

# Savitribai Phule Pune University, Pune

## *Faculty of Commerce and Management*

### Master of Computer Application (MCA)

#### Programme Curriculum (2020-2022)

### CIRCULATION FOR FACULTY ONLY

#### **Preamble:**

1. The name of the programme shall be Masters of Computer Application (M.C.A)
2. The revised MCA Curriculum 2020 builds on the implementation of the Choice Based Credit System (CBCS) and Grading System initiated in the AY 2015. The curriculum takes the MCA programme to the next level in terms of implementing Outcome Based Education along with the Choice Based Credit System (CBCS) and Grading System.
3. The Institutes should organize placement programme for M.C.A. students by interacting with Industries and software consultancy.
4. At the end of each semester, appearing for various certifications is possible for each student enabling them to make their resume rich.
5. With the rapidly changing scenario industry and academia should identify possible areas of collaboration and work together. Institute's placement cell should focus on identifying industrial expectations and institutional preparation for meeting industrial needs.

#### **Introduction:**

##### **1. Definition: Outcome Based Education:**

**1.1 Outcome Based Education (OBE) Approach:** Outcomes are about performance, and this implies:

- 1.1.1** There must be a performer – the student (learner), not only the teacher
- 1.1.2** There must be something performable (thus demonstrable or assessable) to perform
- 1.1.3** The focus is on the performance, not the activity or task to be performed

**1.2 Programme Educational Objectives (PEOs):** Programme educational objectives are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve. Programme Educational Objectives are a set of broad future focused learner's performance outcomes that explicitly identify what learners will be able to do with what they have learned, and what they will be like after they leave institution and are living full and

Semester I					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Java Programming	IT11	3	50	25
2	Data Structure and Algorithms	IT12	3	50	25
3	Object Oriented Software Engineering	IT13	3	50	25
4	Operating System Concepts	IT14	3	50	25
5	Network Technologies	IT15	3	50	25
6	Open Course 1	OC11	1		25
7	Open Course 2	OC12	1		25
<b>* Practicals</b>					
8	Practical	IT11L	5	50	75
9	Mini Project	ITC11	5	50	75
<b>Soft Skills</b>					
10	Soft Skills - I	SS11	1		25
			<b>28</b>	<b>350</b>	<b>350</b>

Semester II					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Python Programming	IT21	3	50	25
2	Software Project Management	IT22	3	50	25
3	Optimization Techniques	MT21	3	50	25
4	Advanced Internet Technologies	IT23	3	50	25
5	Advanced DBMS	IT24	3	50	25
6	Open Course 3	OC21	1		25
7	Open Course 4	OC22	1		25
<b>* Practicals</b>					
8	Practical	IT21L	5	50	75
9	Mini Project	ITC21	5	50	75
<b>Soft Skills</b>					
10	Soft Skills - II	SS21	1		25
			<b>28</b>	<b>350</b>	<b>350</b>

Semester III					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Mobile Application Development	IT31	3	50	25
2	Data Warehousing and Data Mining	IT32	3	50	25
3	Software Testing and Quality Assurance	IT33	3	50	25
4	Knowledge Representation & Artificial Intelligence - ML, DL	IT34	3	50	25
5	Cloud Computing	IT35	3	50	25
6	Open Course 5	OC31	1		25
7	Open Course 6	OC32	1		25
<b>* Practicals</b>					
8	Practical	IT31L	5	50	75
9	Mini Project	ITC31	5	50	75
<b>Soft Skills</b>					
10	Soft Skills- III	SS31	1		25
			<b>28</b>	<b>350</b>	<b>350</b>

Semester IV					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	DevOps	IT41	3	50	25
2	PPM and OB	BM41	3	50	25
2	Project	ITC41	22	250	300
			<b>28</b>	<b>350</b>	<b>350</b>

Semester	Credit	IE	UE
Semester I	28	350	350
Semester II	28	350	350
Semester III	28	350	350
Semester IV	28	350	350
<b>Total</b>	<b>112</b>	<b>1400</b>	<b>1400</b>
			<b>2800</b>

13. Practical based on Divide and Conquer Technique-Binary Search, Tower of Hanoi
14. Implementation of Dynamic Programming- LCS, Regular Expression Matching
15. Practical based on backtracking- N Queen's problems

**Course Code: ITC11**  
**Course Name: Mini Project**

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	10 Hrs./Week	5	-	75	-	50	125

**Course Description:**

A mini project is an assignment that the student needs to complete at the end of every semester to strengthen the understanding of fundamentals through effective application of the subjects learnt.

*Course Outcomes:*

Student will be able to

CO1: Create working project using tools and techniques learnt in this semester (Create)

*Course Structure:*

**Guidelines for Mini Project**

1. Students are expected to undertake one mini project starting from first semester till third semester.
2. The student may take up the mini project in first semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.
3. The student may take up the project individually or in group. However, if project is done in group, each student must be given a responsibility for distinct modules.
4. Selected project/module must have relevant scope as per the marks assigned and must be carried out in the Institute.
5. Internal guide should monitor and evaluate the progress of the project on individual basis through handwritten workbook (Project Diary) maintained by students containing various project milestones with learnings and remarks from internal guide for concurrent evaluation.
6. The Project Synopsis should contain an Introduction to Project clearly stating the project scope in detail justifying enough scope for 125 marks. The project work will carry 75 marks for internal assessment and 50 marks for external assessment.
7. Students are expected to show working demo of the project during final evaluation.
8. **Students are expected to upload mini-project on GITHUB as project repository of the institution.**
9. Students are expected to submit the soft copy of mini project report as a part of final submission.

