MCA Syllabus

Faculty of Management
Savitribai Phule Pune University

Savitribai Phule Pune University (SPPU), Pune
Curriculum for Masters of Computer Application (MCA) Programme
For year 2019-2022

MCA (Part I) From Academic Year 2019-2020
MCA (Part II) From Academic Year 2020-2021
MCA (Part III) From Academic Year 2021-2022

(I) Introduction:
1. The name of the programme shall be Masters of Computer Application (M.C.A)
2. The knowledge and skills required are planning and designing to build Complex Application Software Systems that are highly valued in all industry sectors including business, health, education and arts.
3. The basic objective of the Masters programme in Computer Application (M.C.A) is to provide a steady stream of necessary knowledge, skills and foundation for acquiring a wide range of rewarding careers into rapidly expanding world of Information Technology
4. The MCA Curriculum (AY 2019-22) is designed as per International Accreditation standards specified by Accreditation Board for Engineering. and Technology (ABET). (Ref:www.abet.org, *pg. no. 10)*

5. The Job Opportunities are
   ➢ Many graduates begin their career at a junior level but are not in a position to map their job with expert technical skills obtained from a usual programme. A specialized programme would enhance their exposure to variety of roles and responsibilities which they can take in various fields of expertise. For e.g.: In the area of software development they could take up responsibilities of database, product development, product maintenance and support in addition to management activities.
   ➢ Focused grooming would also make it easier for IT industry to decide which graduate could be mapped to the right domain.
   ➢ Enabling entrepreneurship is also the need of the hour and students interested to be on their own could leverage from the newly designed focused programme for entrepreneurs. It will build right platform for students to become successful software professionals. This would emphasize on domain knowledge of various areas.

6. The Institutes should organize placement programme for M.C.A students by interacting with industries and software consultancy houses in and around the region in which the educational Institution is located.

7. At the end of each semester, appearing for various certifications is possible for each student enabling them to make their resume rich.

8. In each class, not more than 60 students will be admitted.

(II)

    (A) Eligibility for Admission:

The eligibility criteria for admission for the MCA course will be as decided by the Competent Authority (Director, Technical Education-Government of Maharashtra, &/or AICTE, New Delhi)

1. A candidate who has either passed with minimum 50% of marks in the aggregate (45% in case of candidate who is domiciled in Maharashtra and belongs to the reserved categories i.e. S.C., S.T., D.T., N.T., O.B.C., S.B.C.)

<div align="center">OR</div>

appeared at the final year examination of a post 10+2 course of minimum three years duration leading to an award of Bachelor's Degree, in any discipline by the Association of Indian Universities or has passed with minimum 45% of marks in the aggregate (45% in case of candidate who is domiciled in Maharashtra and belongs to the reserved categories) or appeared at an examination considered equivalent there to would be treated as eligible for Common Entrance Test (CET). Also the candidate must have passed mathematics/Business Mathematics & Statistics paper for 10+2 or graduation Level

<div align="center">AND</div>

Passed the CET conducted by Director of Technical Education, Maharashtra State, with **non-zero score** for that year or passed the CET conducted by state level MCA Association with non-zero score for that year, or passed the AIMCET exam for that year.

2. However, a candidate would not be treated as eligible for admission to the MCA programme unless he/she passes his/her qualifying examination with requisite percentage on or before 30th September of the concerned academic year and also passes in the CET.

    (B) Reservation of Seat:

The percentage of seat reserved for candidates belonging to backward classes only from Maharashtra State in all the Government Aided, Un-aided Institutions/Colleges and University Departments is as per the norms given by Government of Maharashtra, time to time.

    (C) Selection Basis:

The selection would be done as per the guidelines given by the Director of Technical Education, Maharashtra State, time to time.

(III) Number of Lectures and Practical:

    Lectures and Practical should be conducted as per the scheme of lectures and practical indicated in the course structure where one session is of 1 hour, though it is up to the individual Institute to decide the time for one session while designing the time table.

Practical Training and Project Work:

At the end of the sixth semester of study, a student will be examined in the course" Project work".

1. The Major Project work will be in the Semester VI. It may be done individually or in groups in case of bigger projects. However if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to see the progress of individual modules is independent of others.
2. Students should take guidance from an internal guide and prepare a Project Report on "Project Work" back to back print (one copy) which is to be submitted to the Director of the Institute. Wherever possible, a separate file containing source-code listings should also be submitted. Every student should also submit soft copy of their project synopsis.
3. The Project Synopsis should contain an Introduction to Project, which should clearly explain the project scope in detail. Also, Data Dictionary, ERDs, File designs and a list of output reports should be included if required as per the project title and scope.
4. The project Work should be of such a nature that it could prove useful or be relevant from the commercial/management angle.
5. Selected project must have relevant scope for 400 marks.
6. For Major Project work, student must visit at least once in a week to the institute and the progress of the project must be communicated to project guide.
7. The project report will be duly accessed by the internal guide and marks will be communicated by the Director to the University along with the marks of the internal credit for theory and practical to be communicated for all other courses.
8. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.
9. The major project work carry 150 marks for internal assessment and 250 marks for external viva. The external viva shall be conducted by a minimum of one external examiner.
10. Project work can be carried out in the Institute or outside with prior permission of the Institute.

(IV) Choice Based Credit System

Choice Based Credit System (CBCS) offers wide ranging choice for students to opt for courses based on their aptitude and their career goals. CBCS works on the fundamental premise that students are mature individuals, capable of making their own decisions.

CBCS enables a student to obtain a degree by accumulating required number of credits prescribed for that degree. The number of credits earned by the student reflects the knowledge or skills acquired by him / her. Each course is assigned a fixed number of credits based on the contents to be learned & the expected effort of the student. The grade points earned for each course reflects the student's proficiency in that course. CBCS is a process of evolution of educational reforms that would yield the result in subsequent years and after a few cycles of its implementation.

A. Key features of CBCS:

1. **Enriching Learning Environment:** A student is provided with an academically rich, highly flexible learning system blended with abundant provision for skill development and a practical

orientation that he/she could imbibe without sacrificing his/her creativity. There is a definite movement away from the traditional lectures and written examination.

2. **Continuous Learning & Student Centric Concurrent Evaluation:** CBCS makes the learning process continuous. Likewise the evaluation process is not only made continuous but also made learner-centric. The evaluation is designed to recognize the capability and talent of a student.

3. **Active Student-Teacher Participation:** CBCS leads to quality education with active teacher student participation. This provides avenues to meet student's scholastic needs and aspirations.

4. **Industry Institute Collaboration:** CBCS provides opportunities for meaningful collaboration with industry and foreign partners to foster innovation, by introduction of electives and half credit courses through the cafeteria approach. This will go a long way in capacity building of students and faculty.

5. **Interdisciplinary Curriculum:** Cutting edge developments generally occur at the interface of two or more discipline. The interdisciplinary approach enables integration of concepts, theories, techniques, and perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline.

6. **Employability Enhancement:** CBCS shall ensure that students enhance their skill/employability by taking up project work , entrepreneurship and vocational training

7. **Faculty Expertise:** CBCS shall give the Institutes the much needed flexibility to make best use of the available faculty expertise.

B. Pre-requisites for successful implementation of CBCS

The success of the CBCS also requires certain commitments from both the students and the teachers.

1. The student should be regular and punctual to his classes, studious in carrying out the assignments and should maintain consistency in his tempo of learning. He should make maximum use of the available library, internet and other facilities.

2. The teachers are expected to be alert and punctual and strictly adhere to the schedules of teaching, tests, seminars, evaluation and notification of results.

3. All teachers should notify the tentative schedule of teaching and tests of the entire semester, including the dates of tests, dates of score notification and all other schedules, which can be planned in advance.

4. The teachers are expected to adhere to unbiased and objective evaluation and marking of concurrent evaluation scores (internal examinations) which will not only maintain the confidence of the students, but, at the same time, ensure that merit is given due credit.

5. Transparency, objectivity and quality are the key factors that will sustain a good CBCS system.

6. At the post-graduate level, and in a professional programme, the syllabus is to be looked upon as the bare minimum requirement to be fulfilled and sufficient emphasis shall be laid on contemporary aspects, going beyond the syllabus.

C. Credits

Credit: The definition of 'credits' can be based on various parameters - such as the learning hours put in, learning outcomes and contact hours, the quantum of content/syllabus prescribed for the course.

Each course is assigned a certain credit, depending on the estimated effort put in by a student. When the student passes that course, he/she earns the credits associated with that course.

In the Credit system the emphasis is on the **hours put in by the learner and not on the workload of the teacher.** Each credit can be visualized as a individual and/or combination of **three components viz. Lecture (L), Tutorials (T), Practice (Practical / Project Work) (P) i.e. LTP Pattern.**

The effort of the learner for each Credit Point may be considered to have two parts:

a) One part consisting of the hours actually spent in class room / practical / field work instructions and
b) The other part consisting of notional hours spent by the Learner in self-study, in the library, peer interactions, case study, writing of journals and assignments, projects etc. for the completion of that course.

