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.)

    OR

    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

    AND

    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:

OPEN SUBJECT

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

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:

Every candidate must secure at least Grade P in Concurrent Evaluation as well as University Examination as separate heads of passing for each course.

Conversion of Marks to Grade Points & Grades: The marks shall be converted to grade points and grades using Table I below.

Table I: Points Grading System

Sr. No	Marks	Grade	Grade Point
1	80-100	**O : Outstanding**	**10**
2	**70-79**	**A+ : Excellent**	**9**
3	**60-69**	**A: Very Good**	**8**

4	55-59	B+ : Good	7
5	50-54	B:Above Average	6
6	45-49	C: Average	5
7	40-44	P:Pass	4
8	0-39	F:Fail	0
9		Ab : Absent	0

Reassessment of Internal Marks:

In case of those who have secured less than passing percentage of marks in internal i.e. less than 40%, the institute will administer a separate internal test. The results of which may be conveyed to the University as the Revised Internal Marks.

In case the result of the revised internal test is lower than the original marks then the original marks will prevail. In short, the rule is higher of the two figures should be considered.

However, the institute will not administer any internal test, for any subject for those candidates who have already secured 40% or more marks in the internal examination.

VIII) **Backlog:**
Candidates can keep terms for any semester of M.C.A., irrespective of the number of subjects in which he/she has failed in the previous MCA semester examinations.

(IX) **Board of Paper Setters /Examiners:**
For each Semester and examination there will be one board of Paper setters and examiners for every course. While appointing paper setter /examiners, care should be taken to see that there is at least one person specialized in each unit course.

(x) Class:

The performance of a student will be evaluated in terms of two indices, viz.
   a) *Semester Grade Point Average (SGPA)* which is the Grade Point Average for a semester
   b) *Cumulative Grade Point Average (CGPA)* which is the Grade Point Average for all the completed semesters at any point in time.

Semester Grade Point Average (SGPA): At the end of each semester, SGPA is calculated as the weighted average of GPI of all courses in the current semester in which the student has passed, the weights being the credit values of respective courses.

SGPA = Grade Points divided by the summation of Credits of all Courses.

$$SGPA = \frac{\sum \{C * GPI\}}{\sum C} \text{ for a semester.}$$

Where GPI is the Grade and C is credit for the respective Course.

Cumulative Grade Point Average (CGPA): Cumulative Grade Point Average (CGPA) is the grade point average for all completed semesters. CGPA is calculated as the weighted average of all GPI of all courses in which the student has passed up to the current semester.

Cumulative Grade Point Average (CGPA) for the Entire Course

$$SGPA = \frac{\sum \{C * GPI\}}{\sum C} \quad \text{for all semesters taken together.}$$

Where GPI is the Grade and C is credit for the respective Course.

IMPORTANT NOTE:
If a student secures F grade in either or both of Concurrent Evaluation or University Evaluation for a particular course his /her credits earned for that course shall be ZERO.

Award of Grade Cards: The University of Pune under its seal shall issue to the learners a grade card on completion of each semester. The final Grade Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme for obtaining the degree.

Final Grades: After calculating the SGPA for an individual semester and the CGPA for entire programme, the value shall be matched with the grade in the Grade Points & Descriptors Table as per the Points Grading System and expressed as a single designated GRADE (as per Table II)

Table II: Grade Points & Descriptors

O: Outstanding	**Excellent analysis of the topic, (80% and above)** *Accurate knowledge of the primary material, wide range of reading, logical development of ideas, originality in approaching the subject, Neat and systematic organization of content, elegant and lucid style;*
A+ : Excellent	**Excellent analysis of the topic (70 to 79%)** *Accurate knowledge of the primary material, acquaintance with seminal publications, logical development of ideas, Neat and systematic organization of content, effective and clear expression;*
A: Very Good	**Good analysis and treatment of the topic (60 to 69%)** *Almost accurate knowledge of the primary material, acquaintance with seminal publications, logical development of ideas, Fair and systematic organization of content, effective and clear expression;*
B+: Good	**Good analysis and treatment of the topic (55to 59%)** *Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, effective and clear expression;*
B: Above Average	Some important points covered **(50to 54%)**

	Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, good language or expression;
C: Average	Some points discussed **(45 to 49%)** Basic knowledge of the primary material, some organization, acceptable language or expression;
P: Pass	Any two of the above **(40 to 44%)**
F: Fail	None of the above **(0 to 39%)**

A student who secures grade P or above in a course is said to have completed /earned the credits assigned to the course. A student who completed the minimum credits required for the MBA programme shall be declared to have completed the programme.