**Course Code: ITC21**  
**Course Name: Mini Project**

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	10 Hrs./Week	5	-	75	-	50	125

**Course Description:**

A mini project is an assignment that the student needs to complete at the end of every semester to strengthen the understanding of fundamentals through effective application of the subjects learnt.

*Course Outcomes:*

Student will be able to

CO1: Create working project using tools and techniques learnt in this semester (Create)

*Course Structure:*

**Guidelines for Mini Project**

1. Students are expected to undertake one mini project starting from first semester till third semester.
2. The student may take up the mini project in first semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.
3. The student may take up the project individually or in group. However, if project is done in group, each student must be given a responsibility for distinct modules.
4. Selected project/module must have relevant scope as per the marks assigned and must be carried out in the Institute.

5. Internal guide should monitor and evaluate the progress of the project on individual basis through handwritten workbook (Project Diary) maintained by students containing various project milestones with learnings and remarks from internal guide for concurrent evaluation.
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7. Students are expected to show working demo of the project during final evaluation.
8. **Students are expected to upload mini-project on GITHUB as project repository of the institution.**
9. Students are expected to submit the soft copy of mini project report as a part of final submission.
10. The project will be assessed internally as well as externally by the examiners appointed by University. University may appoint Industry Experts as an external examiner

## Semester III

Course Code: IT-31

Course Name: Mobile Application Development

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
3 Hrs./Week	-	3	25	-	-	50	75

### **Course Description:**

#### *Course Objectives:*

1. To understand the different mobile application Architectures.
2. To understand different types of widgets like buttons, views, layout etc.
3. To know the ways of application handling like intents, adapters, Notifications, Web Services and Web View.
4. To learn and know about data storing, retrieval and sharing in android.
5. To explore cross platform mobile application development framework, React Native and Flutter.

#### *Course Outcomes:*

Student will be able to

- CO1: Understand Various Mobile Application Architectures. (Understand)
- CO2: Apply different types of widgets and Layouts. (Apply)
- CO3: Describe Web Services and Web Views in mobile applications. (Understand)
- CO4: Implement data storing and retrieval methods in android. (Apply)
- CO5: Demonstrate Hybrid Mobile App Framework. (Apply)

#### *Course Structure:*

**Course Code: ITC31**  
**Course Name: Mini Project**

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	10 Hrs./Week	5	-	75	-	50	125

**Course Description:**

A mini project is an assignment that the student needs to complete at the end of every semester to strengthen the understanding of fundamentals through effective application of the subjects learnt.

*Course Outcomes:*

Student will be able to

CO1: Create working project using tools and techniques learnt in this semester (Create)

*Course Structure:*

**Guidelines for Mini Project**

1. Students are expected to undertake one mini project starting from first semester till third semester.
2. The student may take up the mini project in first semester based on the courses learnt in that semester and for every next semester the mini project may be based on the courses learnt in the current semester along with all the subjects learnt in earlier semesters.

3. The student may take up the project individually or in group. However, if project is done in group, each student must be given a responsibility for distinct modules.
4. Selected project/module must have relevant scope as per the marks assigned and must be carried out in the Institute.
5. Internal guide should monitor and evaluate the progress of the project on individual basis through handwritten workbook (Project Diary) maintained by students containing various project milestones with learnings and remarks from internal guide for concurrent evaluation.
6. The Project Synopsis should contain an Introduction to Project clearly stating the project scope in detail justifying enough scope for 125 marks. The project work will carry 75 marks for internal assessment and 50 marks for external assessment.
7. Students are expected to show working demo of the project during final evaluation.
8. **Students are expected to upload mini-project on GITHUB as project repository of the institution.**
9. Students are expected to submit the soft copy of mini project report as a part of final submission.
10. The project will be assessed internally as well as externally by the examiners appointed by University. University may appoint Industry Experts as an external examiner

**Course Code: ITC41**  
**Course Name: Project**

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
-	40 Hrs./Week	22	-	300	-	250	550

**Course Description:**

A project is an assignment that the student needs to complete at the end of semester IV to strengthen the understanding of fundamentals through effective application of the subjects learnt.

***Course Outcomes:***

Student will be able to

CO1: Create working project using tools and techniques learnt in the programme (Create)

***Course Structure:***

The project is an outcome of technical skills and domain knowledge acquired by the students during the program. Students demonstrate problem solving skills, analytical ability, logical thinking, communication skills and team work during the course of the project. The project can be implementation of a research work published in any reputed journal.

1. The project may be done individually or in groups. However, if project is done in groups, each student must be given a responsibility for distinct modules.
2. Selected project/module must have relevant scope as per the marks assigned and can be carried out in the Institute or outside with prior permission of the Institute.
3. Internal guide should monitor and evaluate the progress of the project on individual basis through handwritten workbook maintained by students containing various project milestones with learnings and remarks from internal guide for concurrent evaluation.
4. The Semester IV project should be having sufficient scope for 400 marks. The project work will carry 300 marks for internal assessment and 250 marks for external assessment.
5. Students are expected to show working demo of the project during final evaluation in semester IV.
6. The project report should be prepared as per the University prescribed format with all the chapters mentioned in project guidelines. And it should be printed on back-to-back pages (one copy) which should be signed by the internal guide and the Director of the Institute. A client (colleges, Non IT organization, and IT organization) certificate should be attached to prove the authenticity of the project work done.
7. The project will be assessed internally as well as externally by the examiners appointed by the institutions and University.