Every course offered may have three components and/or combination of three components associated with the teaching-learning process of the course, viz.

a) **Lecture (L):** Classroom sessions delivered by faculty in an *interactive mode*
b) **Tutorial (T):** Session consisting of participatory discussion/ self-study/ desk work/ brief seminar presentations by students and such other *novel methods* that make a student to absorb and assimilate more effectively the contents delivered in the Lecture sessions
c) **Practice (P):** Practice session /Practical / Project Work consisting of Hands-on experience / Field Studies / Case studies that equip students to acquire the much required *skill component*.

The teaching / learning as well as evaluation are to be interpreted in a broader perspective as follows:
a) Teaching – Learning Processes: Classroom sessions, Group Exercises, Seminars, Small Group Projects, Self-study, etc.
b) Evaluation: Tutorials, Class Tests, Presentations, Field work, Assignments, Research papers, Term papers, etc.

In terms of credits, for a period of one semester of 15 weeks:
a) *every ONE hour session per week of L amounts to 1 credit per semester*
b) *a minimum of TWO hours per week of T amounts to 1 credit per semester,*
c) *a minimum of TWO hours per week of P amounts to 1 credit per semester,*

A course shall have either or all the three components, i.e. a course may have only lecture component, or only practice component or a combination of any two or all the three components.

The MCA programme is a combination of:
   a) Four-Credit Courses (100 Marks each): 4 Credits each
   b) Two-Credit Courses (50 Marks each): 2 Credits each
   c) One-Credit Courses (25 Marks each) : 1 Credits each

D. Adoption of Credit and Grading System

As per national policy and international practices, it is proposed to adopt the Credit and Grading System for the MCA programme w.e.f. AY 2013-14.

D-1 Rationale for adoption of the Credit and Grading System:

a) **Learner's Perspective**: The current practice of evaluation of student's performance at the end of a semester is flawed. The students are expected to express their understanding or mastery over the content included in their curriculum for a complete semester within a span of three hours and their efforts over the semesters are often completely ignored. It also promotes unhealthy practice of cramming before the examinations and focusing on marks rather than on learning.

b) **Evaluation Perspective**: The present system of evaluation does not permit the flexibility to deploy multiple techniques of assessment in a valid and reliable way. Moreover, the current practice of awarding numerical marks for reporting the performance of learners suffers from several drawbacks and is a source of a variety of errors. Further, the problem gets compounded due to the variations in the marks awarded in different subjects. **The 'raw score' obtained by the learner, is, therefore, not a reflection of his true ability.**

In view of the above lacunae, it is desirable that the marking system used for the declaration of results is replaced by the grading system. The system of awarding grades provides a more realistic picture of learner's ability than the prevailing marking system. Excellence in quality education can be achieved by evaluating the true ability of the learners with the help of continuous evaluation.

D-2   Salient features of the grading system:

1. In this system, students (learners) are placed in ability bands that represent a range of scores. This ability range may be designated with alphabetical letters called as '**GRADE'**.
2. Grading reflects an individual learner's performance in the form of a certain *level of achievement*.
3. The Grading system ensures natural classification in qualitative terms rather than quantitative terms since it expresses a range /band of scores to which a learner belongs such as O,A,B,C,P & F
4. Grades can be interpreted easily and directly and can be used to prepare an accurate '*profile'* of a learner.
5. A properly introduced grading system not only provides for a comparison of the learners' performance but it also indicates the quality of performance with respect to the amount of efforts put in and the amount of knowledge acquired at the end of the course by the learners.

D-3 Basics of Credit and Grading System

Grading is a method of reporting the result of a learner's performance subsequent to his evaluation. It involves a set of alphabets which are clearly defined and designated and uniformly understood by all the stakeholders. Grading is carried out in a variety of ways. The classification of grades depends upon the reference point.

With 'Approach towards Grading' as the reference point, Grading may be classified as:
a) **Direct grading**: When the performance exhibited by the examinees is assessed in qualitative terms and the impressions so obtained by the examiners are directly expressed in terms of letter grades, it is called, '*Direct Grading*'.
b) **Indirect grading**: When the performance displayed by the examinees is first assessed in terms of marks and subsequently transformed into letter grades by using different modes, it is called, '*Indirect Grading*.'

With 'Standard of Judgment', as the reference point Grading may be classified as:
a) **Absolute grading**: The method that is based on a predetermined standard which becomes a reference point for the learner's performance is called 'Absolute Grading'. This involves direct conversion of marks into grades irrespective of the distribution of marks in a subject.
b) **Relative grading**: Relative Grading is popularly known as grading on the curve. The curve refers to the normal distribution curve or some symmetric variant of it. This method amounts to determining in advance approximately what percentage of learners can be expected to receive different grades, such as O,A,B,C,D,E,F. In this grading system the grade is not determined by the learner's performance but on the basis of group performance.

Absolute grading has several advantages such as:
a) The procedure is simple and straightforward to use,
b) Each grade is distinctly understandable,
c) The learner has the freedom to strive for the attainment of the highest possible grade and
d) It enables the learners to know their strengths and weaknesses.

The few limitations of Absolute Grading method are:
a) The distribution of scores is taken at its face value regardless of the errors of measurement creeping in due to various types of subjectivity.
b) Besides, the cut-offs of different categories are also arbitrarily decided.

It is proposed to use the **Indirect and Absolute Grading System for the MCA programme** i.e. the assessment of individual Courses in the concerned examinations will be on the basis of marks. However the marks shall later be converted into Grades by a **defined mechanism** wherein the overall performance of the learners can be reflected after considering the Credit Points for any given course. The **overall evaluation shall be designated in terms of Grade.**

E. Session Duration:
Each teaching-learning, evaluation session shall be of 60 minutes. However, institutes shall have the flexibility to define their time slots in a manner as to use their faculty and infrastructure resources in the best possible way.

F. Courses Offered:

<u>**OPEN SUBJECT**</u>

Institute has to offer two (or one) open subjects per semester which are attached with respective laboratory. The motive behind keeping an open subject is to make students aware of current/upcoming trends in Information Technology and other domains. Full autonomy is given to the Institute to plan and execute the open subjects. It is expected to extend the autonomy to the student also. Care must be taken to consider credit points and necessary contact hours assigned to it while finalizing any open subject for the given semester. In each semester total 4 credits are reserved for open subjects. Further in Semester I to V, there are 2 Open subjects of 1 credit each and practical based on open subject of 2 credits. Semester VI contains 1 open subject of 4 credits

Some proposed open subject are (Please add more subjects)
- Machin Learning
- Data Science
- R programming
- Tableau
- AWS
- Azure
- Block Chain
- Industry 4.0
- E-Learning
- Six Sigma
-

G. Registration:

Such registration shall be the basis for a student to undergo concurrent evaluation, online evaluation and end semester examination. Application forms for University examinations are to be filled up based on the choices finalized during the registration process and submitted to the University along with the prescribed examination fee.

G-1 Registration Process:

Each student, on admission shall be assigned to a *Faculty Advisor* who shall advise her/him about the academic programs and counsel on the choice of courses considering the student's profile and career objectives.

i. With the advice and consent of the Faculty Advisor the student shall register for a set of courses he/she plans to take up for the Semester.
ii. The student should meet the criteria for prerequisites, if defined for a course, to become eligible to register for that course.
iii. The Institute shall follow a selection procedure on a first come first served basis, determining the maximum number of students and counseling the students if required to avoid overcrowding to particular course(s) at the expense of some other courses.
iv. It is expected that a student registers for 28 credits in Semester I, II, III, IV, V and 20 Credits in Semester VI.

(V) Assessment:

In total 160 credits represent the workload of a year for MCA program.
Total credits=160, 1 credit = 15 lecture Hrs,   100 Marks   Subject = 4 Credits

Semester – I   28 credits

Semester – II	28 credits
Semester – III	28 credits
Semester – IV	28 credits
Semester – V	28 credits
Semester – VI	20 credits

Credit hours are based on the number of "contact hours" per week in class, for one term; formally, Semester Credit Hours. One credit will represent 12 to 15 teaching hours depending on technical and management subjects.

The final total assessment of the candidate is made in terms of an internal (concurrent) assessment and an external (university) assessment for each course. In total the internal (concurrent) to external (university) marks ratio is maintained 50: 50.

In general

1. For each course, 30% marks will be based on internal assessment and 70% marks for semester end examination (external assessment) conducted by University, unless otherwise stated.
2. The division of the 30 marks allotted to internal assessment is based on tutorials, assignments, seminars / presentations, attendance etc.
3. The marks of the practical would be given on internal practical exam, oral and lab assignments.
4. The internal marks will be communicated to the University at the end of each semester, but before the semester-end examinations. These marks will be considered for the declaration of the results.