NOTE:

The Grade Card for the final semester shall indicate the following, amongst other details:

a)   Grades for concurrent and university evaluation, separately, for all courses offered by the student during the entire programme along with the grade for the total score.
b)   SGPA for each semester.
c)   CGPA for final semester.
d)   Total Marks Scored out of Maximum Marks for the entire programme, with break-up of Marks Scored in Concurrent Evaluation and University Evaluation.
e)   Marks scored shall not be recorded on the Grade Card for intermediate semesters.
f)   The grade card shall also show the 10-point scale and the formula to convert GPI, SGPA, and/or CGPA to percent marks.

(XI)   Medium of Instruction:
The medium of Instruction will be English.

(XII)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.

(XIII)   Revision of Syllabus:

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

(XIV)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.*

(XV)ATKT Rules:

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

(XVI)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:		
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

Tutorials should be taken based on following topics

1. Case studies for writing SRS
2. Examples on Use case diagram
3. Examples on Class diagram
4. Examples on Object diagram
5. Examples on Sequence diagram
6. Examples on Collaboration diagram
7. Examples on designing input/output screen layout

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	15	10

	3.2..3 ODL,OQL
	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	% Weightage	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	20	12

	● Drawing Straight Lines ● Drawing Circles Or Arcs ● Drawing Text ● Drawing Images 1.9 Understanding Transforms ● Translation ● 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	25	15

	4.2 Retrieving Page Content ● Using selectors ● Using filters ● Child,visibility, and content filters in jquery 4.3 Manipulating Page Content ● 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

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 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 | 37.5 | 20 |
| 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, **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	15	10
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 **3.3** Types of Decision, decision making processes & Tools **3.4** Individual Vs Group decision making	10	5

	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	10	4

9.2 Personality Theories -Personality and Organisation **9.3** Personality Structure -Personality and Behavior **9.4** Ego State, Johari window- Transactional Analysis	

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

Subject Code: IT-31
Subject: Java Programming

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:
- Object oriented concepts, Programming structures.

Course Objectives:
- To enable the students to understand the core principles of the Java Language and use AWT/Swing tools to produce well designed, effective applications.
- Students will be able to do socket programming, develop server side applications with database handling using Servlets, JSP, and JDBC

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Understand Basic Concepts of Java and multi-threading.-Understand

CO2: Demonstrate Collection framework -Apply

CO3: Develop GUI using AWT and Swing -Apply

CO4: Develop Java Applications using Socket, RMI –Apply

CO5: Develop Web application using JSP and Servlet, JDBC with MVC --Apply

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Revision of core concepts in Java.** OOPs concepts in Java. Arrays and Strings in Java. Java Input & Output Operations. Nested and Inner classes. Interface, Package & Exception Handling.	17	10
2	**Multithreading using Java.** Concepts of Multithreading. Thread Life cycle. Main thread, thread properties, Runnable interface and Thread class.	8	5

	Thread Synchronization & Inter thread communication		
3	**Collection Framework.** Collection framework overview. Collection Interface, Classes and Iterator. Collection, Set, Sorted Set& List interface. ArrayList, LinkedList, HashSet, TreeSet classes. Map and SortedMap Interface. HashMap, and TreeMap Classes. Legacy Classes: Vector, Stack, Hash Table	12	7
4	**GUI Programming Concepts** AWT and Swing Component Classes. Layout Managers: Border, Flow, Grid, Card. Event Delegation Model: Event Source, Event Class, Event Listener Interface, Anonymous class, Adapter classes	10	6
5	**Java Database Connectivity (JDBC).** JDBC Architecture, JDBC API. JDBC Drivers. Steps to create JDBC application. Types of Statement: Statement, Prepared Statement, & Callable Statement. Types of Result Set: Scrollable & Updatable CRUD operations using JDBC. Connection pooling	13	8
6	**Java Network Programming & RMI.** Introduction: Socket, Port, Proxy Server TCP & UDP Java Networking Classes. Develop TCP based and UDP based Java Application. RMI Architecture: stub and skeleton. Marshalling and Unmarshalling Develop RMI application.	8	5
7	**Web Application Development using Java.** Servlet:	22	13