**Type of Projects**

## **1. Application Development**

The students are advised to choose a project that involves window-based development, web-based development, mobile-based development, projects based on machine learning. Analysis and interpretation of any company specific data is not permitted.

## **2. Embedded Systems / IoT**

A project should be developed and implemented for application specific system after thorough investigation of the latest development in the field of electronics or communication to facilitate their efficient operation. The Real Time Operating System (RTOS) or open source platform can be used to develop embedded applications such as Robotics, Microcontroller / Microprocessor based projects etc. An IOT project can be used to design products for reliability and security using simple electronics concepts and integrating with a cloud platform to get the data real-time and make some operational analysis. It has to use efficient algorithms for strong authentication and security protocols and disable non-essential services.

Few examples of IoT applications

Smart home, Health care applications, Smart waste management, Activity Tracker etc.

## **3. ETL Projects**

Extract, transform, load (ETL) is the process of integrating the data from one or more sources. It is expected from the student that he should demonstrate the entire ETL process with reference to any domain like finance, banking, insurance, retail etc.

Data extraction consists of extracting the data from homogeneous or heterogeneous sources and transforming it into a proper format using data cleansing. The data can be finally loaded into a final target database such as operational data base, a data mart or data warehouse. This data can be further used for the purpose of querying and analyzing.

## **4. Research Projects**

The research project will be able to demonstrate the skills of working scientifically, and through the project the students will be able to understand how to do a literature review, and how to appraise the literature to address questions. To explore an area of interest (develop some expertise and a deeper understanding of a topic). Understand the tools to critically and thoughtfully appraise problems which are faced every day; to learn communicate scientific research in verbal presentations and written form. As an example, the students can identify any problem, by observation or through survey to understand the problem in depth and propose the solution by applying the research methodology.

## Project Guidelines:

### 1. Application Development Project

Chapter No		Details
<b>1</b>		<b>Introduction</b>
	1.1	Company Profile / Institute Profile / Client Profile
	1.2	Abstract
	1.3	Existing System and Need for System
	1.4	Scope of System
	1.5	Operating Environment - Hardware and Software
	1.6	Brief Description of Technology Used 1.6.1 Operating systems used (Windows or Unix) 1.6.2 RDBMS/No Sql used to build database (mysql/ oracle, Teradata, etc.)
<b>2</b>		<b>Proposed System</b>
	2.1	Study of Similar Systems ( If required research paper can be included)
	2.2	Feasibility Study
	2.3	Objectives of Proposed System
	2.4	Users of System
<b>3</b>		<b>Analysis and Design</b>
	3.1	System Requirements (Functional and Non-Functional requirements)
	3.2	Entity Relationship Diagram (ERD)
	3.3	Table Structure
	3.4	Use Case Diagrams
	3.5	Class Diagram
	3.6	Activity Diagram
	3.7	Deployment Diagram
	3.8	Module Hierarchy Diagram
	3.9	Sample Input and Output Screens (Screens must have valid data. All reports must have at-least 5 valid records.)
<b>4</b>		<b>Coding</b>
	4.1	Algorithms
	4.2	Code snippets
<b>5</b>		<b>Testing</b>
	5.1	Test Strategy
	5.2	Unit Test Plan
	5.3	Acceptance Test Plan
	5.4	Test Case / Test Script
	5.5	Defect report / Test Log
6		<b>Limitations of Proposed System</b>
7		<b>Proposed Enhancements</b>
8		<b>Conclusion</b>

9		<b>Bibliography</b>
10		<b>Publication / Competition certificates</b>
11		<b>Appendix – Cost sheet , Data sheet</b>
12		<b>User Manual</b> (All screens with proper description/purpose Details about validations related to data to be entered.)

## 2. Embedded Systems / IoT Project

Chapter No		Details
<b>1</b>		<b>Introduction</b>
	1.1	Company Profile / Institute Profile / Client Profile
	1.2	Abstract
	1.3	Existing System and Need for System
	1.4	Scope of System
	1.5	Operating Environment - Hardware and Software
	1.6	Brief Description of Technology Used 1.6.1 Operating systems used (Windows or Unix) 1.6.2 Database (if applicable)
<b>2</b>		<b>Proposed System</b>
	2.1	Study of Similar Systems ( If required research paper can be included)
	2.2	Feasibility Study
	2.3	Objectives of Proposed System
	2.4	Users of System
<b>3</b>		<b>Analysis and Design</b>
	3.1	Technical requirements – H/W , S/W
	3.2	System Architecture / Block Diagram
	3.3	System Hardware Details
	3.4	Pin Diagrams
	3.5	Interface diagrams
	3.6	Design Sequence
	3.7	System Software Details
	3.8	Process / System Flow chart
<b>4</b>		<b>Coding</b>
	4.1	Algorithms
	4.2	Code snippets (if applicable)
<b>5</b>		<b>Testing</b>
	5.1	Results & reports
	5.2	Test cases
	5.3	Acceptance Testing
	5.4	Test reports in IEEE format
<b>6</b>		<b>Limitations of Proposed System</b>
<b>7</b>		<b>Proposed Enhancements</b>

8		<b>Conclusion</b>
9		<b>Bibliography</b>
10		<b>Publication / Competition certificates</b>
11		<b>Appendix – Cost sheet , Data sheet</b>
12		<b>User Manual</b> (All screens with proper description/purpose Details about validations related to data to be entered.)