(VI)   Examination:

Examinations shall be conducted at the end of the semester i.e. during November and in April/May. However supplementary examinations will also be held in November and April/May.

VI-A

Concurrent Evaluation: A continuous assessment system in semester system (also known as internal assessment/comprehensive assessment) is spread through the duration of course and is done by the teacher teaching the course.

The continuous assessment provides a feedback on teaching learning process. The feedback after being analyzed is passed on to the concerned student for implementation and subsequent improvement. As a part of concurrent evaluation, the learners shall be *evaluated on a continuous basis* by the Institute to ensure that student learning takes place in a graded manner.

Concurrent evaluation components should be designed in such a way that the faculty can *monitor the student learning & development and intervene wherever required*. The faculty *must share the outcome* of each concurrent evaluation component with the students, soon after the evaluation, and guide the students for betterment.

Individual faculty member shall have the flexibility to design the concurrent evaluation components in a manner so as to give a balanced assessment of student capabilities across Knowledge, Skills & Attitude (KSA) dimensions based on variety of assessment tools.

Suggested components for Concurrent Evaluation (CE) are:

1. Case Study / Situation Analysis – (Group Activity or Individual Activity)
2. Class Test
3. Open Book Test
4. Field Visit / Study tour and report of the same
5. Small Group Project & Internal Viva-Voce
6. Learning Diary
7. Scrap Book
8. Group Discussion
9. Role Play / Story Telling
10. Individual Term Paper / Thematic Presentation
11. Written Home Assignment
12. Industry Analysis – (Group Activity or Individual Activity)
13. Literature Review / Book Review
14. Model Development / Simulation Exercises – (Group Activity or Individual Activity)
15. In-depth Viva
16. Quiz

There shall be *a minimum of three concurrent evaluation components per full credit course and five concurrent evaluation components for each half credit course*. The faculty shall announce in advance the units based on which each concurrent evaluation shall be conducted. Each component shall ordinarily be of 10 marks. The Institute shall however have the liberty to conduct additional components (beyond three/five). However the total outcome shall be scaled down to 30/50 marks for full credit and half credit courses respectively. Marks for the concurrent evaluation must be communicated by the Institute to the University as per the schedule declared by the University. Detailed record of the Concurrent Evaluation shall be maintained by the Institute. The same shall be made available to the University, on demand.

At the end of Concurrent Evaluation (out of 30/50 marks) the student does NOT have a facility of Grade Improvement, if he/she has secured any grade other than F.

VI-B

Safeguards for Credibility of Concurrent Evaluation: The following practices are encouraged to enhance transparency and authenticity of concurrent evaluation:

a) Involving faculty members from other management institutes.
b) Setting multiple question paper sets and choosing the final question paper in a random manner.
c) One of the internal faculty members (other than the course teacher) acting as jury during activity based evaluations.
d) Involvement of Industry personnel in evaluating projects / field based assignments.
e) Involvement of alumni in evaluating presentations, role plays, etc.
f) 100% moderation of answer sheets, in exceptional cases.

(VII) Standard of Passing, backlog and award of class

Please refer "CREDIT SYSTEM (CS) For SEMESTER PATTERN of Post Graduate Programs Handbook" available on university website (http:// http://unipune.ac.in/university_files/pdf/CBCS-Handbook-28-7-15new-14-5-16.pdf)

(IX) Medium of Instruction:

The medium of Instruction will be English.

(X) Clarification of Syllabus:

It may be necessary to clarify certain points regarding the course. The BOS should meet to study and clarify any difficulties from the Institutes, as and when required.

(XI) Revision of Syllabus:

As the computer technology is changing very fast, revision of the syllabus should be considered every 3 years.

(XII) Attendance:

The student must meet the requirement of **75% attendance per semester per course** for grant of the term. The Director shall have the right to withhold the student from appearing for examination of a specific course if the above requirement is not fulfilled.

Since the emphasis is on continuous learning and concurrent evaluation, it is expected that the students study all-round the semester. *Therefore, there shall not be any preparatory leave before the University examinations.*

(XII)ATKT Rules:

A student shall earn the credits for a given course in **MAXIMUM FOUR ATTEMPTS**.

(XIII)Maximum Duration for completion of the Programme:

The candidates shall complete the MCA Programme **WITHIN 5 YEARS** from the date of admission, by earning the requisite credits. The student will be finally declared as failed if she/he does not pass in all credits within a total period of four years. After that, such students will have to seek fresh admission as per the admission rules prevailing at that time.

SEMESTER I					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Problem Solving using C++	IT11	4	70	30
2	Software Engineering using UML	IT12	4	70	30
3	Database Management System	IT13	4	70	30
4	Essentials of Operating System	IT14	4	70	30
5	Business Process Domain	BM11	4	70	30
6	Open Subject 1	OS11	1	-	25
7	Open Subject 2	OS12	1	-	25
8	Case Study on Requirement Gathering	CS11	1	-	25
	Practicals				
9	Practical based on IT11	IT11L	2	-	50
10	Practical based on OS11 and OS12	OS1L	2	-	50
	Soft Skills				
11	Soft Skills - I	SS11	1	-	25
			28	**350**	**350**

SEMESTER II					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Data Structure and Algorithm	IT21	4	70	30
2	Web Technology	IT22	4	70	30
3	Business Statistics	MT21	4	70	30
4	Essentials of Networking	IT23	4	70	30
5	Principles and Practices of Management and Organizational Behavior	BM21	4	70	30
6	Open Subject 3	OS21	1	-	25
7	Open Subject 4	OS22	1	-	25
8	Case Study on Feasibility Study and Analysis	CS21	1	-	25
	Practicals				
9	Practical based on IT21	IT22L	2	-	50
10	Practical based on OS21 and OS22	OS2L	2	-	50
	Soft Skill				
11	Soft Skills - II	SS21	1	-	25
			28	**350**	**350**

SEMESTER III

Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Java Programming	IT31	4	70	30
2	Data Warehousing & Data Mining	IT32	4	70	30
3	Testing & Quality Assurance	IT33	4	70	30
4	Probability and Combinatorics	MT31	4	70	30
5	Cloud Computing	IT34	4	70	30
6	Open Subject 5	OS31	1	-	25
7	Open Subject 6	OS32	1	-	25
8	Case Study on Design	CS31	1	-	25
	* Practicals				
9	Practical based on IT31	IT31L	2	-	50
10	Practical based on OS31 and OS32	OS2L	2	-	50
	Soft Skills				
11	Soft Skills - III	SS31	1	-	25
			28	**350**	**350**

SEMESTER IV

Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Python Programming	IT41	4	70	30
2	Information System and Security Audit	BM41	4	70	30
3	Optimization Techniques	MT41	4	70	30
4	Essentials of Architectural framework	IT42	4	70	30
5	Knowledge Representation & Artificial Intelligence	IT43	4	70	30
6	Open Subject 7	OS41	1	-	25
7	Open Subject 8	OS42	1	-	25
8	Case Study on Development	CS41	1	-	25
	* Practicals				
9	Practical based on IT41	IT41L	2	-	50
10	Practical based on OS41 and OS42	OS3L	2	-	50
	Soft Skills				
11	Soft Skills - IV	SS41	1	-	25
			28	**350**	**350**

SEMESTER V					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Social Media and Digital Marketing	IT51	4	70	30
2	Mobile Application Development	IT52	4	70	30
3	Software Project Management	IT53	4	70	30
4	Mini Project	ITC51	8	150	50
5	Open Subject 9	OS51	1	-	25
6	Open Subject 10	OS52	1	-	25
7	Case Study on Implementation and Testing	CS51	1	-	25
	* Practicals				
8	Practical based on IT51	IT51L	1	-	25
9	Practical based on OS51 and OS52	OS4L	2	-	50
	Soft Skills				
10	Soft Skills- V	SS51	2	-	50
			28	360	340

SEMESTER VI					
Sr. No.	Course Title	Course Code	CP	EXT	INT
1	Open Subject 11	OS61	4		100
2	Project	ITC61	16	250	150
			20	250	250

CP : Credit Points

Ext.: External Subject

Int.: Internal subject

Hardware and Software Requirements for all semesters

1	Open source IDE for C/C++ Editor/JAVA/Website designing
	Open source application server(s) : WAMP/XAMP etc.
2	Open Source Databases: Postgre SQL/MySQL/SQLite etc.
3	Open Source Accounting Packages: Tally Edu. Mode/GnuCash/LedgerSMB/TurboCASH
4	Open Source office suite : WPS Office Free/Suite Office/Open Office/ LibreOffice etc.
5	Open source Operating System : Linux (Fedora/Ubuntu) etc.
6	Microsoft Windows Operating System for [20 Machines for intake of 60 students]
7	Two Servers are mandatory [One Linux server & One Windows server] ● Windows Server : Microsoft Windows Server for 20 users for intake of 60 students ● Linux Server : Fedora/Ubuntu

Note: Institutes may use any other alternate open source software.