	Servlet Life Cycle. Types of Servlet: Generic Servlet, HTTP Servlet. Handling GET and POST method through Servlet. Handling and configuring web.xml file. Session Tracking in Servlet. Servlet with JDBC. JSP: JSP Directives, Actions, and scripting elements. Default objects in JSP. Session Management in JSP. JSP with JDBC.		
8	**MVC Architecture using Java.** Concept of MVC architecture. Model – View – Controller Classes. Basics of Java Beans. Writing application using MVC architecture (JSP – Servlet – Beans – Database application).	10	6
	Total:	100	60

Recommended Course References:

1. Java Complete Reference Herbert Schildt, TMH.
2. The Complete Reference JSP, Phil Hanna, TMH
3. JDBC, Servlet and JSP, Black Book, Santosh Kumar K. Dremtech publication
4. Head First Servlets and JSP, 2nd Edition by Bert Bates, Bryan Basham, Kathy Sierra
5. OCJP Oracle Certified Programmer for Java Study Guide by Kathy Sierra and Bert Bates.
6. A Programmer's Guide to Java OCJP Certification (A Comprehensive Primer) by Khalid A. Mughal and Rolf W. Rasmussen.

Recommended Website References:

1. www.javatpoint.com
2. www.oracle.com
3. www.tutorialspoint.com/java
4. www.geeksforgeeks.org/java

Course Requirements:

1. Eclipse
2. JDK 1.8.

<h1 style="color:red; text-align:center">Subject Code: IT-32
Subject: Data Warehouse and Data Mining</h1>

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:
- Basic concepts of Database / RDBMS
- Basic knowledge of statistics and data structure.

Course Objectives:
- To Study data warehouse architectures, OLAP and the project planning aspects in building a data warehouse
- To introduce the concepts, techniques, design and applications of data warehousing and data mining.
- To enable students to understand and implement classical algorithms in data mining
- To understand the various approaches to data warehousing and data mining implementations
- To understand how to analyze the data, identify the problems, and choose the relevant algorithms to apply

Course Outcome with Blooms taxonomy :
Student will be able to

CO1: learn and understand techniques of preprocessing various kinds of data -Understand

CO2: Understand Data warehouse concepts. - Understand

CO3: Apply association Mining Techniques on large Data Sets. - Apply

CO4: Apply classification and clustering Techniques on large Data Sets. - Analyze

CO5: Understand other approaches of Data mining techniques. - Understand

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Know your Data & Data Pre-processing:**	15	6

	Data Objects, attribute types, descriptions of data, Measuring Data similarity and dissimilarity			
	Data Pre-processing: Data Quality, major task in preprocessing, Data cleaning: Missing values, Noisy Data, Data Cleaning as a process			
	Data Integration: Entity identification problem, Redundancy – correlation analysis, Tuple duplications, Data value conflict detection & resolution			
	Data reduction: Data reduction strategies, wavelet transforms, principle component analysis, Linear Regression- log-linear Regression models, discriminant analysis and logistic regression			
	Data Transformation & Data Discretization			
2	**Data Warehousing & Online Analytical Processing:** Introduction to data warehousing, Need of Data warehouse(DW), Operational database versus DW Data warehouse life cycle, building a Data Warehouse, Data Warehousing Components, Data Warehousing Architecture, DW Models Extraction, Transformation & Loading, Metadata Repository, feature selection & creation Multi-Dimensional data Modeling: Star schema, snowflake schema & fact constellation schema, On Line Analytical Processing, Categorization of OLAP Tools, Data cubes & Operations on cubes Design and usage of Data Warehouse (at least one system diagram)	15	8
3	**Association Mining Rules basic concepts, Algorithms:** Data mining versus Knowledge Discovery process, Introduction to machine learning and data mining techniques, Data Mining issues and challenges. Why Association Mining is necessary, Pros and Cons of Association Rules Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets - Apriori Algorithm Alternative methods for generating Frequent Item sets, FP Growth Algorithm	20	6

	Extracting best possible rules on real data set and Evaluation of Association Patterns		
4	**Classification and Prediction:** Basics, General approach to solve classification problem, Classification by Decision Tree Induction Bayesian Classification, Rule-Based Classification, k-Nearest-Neighbor Classifiers(Lazy Learners), – Prediction - Classifier accuracy Classification by Back propagation-Artificial Neural Network – Support Vector Machines – Associative Classification – Performing classification and evaluating the efficient model - a case study.	20	8
5	**Clustering Techniques:** Overview, Features of cluster analysis, Types of Data and Computing Distance Categorization of Major Clustering Methods: Partitioning Methods, Hierarchical Methods, Density-Based Methods, K-means algorithm , Quality and Validity of Cluster Analysis, Outlier Analysis A case study on finding efficient Clusters on set of documents data / a case study on real data set.	20	6
6	**Other Approaches of data mining and Data Mining applications:** Discovery of sequential patterns, Discovery of patterns in time series Bayesian Network, Genetic Algorithms , Rough set & Fuzzy Set approach Text mining-NLP, Web Mining Temporal and Spatial Data Mining Data mining Trends and Business Intelligence(BI) applications	10	6