### 3. ETL Projects

Chapter No		Details
<b>1</b>		<b>Introduction</b>
	1.1	Company Profile / Institute Profile / Client Profile
	1.2	Existing System functionality (Source System for which the ANALYTICS is being developed)
	1.3	Business process understanding and specifications 1.3.1 Business Requirement Specifications: 1.3.1.1 The o/p from BR Analysis are BRS Business Requirement Specifications (Business specific Rules to be mentioned here from analysis point of view) 1.3.1.2 Identify the dimensions, required attributes, measures, filter conditions, adjustments for KPIs going to be used in the Target system and its availability in the Source System. If any gaps suggest remediation of gaps 1.3.2 Business Rules Collection 1.3.3 Identify the Key Performance Indicator (specified by client) 1.3.4 Establish the User Acceptance Criteria
	1.4	Scope of the project
	1.5	Operating Environment - Hardware & Software, Description of Tools / Technology to be used in the Target system 1.5.1.1 Operating systems used (Windows or Unix) 1.5.1.2 RDBMS/NoSql used to build database (mysql/ oracle, Teradata, etc.) 1.5.1.3 ETL tools used (Talend/Informatica, Datastage etc) 1.5.1.4 OLAP/ Data mining/ machine learning/ analytics tools used (Python/ Cognos, BO, etc.) 1.5.1.5 Data visualization tools (power BI / Tableau)
<b>2</b>		<b>Proposed System</b>
	2.1	Creating multiple ETL strategies - Specifying metadata details, identifying heterogeneous architectures, processes for I/O only for ETL, scrapping , identifying the volatilities in the channels , designing strategies in the context of the business and existing ERP
	2.2	Comparing them in the context of selected business system (as per the business requirements)
	2.3	Suggesting optimum solution (process)
<b>3</b>		<b>Analysis and Design</b>
	3.1	Use Case Diagram
	3.2	Activity diagram to demonstrate Process flow (execution of ETL process)

	3.3	Design of Target system (Elaborate the tiers of DW architecture in the Target System)
	3.4	Database schema / Table specifications of Target system
	3.5	Details of Source & Targets of mapping in the database
	3.6	Details of Load (Full/Incremental etc.)
	3.7	Design of ETL schema/strategy
<b>4</b>	<b>4.1</b>	<b>Design of strategy for Visualization</b> 4.1.1 Visualizations in support of comparison of performance of various ETL strategies 4.1.2 Data visualization using different techniques (if any)
<b>5</b>		<b>Drawbacks and Limitations Proposed Enhancements</b>
<b>6</b>		<b>Conclusion</b>

#### 4. Research Projects

Research projects especially are designed to gain knowledge about some specified area and the deliverable is that knowledge gained, usually encapsulated in some form of report.

Students are expected to contribute something new to academic or practical knowledge in their research area—something original that is more than the accepted knowledge.

Completing a Research Project as part of your coursework is an opportunity to:

- learn to read and interpret other people’s research critically by doing your own. This gives you an insight into the effects of practical difficulties and theoretical debates on published research
- develop and apply the knowledge that you have learnt in 4 semesters of your curriculum.
- submit a paper for peer-reviewed publication. (If successful, this will give a boost to your c.v.) If you wish to enroll in a research degree such as PhD, a research project as part of your coursework will assist the committee evaluating your application in assessing whether you are ready to do independent research.

#### Research Index

1. Title page
2. Acknowledgements

You should acknowledge the assistance given to you by your supervisors, and any other person or organization that has helped you in the planning, conduct, analysis or reporting of your project.

3. Abstract

This is a synopsis of your study question, aims and objectives, background literature, methods, results, key conclusions and recommendations. This should be 250–300 words long and should be very clear and easy to follow.

#### 4. Introduction

In this section of your report you introduce the subject, provide the background to the topic or problem, outline the study question (or problem or study hypothesis), and outline the aims and objectives of your study.

#### 5. Literature review

This is a review of the literature on the topic or problem you are studying. It should include a review of any other studies or projects similar or relevant to yours, and perhaps a review of the literature on the method you have chosen if your project tests a new method of research or analysis.

#### 6. Methods

This section includes the methodology of your research. It will cover such issues as:  
In case of Computer Management Research :

- Study design
- Study population, sampling frame and numbers, sampling method
- survey design
- survey or data collection instruments
- protocol for obtaining data
- ethical issues and how they are addressed
- information letters, consent forms
- data management and analysis methods
- statistical analysis and tests
- In case of Computer Science Research:
  - Study design
  - System Architecture
  - Implementation
    - Experimental Implementation
    - Simulation
  - Data management and analysis methods
  - Analysis and testing

#### 7. Results

In this section you present the results of your research. Tables, figures and graphs are an excellent means of presenting this sort of information. All tables, figures and graphs, should be numbered consecutively throughout the whole report, and labelled with a clear and concise descriptive title.

#### 8. Discussion

In this section you interpret your results and discuss their implications, with reference to other published research. Any limitations in your research methodology should also be referred to here. Examiners expect you to acknowledge these limitations as an integral part of your evaluation of your project.

## 9. Conclusion

This section summarizes the key results and the conclusions that you can draw from these results. It also needs to reflect what your initial project aims and objectives were.

## 10. Recommendations

It is good research practice to make recommendations or to suggest directions for further research or actions as a result of your project findings.