Hardware Requirements:

Hardware Requirements:		
Desktop Computers :	Processor: Dual Core or above	RAM: Min. 2 GB or Above
Server :	Processor: Xeon/equivalent AMD or above	RAM: Min 8 GB or above

SEMESTER I

Sr. No.	Subject Code	Subject Title	Internal	External
1	**IT11**	**Problem Solving using C++**	**30**	**70**

Course Objectives:
1. To learn the problem-solving techniques by solving small problems.
2. To learn features of the C++ programming language as a continuation of the previous course.
3. To enhance problem solving and programming skills in C++ with extensive programming projects.

Course Outcomes:
After the completion of this course, a student will be able to
1. Use the algorithm paradigms for problem solving.
2. Develop programs with features of the C++ programming language.
3. Develop simple applications using C++
4. Develop programs in the UNIX/Linux programming environment.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Problem Solving Techniques** 1.1 Pseudocode 1.2 Algorithmic paradigms- Greedy, Dynamic Programming and Divide and Conquer 1.3 Efficiency of Algorithms 1.4 Analysis of Algorithms **Note: Simple problems to be solved using algorithms**	15	8
2	Basics of C++ 2.1 A Brief History of C & C++ , C Vs C++ 2.2 A Simple C++ Program , Application of C++ 2.3 Structure & Class, Compiling & Linking	5	3
3	**C++ Expressions and Control Statements** 3.1 Tokens, Keywords, Identifiers & Constants 3.2 Basic Data Types, User-Defined Data Types 3.3 Reference Variables, Operator in C++ 3.4 Scope Resolution Operator, Member Dereferencing 3.5 Operators, Memory Management Operators 3.6 Manipulators, Type Cast Operator 3.7 if..else, switch..case statement while, for, break, continue, goto statements	20	12

4	**Functions In C++** 4.1 The Main Function, Function Prototyping 4.2 Call by Reference, Call by Address, 4.3 Call by Value, Return by Reference 4.4 Inline Function, Default Arguments 4.5 Const Arguments, Function Overloading, 4.6 Friend Function	15	8
5	**Classes & Objects** 5.1 A Sample C++ Program with class, Access modifiers 5.2 Defining Member Functions, Making an Outside Function Inline 5.3 Arrays within a Class 5.4 Memory Allocation for Objects 5.5 Static Data Members, Static Member 5.6 Functions, Arrays of Objects 5.7 Object as Function Arguments 5.8 Friend Functions, Returning Objects, Const member functions 5.9 Pointer to Members, Local Classes 5.10 Constructor - Parameterized Constructor, Multiple Constructor in a Class, Constructors with Default Arguments 5.11 Destructor	10	7
6	**Operator Overloading** 6.1 Defining operator Overloading 6.2 Overloading Unary Operator, Overloading Binary Operator, Overloading Binary Operator Using Friend Function. 6.3 Manipulating of String Using Operators 6.4 Rules for Overloading Operators	15	8
7	**Inheritance & Polymorphism** 7.1 Defining Derived Classes 7.2 Types of Inheritance-Single, Multilevel, Hierarchical, Multiple Inheritance, Hybrid Inheritance 7.3 Virtual Base Classes, Abstract Classes 7.4 Constructor in Derived Classes 7.5 Nesting of Classes 7.6 Pointer to Derived Class 7.7 Virtual Function	10	7
8	**Applications** 8.1 Tower of Hanoi 8.2 Tic-Tac –Toe 8.3 Chess 8.4 Mouse in a maze	10	7

Reference Book

1) Programming with ANSI C++ Bhushan Trivedi, Oxford University Press
2) Sams Teach Yourself C++ in One Hour a Day (8th Edition) - Siddhartha Rao
3) C++: A Beginner's Guide, Second Edition - Herbert Schildt
4) Accelerated C++: Practical Programming by Example - Andrew Koenig, Barbara E. Moo
5) Object-Oriented Programming in C++, 4th Edition - Robert Lafore

Sr. No.	Subject Code	Subject Title	Internal	External
2	IT12	**Software Engineering using UML**	**30**	**70**

Course Objectives:

1. To study basic concepts of software engineering
2. To study phases of SDLC and different process models
3. To learn & understand the Requirement analysis and system Design.
4. To get acquainted with the agile software development methodology

Course Outcome:

Student will able to

CO1: Distinguish different process model for a software development.

CO2: Design software requirements specification solution for a given problem definitions of a software system.

CO3: Apply software engineering analysis/design knowledge to suggest solutions for simulated problems

CO4: Recognize and describe current trends in software engineering

Sr. No	Topic Details	% Weightage	No. of Sessions

1	**1. Introduction to development approach SSAD and OOAD**
	1.1. Overview of Software Development with SSAD
	   1.1.1. Basic System Development Life Cycle with different users and their role in SDLC.
	   1.1.2. Different Approaches and Models for System Development.
	      1.1.2.1. Waterfall Model
	      1.1.2.2. Spiral Model
	      1.1.2.3. Prototyping Model
	      1.1.2.4. RAD
	      1.1.2.5. Rational Unified Process
		10	8

2	**2. Requirement Engineering**
	2.1. Types of Requirements – Functional and Nonfunctional
	2.2. Four Phases of Requirement Engineering
	2.3. Software requirement Specification (SRS)
	   2.3.1. Structure and contents of SRS
	   2.3.2. IEEE standard format for SRS
	
	Case studies should be covered on the above topic
		20	12

3	**3. Use-case Driven Object oriented Analysis** 3.1. Introduction to oops concepts	40	20

	3.1.1. Class and object
	3.1.2. Abstraction and encapsulation
	3.1.3. Method and messages
	3.1.4. Interface, Inheritance and polymorphism
	3.1.5. Structural Diagram - Class Diagram and Object diagram
	3.1.6. Associations and links
	3.1.7. Aggregation , Composition and containment
	3.1.8. Inheritance, Sub Types and IS-A hierarchy
	
	3.2. Behavioral Diagram
	   3.2.1. Use case Diagram
	      3.2.1.1. Identify Actors
	      3.2.1.2. Identify Use cases: describing how the user will use the system
	      3.2.1.3. Develop use-case Model
	      3.2.1.4. Description of Use case Diagram.
	
	   3.2.2. Activity Diagram
	   3.2.3. Sequence diagram
	   3.2.4. Collaboration Diagram.
	   3.2.5. State Transition Diagram
	Case studies should be covered on the above topic		

4	**4. User Interface Design** 4.1. Elements of good design 4.2. Eight golden rules for design 4.3. Features of modern GUI, Menus, Scroll bars, windows, button icons, panels, error messages etc. **Case studies should be covered on the above topic**	10	8

5	**5. Current trends in Software Engineering**
	5.1. Introduction to Web Engineering
	5.2. Agile Process
	   5.2.1. Agile Process Models
	      5.2.1.1. Extreme Programming (XP)
	      5.2.1.2. Adaptive Software Development (ASD)
	      5.2.1.3. Dynamic Systems Development Method (DSDM)
	      5.2.1.4. Scrum
	      5.2.1.5. Crystal
	      5.2.1.6. Feature Driven Development (FDD)
		20	12

Reference Books:

1. **Software Engineering by Roger Pressman (6th edition)**
2. **Object-Oriented Software Engineering: A Use Case Driven Approach by Ivan Jacobson**
3. **Software Engineering by Sommerville,Pearson,8th Ed**
4. **Analysis & Design of Information System James Senn, TMH, 2nd Ed**
5. **Object Oriented System Development - Ali Bahrami McGRAW-HILL International Edition**
6. **Object-Oriented Software Engineering - Ivar Jacobson Pearson Education INC**
7. **UML Instant – Thomas A Pendar – Wiley Publication**
8. **UML in Nutshell ,O'reilly Pub**
9. **Agile Software Engineering with visual studio by Sam Guckenheimer, Neno Loje.**
10. **Software Requirements by Karl Wiegers**
11. **Object Oriented Modeling and Design with UML by James Rumbaugh, Michael Blaha**
12. **Object Oriented Systems and Techniques with UML & Java by Udit Agarwal**
13. **Software Engineering by Chandramouli Subramanian, Saikat Dutt**
14. **Object Oriented systems Analysis and Design using UML by Simon Bennett**
15. **UML 2 Bible by Tom Pender**
16. **The Unified Modeling Language user guide by Grady Booch, James Rumbaugh, Ivar Jacobson**

Sr. No	Subject Code	Subject Title	Internal	External
3	IT13	**Database Management System**	**30**	**70**

Course Objectives
1. Identify structure of database system using data models and ER models
2. Demonstrate SQL , XML schema
3. Provide database design approaches with normalization
4. Define and discuss transaction management and concurrency control