Data-visualization: Dashboard-KPI, BI and Analytics tools			
Total:		100	40

Recommended Reference Books:

- Data Warehousing Fundamentals: A Comprehensive Guide for IT professionals, by Paulraj Poonniah, Latest Edition, WILEY INDIA
- Building the Data Warehouse, 3rd edition by W. H. Inmon WILEY INDIA
- Data Mining concepts and Techniques by Jiawei Han, MichelineKambler –Elsevier.
- Data Mining practical Machine Learning Tools and Techniques by Ian H. Witten Eibe Frank Mark Hall - Elsevier publication
- Introduction to Data Mining with Case Studies by G. K. Gupta, Prentice Hall of India.
- Data Mining: Introductory and Advanced Topics, by Margaret Dunham, Pearson Education
- Data Mining by Arun K. Pujari – University Press.
- Data Mining for Business Intelligence by GalitShmuel, Nitin Patel, WILEY INTERSCIENCE.

Recommended Website References:

- www.ibm.com/in/en/
- www.pentaho.com/
- www.jaspersoft.com/
- www.amazon.com/Data-Mining-Business-Intelligence-Applications
- www.ibm.com/insights/in
- www.sas.com
- Weka– Data Mining with Open Source Machine Learning Software, www.cs.waikato.ac.nz/ml/weka.
- https://cloud.google.com/bigquery/
- https://www.rstudio.com/
- https://aws.amazon.com/redshift/
- www.Kaagal.com

Course Requirements:

- ETL Tools : Pentaho Kettle / Talend-Open Studio / Apache Kafka / Informatica Power Center
- BI and Analytics tools : Python – Pandas / XL-Miner / R-Studio / Rapid-Miner Studio / Tableau / Power-B

Subject Code: IT-33
Subject: Software Testing and Quality Assurance

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:
- Basic understanding of programming language and database concepts.
- Basic knowledge of software engineering and project life cycle.

Course Objectives:
- *To understand the principles of software development emphasizing processes and activities of quality assurance*
- *To study fundamental concepts in software testing, including software testing objectives, process, strategies and methods.*
- *To understand test design techniques based on functionality and structure of software*
- *To understand test planning, monitoring and control process*
- *To gain the techniques and skills on how to use software testing tools to support software testing activities*

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Understand the role of software quality assurance in contributing to the efficient delivery of software solutions –Understand

CO2: Demonstrate specific software tests with well-defined objectives and targets – Apply

CO3: Apply the software testing techniques in commercial environments –Apply

CO4: Construct test strategies and plans for software testing –Analyze

CO5: Understand the usage of software testing tools for test effectiveness, efficiency and coverage – Understand

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Software Quality Assurance Fundamentals:** Definition of Quality, Quality Assurance, Quality Control, Difference between QA and QC, Software Quality Assurance, SQA Planning & Standards SQA Activities Building Blocks of SQA Software Quality factors Software Quality Metrics: Process Metrics & Product Metrics Software Reliability & Reliability Measurement Factors: ROCOF, MTTF, MTTR, MTBF, POFOD, Availability	20	12
2	**Software Testing Fundamentals:** Definition & Objectives of Testing Role of testing and its effect on quality Causes of software failure: Definition of -Error, Bug, Fault , Defect and Failure Seven Testing Principles Software Testing Life cycle Validation & Verification Concepts V Model and W Model Agile Testing- Test Driven Software Development Levels of Testing- Unit (Component) Testing Integration Testing System Testing User Acceptance Testing (UAT) Test Types Functional testing (Black-box)	17	10

	Non-functional testing(Testing of software product characteristics) Structural testing (White-box) Testing related to changes - Confirmation (Re-testing) and Regression Testing Non-Functional Testing Types – Performance(Load & Stress) Usability Maintainability Portability Localization & Internationalization Concept of Smoke testing and Sanity Testing		
3	**Static Testing:** Static Techniques – Review Review Process (Informal & Formal) Desk Checking, Technical or Peer Review Walkthrough Inspection Static Techniques – Static Analysis Data flow analysis Control flow analysis, Static Analysis by Tools (Automated Static Analysis) **Case Study on Preparation of Inspection Checklist**	8	6