## 11. References

This is a list of all the references and sources you used in your literature review, methodology and discussion. This includes books, journal articles, abstracts, conference and symposium papers, media articles, and any form of published literature or comment.

## 12. Appendices

This section may contain copies of any questionnaires if any or evaluation instruments used covering letters, participant information and ethics approvals, or additional explanations.

Sr. No	Course Code	Course Title	Internal	External
1	ITC51	Mini Project	50	150

**Course Objectives:**

1. To identify and understand a real-world problem
2. To understand the need of the project
3. To apply appropriate methodology relevant to the problem
4. To design and develop the solution for the problem
5. To enhance technical and communication skills and present the project work

**Course Outcome:**

Student will able to

- CO1: Understand the real-world problem. (Understand)
- CO2: Express the need of the project through feasibility analysis and literature review. (Understand)
- CO3: Determine the project plan using appropriate methodology. (Apply)
- CO4: Implement the project design pertaining to the problem. (Apply)
- CO5: Demonstrate communication and team-work skills. (Apply)
- CO6: Build and test the solution. (Create)

## General Guidelines

1. The Institute should submit the list of projects to SPPU in semester V itself to ensure that the students are undertaking a project which has a scope of one-year duration.
2. The project may be done individually or in groups. However, if project is done in groups, each student must be given a responsibility for distinct modules.
3. Selected project/module must have relevant scope as per the marks assigned and can be carried out in the Institute or outside with prior permission of the Institute.
4. Internal guide should monitor and evaluate the progress of the project on individual basis through handwritten workbook maintained by students containing various project milestones with learnings and remarks from internal guide for concurrent evaluation.
5. Student must report to the internal project guide for the project reviews scheduled by the institute.
6. The Project Synopsis should contain an Introduction to Project clearly stating the project scope in detail justifying 200 marks which should be approved by the internal guide.
7. Students are expected to submit the soft copy of mini project (major project part1) report as a part of final submission up to Chapter 3. Analysis and Design as mentioned in the project guidelines.
8. The project will be assessed internally as well as externally by the examiners appointed by the institutions and University. The Mini project (major project part1) work will carry 50 marks for internal assessment and 150 marks for external assessment.

## **Type of Projects**

### **1. Application Development**

The students are advised to choose a project that involves window-based development, web-based development, mobile-based development, projects based on machine learning. Analysis and interpretation of any company specific data is not permitted.

### **2. Embedded Systems / IoT**

A project should be developed and implemented for application specific system after thorough investigation of the latest development in the field of electronics or communication to facilitate their efficient operation. The Real Time Operating System (RTOS) or open source platform can be used to develop embedded applications such as Robotics, Microcontroller / Microprocessor based projects etc.

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### **3. ETL Projects**

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### **4. Research Projects**

The research project will be able to demonstrate the skills of working scientifically, and through the project the students will be able to understand how to do a literature review, and how to appraise the literature to address questions. To explore an area of interest (develop some expertise and a deeper understanding of a topic). Understand the tools to critically and thoughtfully appraise problems which are faced every day; to learn communicate scientific research in verbal presentations and written form.

As an example, the students can identify any problem, by observation or through survey to understand the problem in depth and propose the solution by applying the research methodology.

# Project Report Format

## 1. Application Development

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1.1	Company Profile / Institute Profile / Client Profile
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1.3	Existing System and Need for System
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2.3	Objectives of Proposed System
2.4	Users of System
<b>3</b>	<b>Analysis and Design</b>
3.1	System Requirements (Functional and Non-Functional requirements)
3.2	Entity Relationship Diagram (ERD)
3.3	Table Structure
3.4	Use Case Diagrams
3.5	Class Diagram
3.6	Activity Diagram
3.7	Deployment Diagram
3.8	Module Hierarchy Diagram
3.9	Sample Input and Output Screens (Screens must have valid data. All reports must have at-least 5 valid records.)
<b>4</b>	<b>Coding</b>
4.1	Algorithms
4.2	Code snippets
<b>5</b>	<b>Testing</b>
5.1	Test Strategy
5.2	Unit Test Plan
5.3	Acceptance Test Plan
5.4	Test Case / Test Script
5.5	Defect report / Test Log
<b>6</b>	<b>Limitations of Proposed System</b>

<b>7</b>		<b>Proposed Enhancements</b>
<b>8</b>		<b>Conclusion</b>
<b>9</b>		<b>Bibliography</b>
<b>10</b>		<b>Publication / Competition certificates</b>
<b>11</b>		<b>Appendix – Cost sheet, Data sheet</b>
<b>12</b>		<b>User Manual</b> (All screens with proper description/purpose Details about validations related to data to be entered.)

## 2. Embedded Systems / IoT

<b>Chapter No</b>		<b>Details</b>
<b>1</b>		<b>Introduction</b>
	1.1	Company Profile / Institute Profile / Client Profile
	1.2	Abstract
	1.3	Existing System and Need for System
	1.4	Scope of System
	1.5	Operating Environment - Hardware and Software
	1.6	Brief Description of Technology Used 1.6.1 Operating systems used (Windows or Unix) 1.6.2 Database (if applicable)
<b>2</b>		<b>Proposed System</b>
	2.1	Study of Similar Systems (If required research paper can be included)
	2.2	Feasibility Study
	2.3	Objectives of Proposed System
	2.4	Users of System
<b>3</b>		<b>Analysis and Design</b>
	3.1	Technical requirements – H/W, S/W
	3.2	System Architecture / Block Diagram
	3.3	System Hardware Details
	3.4	Pin Diagrams
	3.5	Interface diagrams
	3.6	Design Sequence
	3.7	System Software Details
	3.8	Process / System Flow chart
<b>4</b>		<b>Coding</b>
	4.1	Algorithms
	4.2	Code snippets (if applicable)