Course Outcomes
CO1: Describe the basic concepts of DBMS and various databases used in real applications.
CO2: Design relational database using E-R model and normalization
CO3: Demonstrate nonprocedural structural query languages for various database applications
CO4: Apply concepts of Object Based Database, XML database and non-relational databases.
CO5: Explain transaction management and recovery management for real applications

Sr. No.	Topic Details	Weightage (%)	No. of Sessions
1	**Basic concepts** 1.1 Introduction 1.2 Database and Need for DBMS, 1.3 Characteristics, Users, Views, schema, 1.4 3-tier architecture, 1.5 Introduction of Parallel, Distributed Databases, Mobile databases and Cloud databases. 1.6 Models (Relational model, Object Models) 1.7 Advantages and disadvantages of each model.	10	8
2	**Data Modeling and Relational Database Design** 2.1Entities-attributes, 2.2 Relationship 2.3 Attributes, relationship set, Keys, 2.4 Codd's rules, 2.5 Generalization, aggregation, ER diagrams, 2.6 Normalization (1 NF, 2 NF, 3 NF, BCNF), 2.7 Introduction to SQL, DDL, DML Queries.	25	15
3	**Specialty databases and applications** 3.1 Obstacles using Relational Data Model & Emergence of Special Databases 3.2 Object Oriented Databases (OODBMS) 3.2.1 Feature 3.2.2 Advantages of OODBMS Architecture 3.2..3 ODL,OQL	15	10

	3.2.4 OODBMS Vs RDBMS 3.2.4Object Relational Database, Schema, Mapping 3.2.5OODBMS Vs ORDBMS 3.3XML 　3.3.1 Structure of XML Data 　3.3.2 XML Document Schema 　3.3.3 Querying and Transformation 　3.3.4 Application Program Interfaces to XML 　3.3.5 Storage of XML Data 　3.3.6XML Applications			
4	**Transaction processing and Concurrency** 4.1 Concept of transaction processing, ACID properties, States of transaction 4.2 Serializibility and testing for serializibility 4.3 Concurrency control, schemes 4.4 Locking techniques 4.5 Timestamp based protocols 4.6 Granularity of data items 4.7 Deadlocks	25	14	
5	**Recovery Systems and Backup** 5.1 Failure classifications 5.2 Recovery & Atomicity 5.3 Log base recovery 5.4 Recovery with concurrent transactions 5.5 Failure with loss of non-volatile storage 5.6 Database backup & recovery from catastrophic failure 5.7 Remote backup system	23	8	
6	**No SQL Database** 6.1 Introduction, Need& Advantages 6.2 Types of No SQL Database 6.3 No SQL database vs RDBMS	2	5	

Reference Books:

1. Introduction to database systems C.J.Date, Pearson.
2. Database system concept Korth, TMH,5th Ed.
3. Principles of Database Management James Martin, PHI.
4. Engineering MIS for Strategic Business Processes ArpitaGopal Excel Books
5. Fundamentals of Database SysemsElmasriNavathe, Pearson,5th ed.
6. Object-oriented modeling and design Rumbaugh and Blaha, PHI.
7. Object-oriented analysis and design Grady Booch,Pearson,3rd Ed.
8. Database Management Systems Bipin Desai, Galgotia Pub.
9. Database system practical Approach to design, implementation & management Connoly& Begg,Pearson,4th Ed.
10. Database Management systems Ramakrishnan&Gehrke, McGraw-Hill,3rd Ed.
11. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Martin Fowler

Sr. No.	Subject Code	Subject Title	Internal	External
4	IT14	**Essential of Operating System**	30	70

Course Objectives:
1. To learn the fundamentals of Operating Systems and handle processes and threads and the communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To know the functionality of Multiprocessor OS and Mobile OS.
4. To gain knowledge on distributed operating system concepts.
5. To learn about Basics of Linux.
6. To learn programmatically to implement Linux OS mechanisms

To know about Basic Administration of Linux

Course Outcome:
After completion of this course student will be able to
CO1: Understand structure of OS, process management and synchronization.
CO2: Analyze and design Memory Management.
CO3: Interpret the mechanisms adopted for file sharing in distributed Applications
CO4: Conceptualize the components and can do Shell Programming.
CO5: Know Basic Linux System Administration and Kernel Administration.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Overview:** Overview of operating systems, functionalities and characteristics of OS. Hardware concepts related to OS, CPU states, I/O channels. **Process Management and Synchronization:** UNIX process control and management, PCB. Job and processor scheduling, scheduling algorithms, process hierarchies. Problems of concurrent processes, critical sections, mutual exclusion, synchronization, deadlock, Mutual exclusion	25	18
2	**Memory Management :** Memory Management Techniques, Contiguous & Non Contiguous allocation, Logical & Physical Memory, Conversion of Logical to Physical address, Paging, Segmentation, Segment with paging, Virtual Memory Concept, Demand paging, Page Replacement algorithm, Thrashing	15	10

3	**Multiprocessor Operating Systems:** System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- **Mobile Operating Systems:** ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management	15	8
4	**Distributed Operating Systems:** System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement - Caching	10	6
5	**Basics of Linux:** History, FOSS, current Linux Distributions-Distros examples, Linux Operating System Layers, The Linux Shell (different kinds of shell), Process: (parent and child processes), Files and Directories (File Structure and directory structure), Interaction with System.	10	5
6	**Shells and Utilities:** Getting Started with Shell Programming: The bash shell, Shell commands, the role of shells in the Linux environment, other standard shells, Write a simple shell script - "Hello World!", Variables in shell:, Bash variable existence check, Customize the bash shell environments: Recalling command history, Path name expansion, Create and use aliases, The tilde expansion, Startup scripts, Commonly Used Commands and Utilities.	15	8
7	**Basic Administration of Linux:** Basic System Administration (Run levels, User accounts), Kernel Administration: (Linux kernel sources, rebuilding kernel, installing kernel), Managing Users, Managing File Systems, Linux File Permissions, Devices and Modules (device drivers).	10	7

Reference Books:

1. Operating System Concepts, 9th Edition, John Wiley & Sons, Inc. by Avi Silberschatz, Peter Baer Galvin, Greg Gagne,
2. Linux Administration, A Bebinner's, Guide by Wale Soyinka, Tata McGraw Hill
3. D.M Dhamdhere: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2012.
4. Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 by William Stallings.
5. Modern Operating system by Andrew Tenenbaum.
6. Distributed Operating System by Andrew Tanenbaum
7. Linux Shell Scripting By Ganesh Naik
8. Linux Bible By Christopher Negus
9. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
10. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011

Sr. No.	Subject Code	Subject Title	Internal	External
5	BM11	Business Process Domain	30	70

Course Objectives:
1. To learn & understand the processes and practices in business and their applications
2. To make students understand the necessity and importance of Marketing in business Environment.
3. To understand the concepts & role of e-commerce in business management
4. To introduce advance business applications like CRM and SCM.
5. To learn the financial aspects of business management.

Course Outcome:
After completion of this course student will able to
CO1: describe major bases for marketing mix in business
CO2: describe various functionalities of human resource process
CO3: Identify existing e-commerce model and payment system ,
CO4: Apply knowledge to evaluate and manage an effective supply chain.
CO5: Understand how customer relations are related to business functions and its importance to success of Business entity.
CO6: use various banking and insurance process for business development.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Marketing** 1.1 Definition & importance of consumer behavior, 1.2 Steps buyer decision process 1.3 Market Segmentation 1.4 Marketing mix: 7 Ps of marketing	20	12
2	**Human Resource** 2.1 Employee Database 2.2 Recruitment , selection Processes 2.3 Employee Appraisal, 2.4 Leave Types 2.5 Payroll – Salary calculation, Income Tax calculation and reporting, PF, Gratuity, Bonus.	15	12
3	**E commerce** 3.1 Business model of ecommerce: B2B, B2C, C2C, B2G and other models of ecommerce. 3.2 Electronic payment system: Credit card, debit card, operational and legal risks of e-payments, risk management options for e-payment system, order fulfillment for e-commerce.	15	8
4	**Supply Chain Management (SCM)** 4.1 what is supply chain, 4.2 Major drivers of Supply chain,	20	12

	4.3 Value in Supply Chain- quality, delivery, flexibility 4.4 Source management in Supply Chain- insourcing, outsourcing, Make Vs Buy 4.5 Managing Inventory in Supply chain- definition of inventories, Role of Inventory, Inventory control techniques (ABC Analysis, VED Analysis), Vendor Managed Inventory 4.6 Transportation– Modes of transportation, Transportation Management system (TMS)		
5	**Customer Relationship Management (CRM)** 5.1 What is CRM? , Why we need CRM? 5.2 Customer Life Cycle 5.3 Use of CRM in Business 5.4 CRM implementation Strategy 5.5 CRM Applications in Hospital management, Travel industry, Hotel industry.	15	8
6	**Banking and Insurance** 6.1 Accounts and Deposits, Types of accounts-Saving account, current account, Demat Account 6.2 Digital Payments – NEFT, RTGS, IMPS, BHIM, UPI, Wallets 6.3 Loans and various types of loans- Personal, home loan, vehicle loan, Loan against security, business loans. 6.4 Loan Sanction Process 6.5 Insurance, types of insurance- Life, Health, Accident, Home, Motor, Loan Insurance. 6.6 Insurance processes	15	8

