picture and then save it as the wallpaper.	
11. Create a media player which plays an mp3 song.	
12. Create a media recorder which will record the sound.	

Course Code

MCA20310

Course Name

Lab 10 Elective 3 - iii) Internet of Things

Credits

1

Course Outcomes :

On completion of the course, the students will be able to Design and Develop IoT based application

Contents

The following list of can be used as guidelines for basic understanding but the scope of the laboratory should not be limited to this list. Aim of the list to inform about expected outcomes.	
1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller .	
2. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board.	
3. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.	
4. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs.	
5. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor.	
6. Write an application to detect obstacle and notify user using LEDs.	
	Total Hrs

7. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image. 30
8. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee .
9. Write an application using Raspberry-Pi /Beagle board to control the operation of stepper motor.
10. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardware simulated traffic signal.
11. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application .
12. Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.

Course Code **MCA20310**

Course Name **Lab 10 Elective 3 - iv) Soft Computing**

Credits **1**

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

1. Describe soft computing concepts and techniques
2. Apply fuzzy logic and neural network to solve various engineering problems.
3. Apply genetic algorithms in problem solving.
4. Evaluate and compare solutions by various soft computing approaches for a given problem

Contents	Total Hrs
1. Implement basic logic gate by considering Boolean value.	30
2. Implement Union, Intersection, Complement and Difference operations on fuzzy sets.	
3. Perform Max-Min Composition on any two fuzzy relations.	
4. Implementation of simple neural network.	
5. Implementation of Single layer Perceptron Learning Algorithm.	
6. Implementation of Simple Genetic Application	
7. Write a program to implement artificial neural network with or without back propagation algorithm.	
8. Implement any classification algorithm by applying Fuzzy concept	
9. Study of ANFIS Architecture to understand Hybrid System.	
10. Study of research paper on Soft Computing	

SEMESTER : IV

Course Code	MCA20401
Course Name	Industry Project and Internship/Start-up
Credits	18

Details	Total Hrs
Guidelines : 1. Students may opt either Industrial Project or Internship or Start-up. 2. Industrial Project: It is a software development project assigned by any registered industry/organization to the student. Student may complete the project at industry/organization or from home. Student shall submit the completion/implementation certificate issued by the Industry/organization. Students should take prior approval from the institute in this regard. 3. Internship: In the internship, students shall apply direct/through institute to the Industry/Organization for internship or take use of 'Intershala', an initiative of AICTE. The internship is placement of students in the industry/organization for which they are entitled to receive stipend. Students shall submit the appointment letter at the start of the internship and completion certificate at the end of the session well before the final examination. 4. Start-up: Students may undertake startup activity which is recognized by the Institute. Institute shall incubate the start-up using the system available at institute level and assign a mentor/guide to the student. The necessary support may be extended to the students for this activity. Students shall submit their proposal well in advance to the institute and Institute should grant its approval through available mechanism at Institute level. The registration of start-up and business proposal shall be the essential documents for this activity. Activity shall be evaluated on the basis of its profit ratio. 5. In all the three above activities, students need to submit complete Project Report to the Institute well before the final examination.	06 Months

Course Code	MCA20402
Course Name	Seminar
Credits	6

Details
Guidelines : 1. Institute shall assign mentor/guide to each student. 2. Student shall submit synopsis approved by the mentor/guide. 3. Institute shall approve the seminar topic. 4. Students shall prepare seminar report and presentation with the help of guide and submit seminar report and presentation approved by the guide well in advance to conduct final presentation/examination. 5. Students may take seminar topic based on new technology, case study, success story of start-up he/she has undertaken in the 'Industrial Project/Internship/Start-up activity'.

Course Code	MCA20403
Course Name	Online Subject - i) Management Information System
Credits	02
Prerequisite	Basic Knowledge of managerial functions and organization