4	**Dynamic Testing:**	15	8
	Test Design Techniques-Black Box Testing Techniques:		
	Equivalence Partitioning		
	Boundary Value Analysis		
	Decision Table Testing		
	State Transition Testing		
	Test Design Techniques -White Box Testing Techniques (coverage based and fault-based)		
	Statement coverage		
	Branch & Decision coverage		
	Path coverage		
	McCabe's Cyclomatic Complexity Metric(Computation of Cyclomatic Complexity to be covered)		
	Data Flow based Testing		
	Mutation Testing		
	Test Design Techniques -Experience based techniques:		
	Error Guessing		
	Exploratory Testing		
	Problems based on Black Box and White Box Testing Techniques to be covered		

5	**Test Management:**	25	16
	Test Organization- Roles & Skills of Tester, Test Lead, Test Manager		
	Test Planning- Test Plan as per IEEE 829 STANDARD		
	TEST PLAN TEMPLATE		
	Test Process Monitoring & Control		
	Test Monitoring through -Test Log (IEEE 829: TEST LOG TEMPLATE to be discussed) and Defect Density		
	Reporting Test Status (IEEE 829: TEST SUMMARY REPORT TEMPLATE to be discussed)		
	Test Control		
	Requirement Traceability Matrix, Test Scenario, Test Suite, Test Cases(both Positive & Negative Test Cases, as per IEEE 829: TEST CASE SPECIFICATION TEMPLATE)		
	Configuration Management- Configuration Management support for Testing		
	Risk and Testing- Project Risk & Product Risk		
	Incident/ Defect Management		
	Defect Life Cycle		
	Defect/ Incident Report (IEEE 829 : TEST INCIDENT REPORT TEMPLATE to be discussed)		
	Case Study on Test Plan for applications		
	Case study on Test Cases for different features within applications		
6	**Tool Support for Testing:**	15	8
	Types of Test tools –CAST (only type & their purpose should be covered)		
	Effective Use of Tools: Potential Benefits and Risks		
	Introduction of a tool into an organization		
	Introduction to testing tools		
	Selenium (Load and Stress, Connection time, FTP authentication for 100 concurrent users and up to 1MB		
	RAM and 2TB HDD)		

		Total:	100	60
	Appium (OS compatibility, Visual testing, Load and Stress, Language support)			

Course References:

Recommended Texts Books:

- Foundations of Software Testing by Rex black, Erik Van Veenendaal, Dorothy Graham (2012)-Cengage Learning: London UK, 3rd Edition
- Software Engineering by Sommerville-Pearson,8thEdition
- Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, 2012. 2.
- Effective Methods for Software Testing by William Perry- Wiley Pub, 3rd Edition
- Recommended Reference Books:

Recommended Reference Books:

- Roger S. Pressman, "Software Engineering-A Practitioner's Approach", McGraw Hill pub.2010
- Software Testing in Real World Edward Kit- Pearson Pub
- Software Testing Techniques by Boris Beizer-DreamTech Pub,2nd Edition
- Software Testing by Ron Patton, TechMedia Pub.
- Introducing Software by Testing Louise Tamres
- Fundamentals of Software Engineering –Rajib Mall, 3rd Edition
- Allen Gilles "Software quality: Theory and management", International Thomson, Computer press 1997.
- Software Testing Principles Techniques and Tools by Milind.G. Limaye- Tata Mcgraw Hill Pub.
- Stephen H. Kan, "Metrics and models in software quality Engineering", Addison –Wesley 2003

Recommended Web Sites:

- https://www.istqb.org
- https://www.guru99.com/software-testing.html
- https://www.guru99.com/selenium-tutorial.html
- https://www.guru99.com/mobile-testing.html
- http://professionalqa.com

Subject Code: IT-34
Subject: Cloud Computing

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:

- Basic computer networking.

Course Objectives:

- *To introduce the fundamentals of cloud computing, its technologies, Challenges and Applications*
- *To give Insights into the virtualization technologies and Architecture.*
- *To know the relationship between Cloud and SOA.*
- *To classify and evaluate Cloud Security Issues.*
- *To apply theory to practical knowledge through case Studies.*

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Describe the concepts of Cloud Computing and its Service Models & Deployment Models – Understand.

CO2: Classify the types of Virtualization – Understand.