Reference Books:

1. Marketing Management: A South Asian Perspective, 14th Edition (English), Philip Kotler, K. Keller, Abraham Koshy and Mithileshwar Jha
2. Supply Chain Management - Strategy, Planning & Operation by Sunil Chopra, Peter Meindl, D. V. Kalra, Pearson Education.
3. Human Resource Management by J. John Bernardin, Tata McGraw Hill Publishing, 4thEdition
4. E-Commerce concept-model-strategies, C.S.V. Murthy, Himayalaya Publication House
5. Customer Relationship Management by Kristin Anderson and Carol Kerr, TMGH
6. Management of banking and Financial Services, by Padmalatha Suresh & Justin Paul, Pearson India Ltd, New Delhi

Sr. No.	Subject Code	Subject Title	Internal	External
1	IT11L	**Practical based on IT11**	**50**	---

Steps involved in Problem Solving are:
1. Understanding the problem
2. Analyzing the problem
3. Developing the solution
4. Coding and implementation.

LIST OF EXPERIMENTS

1. Simple C++ programs to implement various control structures.
   a. if statement
   b. switch case statement and do while loop
   c. for loop
   d. while loop
2. Programs to understand structure & unions.
   a. structure
   b. union
3. Programs to understand pointer arithmetic.
4. Functions & Recursion.
   a. recursion
   b. function
5. Inline functions.
6. Programs to understand different function call mechanism.
   a. call by reference
   b. call by value
7. Programs to understand storage specifiers.
8. Constructors & destructors.
9. Use of "this" pointer using class
10. Programs to implement inheritance and function overriding.
    a. multiple inheritance –access Specifiers
    b. hierarchical inheritance – function overriding /virtual Function
11. Programs to overload unary & binary operators as member function.
    a. unary operator as member function
    b. binary operator as member function
12. Programs to understand friend function & friend Class.
    a. friend Function
    b. friend class
13. C++ Applications viz. Tower of Hanoi, Tic-Tac –Toe, Chess, Mouse in a maze

SEMESTER II

Sr. No.	Subject Code	Subject Title	Internal	External
1	IT21	**Data Structure and Algorithm**	**30**	**70**

Course Objectives:
1. To impart the basic concepts of data structure and algorithms
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs
4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Course Outcome:

After completion of this course student will able to

CO1: apply design principles and concepts for Data structure and algorithm

CO2: summarize searching and sorting techniques

CO3: describe stack, queue and linked list operation

CO4: demonstrate the concepts of tree and graphs

Sr. No	Topic Details	% Weightage	No. of Sessions

1	**Introduction to Data Structure**
	1.1 Fundamentals of Data Structure
	1.2 Operations of Data Structure
	    1.2.1 Traversing
	    1.2.2 Searching (Linear and Binary Search)
	    1.2.3 Sorting (Bubble, Insertion, Selection, Quick and Merge sort)
	    1.2.4 Inserting and Deleting
	1.3 Arrays as Data Structure
	1.4 Storage Representation of Arrays
	1.5 Polynomial Representation of Arrays
	    1.5.1 Addition of Two Polynomial
	    1.5.2 Addition of Sparse Matrix
		20	8

2	**Stacks**
	2.1 Introduction and Definition
	2.2 Representation of Stacks
	2.3 Operations on Stacks
	2.4 Applications of Stacks
	2.5 Representation of Arithmetic Expressions
	    2.5.1 Infix
	    2.5.2 Postfix
	    2.5.3 Prefix
		15	8

3	**Queues** 3.1 Introduction and Definition 3.2 Representation of Queues 3.3 Operation on Queues 3.4 Applications of Queues 3.5 Dequeue 3.6 Circular Queue 3.7 Priority Queue	15	8

4	**Linked List**
	
	1.1 Definition of Linked List
	1.2 Dynamic Memory Management
	1.3 Representation of Linked List
	1.4 Operations on Linked List
	    1.4.1 Inserting
	    1.4.2 Removing
	    1.4.3 Searching
	    1.4.4 Sorting
	    1.4.5 Merging Nodes
	
	4.5 Double Linked List
		10	10

5	**Trees**
	5.1 Definition of Tree
	5.2 Binary Tree and their types
	5.3 Representation of Binary Tree
	5.4 Operations on Binary Tree
	5.5 Binary Search Tree (BST)
	5.6 Traversal of Binary Tree
	    5.6.1 Preorder Traversal
	    5.6.2 In-order Traversal
	    5.6.3 Post-order Traversal
	5.7 Threaded Binary Tree
	5.8 AVL Tree
	5.9 B-Tree
	    5.10 Operations on B-Tree
		20	16

6	**Graphs**
	
	6.1 Definition of Graph
	6.2 Basic Concepts of Graph
	6.3 Representation of Graph
	    6.2.1 Adjacency Matrix
	    6.2.2 Adjacency List
	6.4 Single Source shortest path algorithm-Dijkstra's
	    algorithm.
	6.5 Spanning Tree
	6.6 Minimum Spanning Tree
		20	10

6.6.1 Kruskal's Algorithm
6.6.2 PRIM's Algorithm
6.7 Graph Traversal
    6.7.1 Breadth First Search (BFS)
    6.7.2 Depth First Search (DFS)			

Note: Course should be taught independent of any programming language.			

References Books :

1. Jean Paul Tremblay, Paul G. Sorensons, "AN Introduction to Data Structures with Application", McGraw Hall Publication(INDIAN edition), ISBN: 9780074624715, 0074624717
2. Lipschutz Schaum's, "Data Structure", Outline Series,TMH, ISBN-0-07-060168-2.
3. D. Samanta, "Classical Data Structure", PHI, ISBN: 8120318749.
4. Fundamental of DS using C++ by Horowitz Sahani, Galgotia pub.
5. Practical Approach to Data Structures by Hanumanthappa.
6. Tremblay, J. & Sorenson, P.G., (2001), An Introduction to Data Structures with Application, Mcgraw Hill India, ISBN: 978-0074624715, 0074624717
7. Tenenbaum," Data Structures Using C and C++", Second Edition, PHI, ISBN-81317-0328-2
8. Data Structures Using C and C++ by Langsam Y, PHI,2nd Ed.
9. The Essence of Data Structures using C++ by Brownesy,Kan
10. Data Structure and Algorithms in C++ by Joshi Brijendra Kumar
11. Data Structures with C++: Schaums Outlines by Hubbard John

Sr. No.	Subject Code	Subject Title	Internal	External
2	IT22	Web Technology	30	70

Course Objectives:
1. To impart the design, development and implementation of Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages.
3. To Design and implement dynamic websites with good sense of designing and latest technical aspects

Course Outcome:
After completion of this course student will able to
CO1: Implement interactive web page(s) using HTML, CSS and JavaScript.
CO2: Build Dynamic web site using server-side PHP Programming and Database connectivity.
CO3: Design a responsive web site.

Sr. No	Topic Details	% Weightag	No. of Sessions
1	1.1 Introduction to HTML5, What Is HTML5? Features of HTML5 Introduction to Web 2.0 and Web 3.0 1.2 History And Major Actors ● A Little Retrospective ● What Is The W3C? ● What Is The WHATWG? 1.3 Getting Started With HTML5 ● Feature Detection ● Support For Legacy Browsers 1.4 Structure of a Web Page ● HTML5 DOCTYPE ● Page Encoding ● New And Updated Elements ● New Attributes ● Deprecated Elements And Attributes 1.5 Audio and Video ● The State of Web Audio And Video Based On Plug-in ● Attributes And Methods ● Understanding Audio/Video Events 1.6 HTML5 Canvas ● Overview Of Graphics In The Browser ● Canvas Vs. SVG ● Using A Canvas 1.7 Forms 1.8 Working With Paths ● Drawing Straight Lines ● Drawing Circles Or Arcs ● Drawing Text ● Drawing Images 1.9 Understanding Transforms ● Translation	20	12