Course Outcomes :	On completion of the course, the students will be able to 1. Describe various organization structures, behaviors and its influence on MIS Design 2. Create reports for various subsystem in an organization based on their functionality and interrelationship 3. Explain the planning models and relevance of each in current scenario at various levels of management. 4. Analyze the decision making requirements to create an appropriate decision support system.
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Unit	Contents	Duration
I	Introduction An introduction to Information systems, Information systems in organization and their capabilities, Foundation concepts: Business Applications, development and Management, Role and process of management, Functions of a manager, Methods of Management, Types of Information Systems, Transaction Processing system, Management Reporting system, Decision Support system, Executive Information system, Office information system, Professional information system ,Expert Systems	8
II	Competing with Information Technology Systems Definition, Effectiveness and efficiency, Various Models, Control in systems (Feedback and Feed forward control), Organization Model, Strategic Planning Model, Management Control Model	8
III	IS Planning Types of planning, Traditional Strategy making, Assumptions in traditional planning, Various Planning approaches: Traditional and Current scenario Functional subsystem Marketing and Sales, Finance and Accounting, Production, Human Resources, Logistics and Inventory, Research and development Decision Support Systems Overview, Capabilities of DSS, DSS models: Scenario generation, Goal Seeking, DSS Components/ Architecture, DSS Classification, Building DSS Expert Systems Capabilities of ES, Architecture, Applications to Information Systems, Development and Maintenance of ES, Benefits and Limitations	8

Text Books :

1. Davis, Gordon B., and Margrethe H. Olson. Management information systems: conceptual foundations, structure, and development. McGraw-Hill, Inc., 1984.
2. Barbara McNurlin et al, IS Management in practice, Pearson Education, 5th edition
3. Zwass, Vladimir. Foundations of information systems. Irwin/McGraw Hill, 1997.
- 4.

Reference Books :

1. Laudon, Kenneth C., and Jane P. Laudon. "Management information systems: managing the digital firm." New Jersey 8 (2004).
2. W. S. Jawadekar, Management information Systems, Global Digital Enterprise Perspective, McGrawHill India, 5thed
3. James Obrien and George Maracus, Management information Systems McGrawHill India, 10thed,
4. Haag, Dawkins, Management information Systems for Information Age , McGrawHill India, 6thed

Course Code	MCA20403
Course Name	Online Subject- ii) Entrepreneurship Development
Credits	02

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

1. Understand the systematic process to select and screen a business idea.
2. Identify business opportunities in chosen sector.
3. Sub-sector and plan and market and sell products / services.
4. Effectively manage small business enterprise

Unit	Contents	Total Hrs
	ENTREPRENEURIAL COMPETENCE	
	Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneur - Personality Characteristics of Successful. Entrepreneur - Knowledge and Skills Required- or an entrepreneur.	
I	ENTREPRENEURIAL ENVIRONMENT	8
	Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations - International Business	

BUSINESS PLAN PREPARATION

II	Sources of Product for Business - Pre-feasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.	8
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LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection- Growth Strategies - Product Launching.

MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units - Effective Management of small Business.

III	FINANCING THE ENTREPRENEURIAL BUSINESS Funding & Start up and Entrepreneurship Councils in India, Arrangement of funds, Exercise on writing of project report, Entrepreneurial Financing and Risk. Appraisal of loans by financial institutions, Role of Commercial Banks in financing Business Entrepreneurs, Venture Capital.	8
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Text Books :

1. Hisrich, 'Entrepreneurship', Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, 'Entrepreneurial Development', S.Chand and Company Limited.

Reference Books :

1. Prasama Chandra, Projects - 'Planning, Analysis, Selection, Implementation and Reviews', Tata McGraw-Hill.
2. P. C.Jain (ed.), 'Handbook for Nmv Entrepreneurs', EDII, Oxford University Press.

Course Code **MCA20403**

Course Name **Online Subject- iii) Enterprise Resource Planning**

Credits **02**

Course Outcomes :

At the end of the course student will be able to

1. Develop model for ERP for large projects
2. Develop model for E-commerce architecture for any application
3. Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain
4. Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.
5. Evaluate organizational opportunities and challenges in the design system within a business scenario.
6. Use various platforms to implement the ERP

Unit	Details	Total Hrs
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.	8
II	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.	8
III	ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees. ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: ERP Softwares and tools, either SAP or ORACLE format to case study	8

Text Books :

1. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning Concepts and Practice", PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology.

Reference Books :

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill
2. Rahul V. Altekar "Enterprise Resource Planning", Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – A Concepts and Practice", PHI
4. Mary Summer, "Enterprise Resource Planning"- Pearson Education

Course Code **MCA20403**

Course Name **Online Subject- iv) Research Methodology**

Credits **2**

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

1. Explain fundamentals of Research Methodology
2. Analyze and classify different problem identification technique
3. Describe data analysis and data interpretation.
4. Use of different research techniques and tools.

Unit	Details	Total Hrs
I	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process	8
II	Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables	8
III	Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism Use of Encyclopaedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	8

Reference Books :

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R. Kothari