<b>5</b>		<b>Testing</b>
	5.1	Results & reports
	5.2	Test cases
	5.3	Acceptance Testing
	5.4	Test reports in IEEE format
<b>6</b>		<b>Limitations of Proposed System</b>
<b>7</b>		<b>Proposed Enhancements</b>
<b>8</b>		<b>Conclusion</b>
<b>9</b>		<b>Bibliography</b>
<b>10</b>		<b>Publication / Competition certificates</b>
<b>11</b>		<b>Appendix – Cost sheet, Data sheet</b>
<b>12</b>		<b>User Manual</b> (All screens with proper description/purpose Details about validations related to data to be entered.)

### 3. ETL Projects

Chapter No		Details
<b>1</b>		<b>Introduction</b>
	1.1	Company Profile / Institute Profile / Client Profile
	1.2	Existing System functionality (Source System for which the ANALYTICS is being developed)
	1.3	Business process understanding and specifications 1.3.1 Business Requirement Specifications: 1.3.1.1 The o/p from BR Analysis are BRS Business Requirement Specifications (Business specific Rules to be mentioned here from analysis point of view) 1.3.1.2 Identify the dimensions, required attributes, measures, filter conditions, adjustments for KPIs going to be used in the Target system and its availability in the Source System. If any gaps suggest remediation of gaps 1.3.2 Business Rules Collection 1.3.3 Identify the Key Performance Indicator (specified by client) 1.3.4 Establish the User Acceptance Criteria
	1.4	Scope of the project
	1.5	Operating Environment - Hardware & Software, Description of Tools / Technology to be used in the Target system 1.5.1.1 Operating systems used (Windows or Unix) 1.5.1.2 RDBMS/NoSQL used to build database (MySQL/ oracle, Teradata, etc.) 1.5.1.3 ETL tools used (Talend/Informatica, DataStage etc.) 1.5.1.4 OLAP/ Data mining/ machine learning/ analytics tools used (Python/ Cognos, BO, etc.) 1.5.1.5 Data visualization tools (power BI / Tableau)
<b>2</b>		<b>Proposed System</b>

	2.1	Creating multiple ETL strategies - Specifying metadata details, identifying heterogeneous architectures, processes for I/O only for ETL, scrapping, identifying the volatilities in the channels, designing strategies in the context of the business and existing ERP
	2.2	Comparing them in the context of selected business system (as per the business requirements)
	2.3	Suggesting optimum solution (process)
<b>3</b>		<b>Analysis and Design</b>
	3.1	Use Case Diagram
	3.2	Activity diagram to demonstrate Process flow (execution of ETL process)
	3.3	Design of Target system (Elaborate the tiers of DW architecture in the Target System)
	3.4	Database schema / Table specifications of Target system
	3.5	Details of Source & Targets of mapping in the database
	3.6	Details of Load (Full/Incremental etc.)
	3.7	Design of ETL schema/strategy
<b>4</b>	<b>4.1</b>	<b>Design of strategy for Visualization</b> 4.1.1 Visualizations in support of comparison of performance of various ETL strategies 4.1.2 Data visualization using different techniques (if any)
<b>5</b>		<b>Drawbacks and Limitations Proposed Enhancements</b>
<b>6</b>		<b>Conclusion</b>

#### 4. Research Projects

Research projects especially are designed to gain knowledge about some specified area and the deliverable is that knowledge gained, usually encapsulated in some form of report. Students are expected to contribute something new to academic or practical knowledge in their research area—something original that is more than the accepted knowledge.

Completing a Research Project as part of your coursework is an opportunity to:

- learn to read and interpret another people’s research critically by doing your own. This gives you an insight into the effects of practical difficulties and theoretical debates on published research
- develop and apply the knowledge that you have learnt in 4 semesters of your curriculum.
- submit a paper for peer-reviewed publication. (If successful, this will give a boost to your c.v.) If you wish to enroll in a research degree such as PhD, a research project as part of your coursework will assist the committee evaluating your application in assessing whether you are ready to do independent research.

## Research Index

1. Title page

2. Acknowledgements - You should acknowledge the assistance given to you by your supervisors, and any other person or organization that has helped you in the planning, conduct, analysis or reporting of your project.

3. Abstract - This is a synopsis of your study question, aims and objectives, background literature, methods, results, key conclusions and recommendations. This should be 250–300 words long and should be very clear and easy to follow.

4. Introduction - In this section of your report you introduce the subject, provide the background to the topic or problem, outline the study question (or problem or study hypothesis), and outline the aims and objectives of your study.

5. Literature review - This is a review of the literature on the topic or problem you are studying. It should include a review of any other studies or projects similar or relevant to yours, and perhaps a review of the literature on the method you have chosen if your project tests a new method of research or analysis.

6. Methods - This section includes the methodology of your research. It will cover such issues as:

In case of Computer Management Research:

- Study design
- Study population, sampling frame and numbers, sampling method
- survey design
- survey or data collection instruments
- protocol for obtaining data
- ethical issues and how they are addressed
- information letters, consent forms
- data management and analysis methods
- statistical analysis and tests
- In case of Computer Science Research:
  - Study design
  - System Architecture
  - Implementation
  - Experimental Implementation
  - Simulation
  - Data management and analysis methods
  - Analysis and testing

7. Results - In this section you present the results of your research. Tables, figures and graphs are an excellent means of presenting this sort of information. All tables, figures and graphs, should be numbered consecutively throughout the whole report, and labelled with a clear and concise descriptive title.