	● Rotation ● Scaling		
2	CSS3 2.1 Introducing CSS3 ● What is CSS3? ● The History of CSS 2.2 Selectors and Pseudo Classes ● Attribute Selectors ● The Target Pseudo-Class ● UI Element States Pseudo-Classes 2.3 Fonts and Text Effects ● Fonts on the Web ● Font Services ● The @font-face Rule 2.4 Colours, Gradients, Background Images, and Masks ● Colour ● The Opacity Property ● Backgrounds 2.5 Transitions,Transforms and Animations ● Transitions and Transforms 2.6 Embedding Media ● Video Formats ● Styling Video	15	10
3	Javascript 3.1 Introduction to Javascript,Types of Scripts with suitable example 3.2 Control and looping structure 3.3 Various Operators in Javascript with Example 3.4 Array its Types 3.5 Event Handling with Example 3.6 Math, Date and String objects with Example 3.7 DOM Objects 3.8 Form Validation 3.9 Dynamic effect using Javascript	20	12
4	Jquery 4.1 Intro to jQuery ● Need of jQuery ● Advantages of jQuery ● JQuery versions ● Features 4.2 Retrieving Page Content ● Using selectors ● Using filters ● Child,visibility, and content filters in jquery 4.3 Manipulating Page Content	25	15

	● Creating, getting, and setting content ● Manipulating attributes ● Inserting content ● Wrapping, replacing, and removing content 4.4 Methods in jQuery 4.5 Events in JQuery 4.6 Animation in JQuery 4.7 Plugins in JQuery		
5	PHP 5.1 Installing and Configuring PHP 5.2Introduction ● PHP and the Web Server Architecture, PHP Capabilities ● PHP and HTTP Environment Variables 5.3 PHP Language Core ● Variables ● Constants ● Data Types ● Operators ● Working with Arrays 5.4 Decision Making , Flow Control and Loops 5.5 Error Handling and Reporting Considerations 5.6 Creating a Dynamic HTML Form with PHP 5.7 Database Connectivity with MySql ● Connection with MySql Database ● Performing basic database operations(DML) Insert, Delete, Update, Select) 5.8 Using GET, POST, SESSION, and COOKIE Variables	20	12

Reference Books:

1. Javascript: the Complete Reference by Thomas Powell, Fritz Schneider
2. HTML & CSS: The Complete Reference, Fifth Edition by Powell Thomas
3. JavaScript The Complete Reference 3rd Edition (Paperback, Powell Thomas)
4. jQuery Reference Guide by Chaffer Jonathan
5. Complete Ref. PHP
6. Introducing HTML5 - Bruce Lawson, Remy Sharp
7. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed
8. JavaScript The Complete Reference 3rd Edition (Paperback, Powell Thomas)
9. Learning jQuery - Jonathan Chaffer, Karl Swedberg
10. HTML5 & CSS3 , Castro Elizabeth 7th Edition
11. Head First PHP & MySQL – by Lynn Beighley & Michael Morrison
12. The Joy of PHP Programming: A Beginner's Guide – by Alan Forbes
13.

Sr. No	Subject Code	Subject Title	Internal	External
3	MT21	BUSINESS STATISTICS	30	70

Course Objectives:
1. To understand the importance of data-driven business decisions.
2. To learn the basics of business decision-analysis.
3. To summarize business data numerically and graphically.
4. Learn the basics of beginning predictive business modeling
5. To understand the importance of business sampling methods, and be able to describe different business sampling methods.
6. To understand the process associated with statistical decisions, defining and formulating problems, analyzing the data, and using the results in decision making.

Course Outcome:
After completion of this course student will be able tp

CO1: Demonstrate concepts of business statistics (such as measures of central tendency, dispersion, correlation, regression analysis and time series analysis)

CO2: Students will be able to analyze and apply statistical tools to solve problems.

CO3: based on the acquired knowledge to interpret the meaning of the calculated statistical indicators

CO4: Demonstrate concept of index numbers for solving practical problems in business world

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Statistics**: Introduction to Statistics, Importance of Statistics in modern business environment. Definition of Statistics, Importance, Scope and Applications of Statistics, Characteristics of Statistics, Functions of Statistics, Limitations of Statistics. Need of Data, Types of Data, Principles of Measurement, Source of Data, Data Classification, Tabulation and Presentation.	5	4
2	**Measures of Central Tendency and Dispersion:** Introduction, Objectives of statistical average, Requisites of a Good Average, Statistical Averages - Arithmetic mean - Properties of arithmetic mean - Merits and demerits of arithmetic mean ,Median - Merits and demerits of median , Mode - Merits and demerits of mode , Geometric Mean , Harmonic Mean , Appropriate Situations for the Use of Various Averages , Positional Averages , Dispersion – Range - Quartile deviations, Mean deviation ,Standard Deviation -Properties of standard deviation Coefficient of Variance	12.5	6
3	**Sampling, Sampling Distributions and Testing:** Introduction , Population and Sample - Universe or Population - Types of Population – Sample , Advantages of Sampling, Sampling Theory - Law of Statistical Regularity - Principle of	37.5	20

	Inertia of Large Numbers - Principle of Persistence of Small Numbers - Principle of Validity - Principle of Optimization , Terms Used in Sampling Theory, Errors in Statistics, Measures of Statistical Errors, Types of Sampling - Probability Sampling - Non-Probability Sampling, Case let on Types of Sampling, Determination of Sample Size, Central Limit Theorem **Testing of Hypothesis in Case of Large and Small Samples:** Introduction – Large Samples – Assumptions , Testing Hypothesis - Null and alternate hypothesis - Interpreting the level of significance - Hypotheses are accepted and not proved , Selecting a Significance Level - Preference of type I error - Preference of type II error - Determine appropriate distribution, Two – Tailed Tests and One – Tailed Tests - Two – tailed tests - Case study on two –tailed and one-tailed tests, Classification of Test Statistics - Statistics used for testing of hypothesis - Test procedure - How to identify the right statistics for the test , Testing of Hypothesis in Case of Small Samples - Introduction – small samples, 't' Distribution , Uses of 't' test **Chi – Square Test:** Introduction , Chi-Square as a Test of Independence - Characteristics of χ^2 test - Degrees of freedom - Restrictions in applying χ^2 test - Practical applications of χ^2 test - Levels of significance - Steps in solving problems related to Chi-Square test - Interpretation of Chi-Square values , Chi-Square Distribution - Properties of χ^2 distribution - Conditions for applying the Chi-Square test - Uses of χ^2 test , Applications of Chi-Square test - Tests for independence of attributes - Test of goodness of fit - Test for specified variance		
4	**Simple Correlation and Regression:** Introduction , Correlation - Causation and Correlation - Types of Correlation - Measures of Correlation - Scatter diagram - Karl Pearson's correlation coefficient - Properties of Karl Pearson's correlation coefficient - Factors influencing the size of correlation coefficient , Probable Error - Conditions under which probable error can be used , Spearman's Rank Correlation Coefficient , Partial Correlations , Multiple Correlations , Regression - Regression analysis - Regression lines - Regression coefficient , Standard Error of Estimate , Multiple Regression Analysis , Reliability of Estimates , Application of Multiple Regressions	15	10
5	**Forecasting and Time Series Analysis:** Introduction, Types of forecasts, Timing of forecast, Forecast methods-Quantitative and Qualitative Forecasting Methods,	15	10

	Time Series Analysis -Introduction, Time Series Analysis , Utility of the Time Series , Components of Time Series - Long term trend or secular trend - Seasonal variations - Cyclic variations - Random variations, Methods of Measuring Trend - Free hand or graphic method - Semi-average method - Method of moving averages - Method of least squares, Mathematical Models for Time Series - Additive model - multiplicative model, Editing of Time Series, Measurement of Seasonal Variation - Seasonal average method - Seasonal variation through moving averages - Chain or link relative method - Ratio to trend method, Forecasting Methods Using Time Series - Mean forecast - Naive forecast - Linear trend forecast - Non-linear trend forecast - Forecasting with exponential smoothing		
6	**Index Numbers:** Introduction, Definition of an Index Number – Relative - Classification of index numbers , Base year and current year - Chief characteristics of index numbers - Main steps in the construction of index numbers, Methods of Computation of Index Numbers – Un-weighted index numbers - Weighted index numbers, Tests for Adequacy of Index Number Formulae , Cost of Living Index Numbers of Consumer Price Index - Utility of consumer price index numbers - Assumptions of cost of living index number - Steps in construction of cost of living index numbers , Methods of Constructing Consumer Price Index - Aggregate expenditure method - Family budget method - Weight average of price relatives, Limitations of Index Numbers , Utility and Importance of Index Numbers	15	10
	Reference Books		
	1. Business Statistics, J. K. Sharma, Pearson Education-2nd Edition 2. Business Statistics, Naval Bajpai, Pearson Education-2nd Edition 3. The Art of Computer systems Performance Analysis, Raj Jain, Wiley India Pvt Ltd, 4. Complete Business Statistics, Amir Aczel, Jayavel Sounderpandian, (Seventh Edition), *Tata McGraw-Hill* Education Pvt. Ltd - 2012 5. Business Statistics Theory and Applications, by Jani P.N , PHI		

Sr. No.	Subject Code	Subject Title	Internal	External
4	IT13	Essentials of Networking	30	70