8. Discussion - In this section you interpret your results and discuss their implications, with reference to other published research. Any limitations in your research methodology should also be referred to here. Examiners expect you to acknowledge these limitations as an integral part of your evaluation of your project.

9. Conclusion - This section summarizes the key results and the conclusions that you can draw from these results. It also needs to reflect what your initial project aims, and objectives were.

10. Recommendations - It is good research practice to make recommendations or to suggest directions for further research or actions because of your project findings.

11. References - This is a list of all the references and sources you used in your literature review, methodology and discussion. This includes books, journal articles, abstracts, conference and symposium papers, media articles, and any form of published literature or comment.

12. Appendices - This section may contain copies of any questionnaires if any or evaluation instruments used to cover letters, participant information and ethics approvals, or additional explanations.

**Master of Business Administration (MBA) – Revised Syllabus 2019**

**2 year, 4 Semester Full time Programme  
Choice Based Credit System (CBCS) and Grading System  
Outcome Based Education Pattern**

MBA I effective from AY 2019-20

MBA II effective from AY 2020-21

**1.0 Preamble:** The revised MBA Curriculum 2019 builds on the implementation of the Choice Based Credit System (CBCS) and Grading System initiated in the AY 2013. The curriculum takes the MBA programme to the next level in terms of implementing Outcome Based Education along with the Choice Based Credit System (CBCS) and Grading System.

**2.0 Definitions:**

**2.1 Outcome Based Education:**

**2.1.1 Outcome Based Education (OBE) Approach:** Outcomes are about performance, and this implies:

- a) There must be a performer – the student (learner), not only the teacher
- b) There must be something performable (thus demonstrable or assessable) to perform
- c) The focus is on the performance, not the activity or task to be performed

**2.1.2 Programme Educational Objectives (PEOs):** Programme Educational Objectives are a set of **broad future-focused student performance outcomes** that explicitly identify what students will be **able to do with what they have learned**, and **what they will be like** after they leave school and are **living full and productive lives**. Thus PEOs are what the programme is preparing graduates for in their **career and professional life** (to attain within a **few years** after graduation<sup>1</sup>).

**2.1.3 Graduate Attributes (GAs):** Graduate Attributes (GAs) are the **qualities, knowledge and capabilities** that students are encouraged to take responsibility for developing throughout their studies and are the **defining characteristics** of the students passing out of the MBA program. These attributes include, but go **beyond, the disciplinary expertise or technical knowledge**.

**2.1.4 Programme Outcomes (POs):** Programme Outcomes are a set of **narrow statements** that describes what students (learners) **of the programme** are expected to know and be able to perform or attain **by the time of graduation**.

**2.1.5 Programme Specific Outcomes (PSOs):** Programme Outcomes are a set of **narrow statements** that describes what students (learners) **of a particular specialization of the programme** are expected to know and be able to perform or attain **by the time of graduation**. PSOs are also a function of the various course combinations offered by the Institute.

**2.1.6 Learning Outcomes:** A learning outcome is what a student **CAN DO** as a result of a learning experience. It describes a **specific task** that he/she is able to perform at a **given level of competence under a certain situation**. The three broad types of learning outcomes are:

- a) Disciplinary knowledge and skills
- b) Generic skills
- c) Attitudes and values

**2.1.7 Course Outcomes (COs):** A set of specific statements that describes the **complex performances** a student should be capable of as a result of **learning experiences within a course**.

**2.1.8 Teaching and Learning Activities (TLAs):** The set of **pedagogical tools and techniques** or the teaching and learning activities that aim to **help students to attain** the intended learning outcomes and engage them in these learning activities through the teaching process.

**2.1.9 Outcome Based Assessment (OBA):** An assessment system that asks course teachers to first identify what it is that we expect students to be able to do once they have completed a course or program. It then asks course teachers to provide evidence that they are able to do so. In other words, how will each learning outcome be assessed? What **evidence of student learning** is most **relevant for each learning outcome** and **what standard or criteria** will be used to evaluate that evidence? Assessment is therefore a key part of outcome-based education and used to determine whether or not a qualification has been achieved.

**2.2 Credit:** *In terms of credits, for a period of one semester of 15 weeks:*

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<sup>1</sup> Graduation refers to passing out of the MBA programme. Graduation does NOT refer to 10+2+3/4 degree e.g. BA, BE, etc.

**SUBJECT TO THE minimum and maximum limits of credits prescribed and,** subject to institutional norms and guidelines, issued from time to time.

**6.0 Summer Internship Project:** At the end of Second Semester each student shall undertake a Summer Internship Project (SIP) for a **minimum of 8 weeks**. For SIP, 1 credit is equivalent to minimum 40-45 hours of effective work. SIP shall have 6 credits. It is mandatory for the student to seek advance written approval from the faculty guide and the Director of the Institute about the topic and organization before commencing the SIP.

The SIP may or may not have a Functional Focus, i.e. the student may take up a SIP in his/her intended area of specialization or in any other functional area of management. **Ideally the SIP should exhibit a cross-functional orientation.** SIP can be carried out in a Corporate Entity / NGO / SME / Government Undertaking / Cooperative Sector. SIP may be a research project – based on primary / secondary data or may be an operational assignment involving working by the student on a given task/assignment/project/ etc. in an organization / industry. It is expected that the SIP shall sensitize the students to the demands of the workplace.

**Each student shall maintain a SIP Progress Diary detailing the work carried out and the progress achieved on a daily basis.** The student shall submit a written structured SIP report based on work done during this period. The student shall submit the SIP Progress Diary along with the SIP Report.

**Students shall also seek a formal evaluation of their SIP from the company guide.** The formal evaluation by the company guide shall comment on the nature and quantum of work undertaken by the student, the effectiveness and overall professionalism. The learning outcomes of the SIP and utility of the SIP to the host organization must be specifically highlighted in the formal evaluation by the company guide. The SIP evaluation sheet duly signed and stamped by the industry guide shall be included in the final SIP report.

The SIP report must reflect 8 weeks of work and justify the same. The SIP report should be well documented and supported by –

1. Institute's Certificate
2. Certificate by the Company
3. Formal feedback from the company guide
4. Executive Summary
5. Organization profile
6. Outline of the problem/task undertaken
7. Research methodology & data analysis (in case of research projects only)
8. Relevant activity charts, tables, graphs, diagrams, AV material, etc.
9. Learning of the student through the project
10. Contribution to the host organization
11. References in appropriate referencing styles. (APA, MLA, Harvard, Chicago Style etc.)

The completion of the SIP shall be certified by the respective Faculty Guide & approved by the Director of the Institute. The external organization (Corporate / NGO/ SME/ Government Entity/ Cooperative/ etc.) shall also certify the SIP work.

The students shall submit a spiral bound copy of the SIP report by 15<sup>th</sup> September. The Institute shall conduct an internal viva-voce for evaluation of the SIP for 50 marks between 15<sup>th</sup> September to 30<sup>th</sup> September. The Panel shall comprise of two evaluators appointed by the Director of the Institute / Head of Department (for MBA departments in engineering colleges). Institutes are encouraged to involve senior alumni, industry experts, recruiters to conduct the internal viva-voce. The internal viva-voce panel shall provide a detailed assessment of the SIP report and suggest changes required, if any.

After the internal viva-voce, the student shall finalize the SIP report by incorporating all the suggestions and recommendations of the internal viva-voce panel. The internal guide shall then issue the Institute's Certificate to the student.

The student shall submit TWO hard copies & one soft copy (CD) of the project report before 30<sup>th</sup> October in Sem III. One hard copy of the SIP report is to be returned to the student by the Institute after the External Viva-Voce. In the interest

of environmental considerations, students are encouraged to print their project reports on both faces of the paper. Spiral bound copies may be accepted.

There shall be an external viva-voce for the SIP for 50 marks. The external viva-voce shall be conducted after the theory exam of Semester III.

The Internal & the External viva-voce shall evaluate the SIP based on:

1. Adequacy of work undertaken by the student
2. Application of concepts learned in Sem I and II
3. Understanding of the organization and business environment
4. Analytical capabilities
5. Technical Writing & Documentation Skills
6. Outcome of the project – sense of purpose
7. Utility of the project to the organization
8. Variety and relevance of learning experience

Copies of SIP report and records of evaluation shall be maintained by the Institute for a period of 3 academic years.

#### **7.0 Comprehensive Concurrent Evaluation (CCE) / Concurrent Internal Evaluation (CIE):**

1. The course teacher shall prepare the scheme of Comprehensive Concurrent Evaluation (Formative Assessment) before commencement of the term. The scheme of Comprehensive Concurrent Evaluation shall explicitly state the linkages of each CCE with the Course Outcomes and define the targeted attainment levels for each CO.
2. The Director / Head of the Department / designated academic authority shall approve the scheme of Comprehensive Concurrent Evaluation with or without modifications.
3. The course teacher shall display, on the notice board, the approved CCE scheme of the course and the same shall also be hosted on the website, not later than the first week of the term.
4. Each CCE item shall be of minimum 25 marks.
5. For a 3 Credit Course there shall be a MINIMUM of three CCE items. The final scores shall be converted to 50, using an average or best two out of three formula.
6. For 2 Credit Course there shall be a MINIMUM of two CCE items. The final scores shall be converted to 50.
7. For a 1 Credit Course there shall be a MINIMUM of one CCE item.
8. CCE shall be spread through the duration of course and shall be conceptualized, executed, assessed and documented by the course teacher along with student-wise and class-wise attainment levels of the COs and the attainment levels of the course.
9. The assessment outcome of each CCE shall be duly signed by the course teacher, programme coordinator / academic head and the Director / Head of the Department / designated academic authority of the Institute.
10. A copy of the duly signed CCE *outcome* shall be displayed on the notice boards, within a week of the assessment and course teachers shall guide the students on a need basis.
11. Institute may conduct additional make up / remedial CCE items at its discretion.
12. At the end of the term aggregate CCE scores / grades shall be calculated and the CO attainment levels shall be calculated by the course teacher. The same shall be displayed on the notice board

**7.1 Comprehensive Concurrent Evaluation Methods:** Course teachers shall opt for a combination of one of more CCE methods listed below.

Group A (Individual Assessment) – Not more than 1 per course

1. Class Test
2. Open Book Test
3. Written Home Assignment
4. In-depth Viva-Voce

Group B (Individual Assessment) – Atleast 1 per course

5. Case Study
6. Caselet
7. Situation Analysis