Course Objectives:
1. To understand various computer networks and technologies behind networks
2. To study TCP/IP suite.
3. To study routing concept along with Routing protocols
4. To be familiar with wireless networking concepts and protocols
5. To understand cryptography

Course Outcome:
After completion of this course student will able to
CO1: Understand the basic concepts of data communication including the key aspects of networking
 and their interrelationship
CO2: Understand various protocols such as HTTP, SMTP, POP3, IMAP, FTP, DNS, DHCP and the basic structure of IPv4, IPv6 Address and concept of sub netting with numerical
CO3: Understand routing concept and working of routing protocols such as RIP, OSPF and BGP
CO4: Understand various encryption techniques

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Data Communication and Computer Networks** 1.1 Overview of basic concepts and components. [Data communication characteristic, Data representation, data flow, Network Criteria, Physical structures and topologies, Network types- LAN, MAN, WAN, Internet] 1.2 Various types of Networks (only overview) 1.2.1 Connection Oriented N/Ws Vs Connectionless N/Ws, 1.2.2 Ethernet 1.2.3 Wireless LAN 1.2.4 X.25 1.2.5 ATM	5	2
2	**Principle of Layering concept** 2.1 Need for layering 2.2 ISO-OSI 7 Layer Model 2.3 TCP/IP model 2.4 OSI Model vs TCP/IP mode	10	12

2	**Physical communication**: 2.1 Hardware Architecture 2.2 Transmission Media (Guided and unguided i.e. Twisted pair, Coaxial cable, Fiber optics, Wireless Transmission etc.) 2.3 Communication Devices (Switch, Router etc.) 2.3, Switching and its types (Circuit Switching, Message Switching, Packet Switching)	10	6
3	**Link Layer Communication** 3.1 Error detection and correction techniques 3.2 Framing and its types 3.3 Flow and error control 3.4 HDLC protocol 3.5 P2P Protocol **Note: Examples based on 3.1 to be covered**	20	12
4	**IP Addressing & Routing** 4.1 Internet Protocol and IPv4 Packet format, 4.2 Addressing, Physical Addresses, Logical Addresses Port Addresses, Specific Addresses 4.3 IP Address- Network Part and Host Part 4.4 Network Masks, Network Addresses and, Broadcast Addresses, Loop Back Address 4.5 Address Classes 4.7 TCP and UDP Connections 4.9 Overview of IPv6 **Notes: Examples based on IP addressing to be covered**	15	10
5	**Routing Protocol** 5.1 IP routing concept, 5.2 Routing tables 5.3 Routing protocols – RIP, IGRP, EIGRP, OSPF,BGP	10	4
5	**Domain Name System (DNS)** 5.1 Domain Name Space 5.2 DNS in the internet 5.3 DNS Resolution and caching 5.4 Resource Records, DNS message	10	4

6	Network Applications	20	10
	6.1 Hyper Text Transfer Protocol (HTTP), HTTP communications –HTTP request, Request, Headers, Responses, Status Code, Error Status Code 6.2 Email- Sending & Receiving Email, Email, Addressing, Message Structure, SMTP – Simple Mail Transfer Protocol, POP – Post Office Protocol, IMAP- Internet Message Access Protocol, FTP- File Transfer Protocol 6.3 Overview of Network Security – Active and Passive attacks, Cryptography (Symmetric and Asymmetric) and Firewall		

Reference Books:

1. Computer Networks   Abndrew S. Tanenbaum 4e

2. Data Communication and Networking   Behroz A.Forouzan, TMH, 4th Ed

3. Cryptography and Network Security   Atul Kahate, TMH 2nd Ed.

1. Network Essential Notes   GSW MCSE Study Notes

2. Internetworking Technology Handbook   CISCO System

3. Computer Networks and Internets with Internet Applications   Douglas Comer

Sr. No.	Subject Code	Subject Title	Internal	External
5	BM21	**Principles and Practices of Management and Organizational Behavior**	30	70

Course Objectives:

1. To understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories.
2. To understand group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations.
3. To understand the organizational system, including organizational structures, culture, human resources, and change.

Course Outcomes:

After completion of the course students will be able to

CO1. Describe and analyze the interactions between multiple aspects of management.

CO2. Analyze the role of planning and decision making in Organization

CO3. Justify the role of leadership qualities, Motivation Group dynamics and Team Building.

CO4. Compare the controlling process

Sr. No.	Topic Details	% Weightage	No. of Sessions
1	**Management:** **1.1** Meaning and Definition **1.2** The need, scope and process of Management **1.3** Managerial levels/Hierarchy **1.4** Managerial functions: Planning, Organizing, Staffing, Directing, Controlling **1.5** Types of managers & its Skill: Functional, Specialize, Generalize **1.6** Social responsibility of management	10	4
2	**Nature & Development of Management Thought:** **2.1** Historical perspective **2.2** Evolution of Management: Introduction to Scientific Management by Taylor, Administrative Management by Fayol, Contribution of Peter Drucker **2.3** System approach-with reference to management, organization and MIS **2.4** Contingency approach	10	6
3	**Decision making:** **3.1** Introduction **3.2** Decision making environment- Decision making under certainty, under uncertainty, under risk	10	5

	3.3 Types of Decision, decision making processes & Tools **3.4** Individual Vs Group decision making **3.5** Herbert Simon's Model & Principle of Rationality		
4	**Organization, Organizational Behaviour & Organizational Culture:** **4.1** Definition and Need for Organization **4.2** Introduction to OB, Organizing Process **4.3** Organizational structure (Functional organization, Product Organization, Territorial Organization) **4.4** Introduction- Development and Levels of Organizational Culture **4.5** Types of Corporate Culture	10	5
5	**Motivation and Leadership:** **5.1** Concept of Motivation, Benefits to organization and Manager **5.2** Maslow's need Hierarchy theory **5.3** Herzberg's Motivation- Hygiene Theory **5.5** Theory X and Y, Theory Z **5.6** Definition, Nature, Qualities of Leader, Leader V/s Manager **5.7** Leadership Styles(Autocratic, Participative, Laissez faire or subordinate-centered ,Bureaucratic leadership, Transformational leadership, Transactional leadership)	15	10
6	**Group and Group Dynamics:** **6.1** Concept of Group, Effect & Characteristics of group, Types of groups **6.2** The Five-Stage Model of Group Development **6.3** Group Properties (Roles, Norms, Status, Size, and Cohesiveness)	10	6
7	**Team Building** **7.1** Concept of Team, Nature, Benefits from team, **7.2** Types of Teams **7.3** Creating Effective Teams, Turning Individuals into Team Player.	10	8
8	**Stress Management and Conflict management:** **8.1** Work stress: Meaning of stress, Stressors, Sources of Stress, Types of stress **8.2** Stress Management strategies **8.3** Concept of Conflict, Functional versus Dysfunctional Conflict **8.4** Five stage Conflict Process, Types of Conflict (Task Conflict, Relationship Conflict, Process Conflict, Personality Conflict, Intergroup Conflict) **8.5** Managing Conflict (Styles for Handling Dysfunctional Conflict, Third-Party Interventions)	15	12

9	**Personality and Understanding Individual Behavior:** **9.1** Introduction, Definition of Personality -Determinants of Personality **9.2** Personality Theories -Personality and Organisation **9.3** Personality Structure -Personality and Behavior **9.4** Ego State, Johari window- Transactional Analysis	10	4

Reference Books:
1. Principles and Practices of Management- Shejwalkar
2. Essential of management- 7th edition Koontz H &Weitrich H TMH
3. Management Today Principles And Practices - Burton & Thakur
4. Mgmt. Principles and Functions - Ivancevich & Gibson, Donnelly
5. Organizational behavior Keith Davis
6. Organizational behavior Fred Luthans TMH 10th edition
7. Organizational behavior Dr.Ashwatthapa THI 7th edition
8. Organizational Behaviour - Fred Luthans
9. Organizational Behaviour - Stephen Robbins
10. Organizational Behaviour - K. Aswathappa (8th revised edition)
11.Business psychology and Organizational Behaviour – Eugene McKenna
12.Understanding Organizational Behaviour - Udai Pareek
13. Organization Development – Wendell L. French and Cecil H. Bell Jr.

Sr. No.	Subject Code	Subject Title	Internal	External
1	IT21L	**Practical based on IT21**	50	---

Steps involved while conducting practical:
1. Write an algorithm.
2. Analyze algorithm based on time complexity.
3. Coding and implementation using C++
4. Analyze program based on time complexity.

Experiment based on -

1. Operations on Data Structure – Traversing, Searching, Sorting and insertion-deletion
2. Application of Data Structure – Polynomial, Sparse matrix
3. Operation on Stack, Queue and Linked List
4. Operations on Tree traversal and B-tree
5. Operations on Graph traversal
6. Implementation of Dijkstra's algorithm, Kruskal's Algorithm and PRIM's Algorithm