CO3: Describe the Cloud Management and relate Cloud to SOA – Understand.

CO4: Interpret Moving application s to of Cloud – Apply.

CO5: Demonstrate practical implementation of Cloud computing – Apply.

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Fundamentals Of Cloud Computing:** Overview of Cloud Computing. History of Cloud Computing. Cloud Computing (NIST) Model. Cloud Stakeholders -Cloud providers, Cloud Users& End Users. Characteristics of Cloud Computing. Benefits and Limitations. Challenge and Applications of Cloud Computing. Cloud Computing vs. Cluster Computing V/S. Grid Computing	15	8
2	**Cloud Service Models:** Introduction to Cloud Service Models SAAS characteristics ,benefits and Applications PAAS characteristics , benefits and Applications IAAS characteristics ,benefits and Applications XAAS- Anything as a Service – Storage as a service, Network as a Service, Database as a Service etc. Comparison of SAAS,PASS and IAAS Cloud Deployment Models-Public, Private, Hybrid Cloud Platforms : Google Cloud Platform, Microsoft Azure, Sales Force, AWS.	20	12
3	**Virtualization:** Introduction to Virtualization Characteristics of Virtualized Environments Types of Virtualization: Server, Storage and Network Machine Image, Virtual Machine(VM), VMware Pros and Cons of Virtualization Hypervisor - Types Technology Examples Xen: Par virtualization VMware: Full Virtualization Microsoft Hyper-V	15	10

4	**SOA & Cloud Management:** Definition of Service Oriented Architecture Basic concepts of SOA Web Services : SOAP and REST Relating SOA and Cloud Computing. Cloud Governance Cloud Availability & Disaster Recovery Pricing Model: Usage Reporting, billing and metering (AWS)[Service Level Agreement]	15	10
5	**Moving Applications to the Cloud:** Applications in the Clouds Cloud Service Attributes Cloud Bursting. Data Migration in Cloud Quality of Services in cloud Computing Cloud APIs	15	8
6	**Cloud Security & Implementation of Cloud:** Cloud Security Fundamentals Cloud Security Architecture Identity Management and Access control Cloud Computing Security Challenges Privacy and Security in Cloud Demonstrate the commercial cloud computing Infrastructures Introduction to Docker Container Case Study's based on Cloud Computing Concepts.	20	12
	Total:	100	60

Recommended Reference Books:
1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt..Ltd,
2. Cloud Computing: Automating the Virtualized Data Center
3. Cloud Computing by Dr. Kumar Saurabh, Wiley –India
4. Cloud computing: A practical approach, Anthony T. Velte, Tata McGraw-Hill
5. Cloud Computing Concepts, Technology & Architecture Thomas Erl,, Zaigham Mahmoud, and Ricardo Puttin
6. Mastering Cloud Computing by Raj Kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited,
7. Cloud Computing Web –Based Applications that change the way you work and Collaborate Online by Michael Miller, Pearson

8. Cloud Computing for Dummies by Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper

Recommended Web Sites:
- **http://www.cloudcomputingpatterns.org/**
- **http://whatiscloud.com**
- **www.w3schools.com**

Subject Code: MT31
Subject: Probability & Combinatorics

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:
- Discrete mathematics

Course Objectives:
- *Count similar things in sophisticated ways*
- *Understand the mathematical underpinnings of probability.*
- *Use probability theory to solve interesting problems.*

Course Outcome with Blooms taxonomy :
Student will be able to

CO1: Apply counting principles to solve the problems –Apply

CO2: Apply various mathematical tools to solve problems. –Apply

CO3: Understand and apply basic probability principles. –Apply

CO4: Demonstrate the concept of univariate and bivariate random variable – Apply

CO5: Understand and illustrate the probability distributions.-Analyze

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Counting Principles:** Addition and Multiplication Principles Permutations of n Objects with and without repetition, Circular Permutation Combinations of n Objects with and without repetition Combinatorial identities (Using Arguments only)	15	10

2	**Principle Of Inclusion And Exclusion:** Principle of Inclusion and Exclusion theorems and applications Derangements (Nothing in its right place) theorems and applications Integer solutions to linear equations (Non-negative and Positive) Multinomial theorems and applications	15	10
3	**Introduction To Probability:** Trials, Events, Sample Space – Types and Examples Mathematical Probability, Axioms of Probability, Some elementary theorems in probability Independent and Dependent Events Conditional probability and its application Bayes' Theorem and its application	20	12
4	**Random Variables And Mathematical Expectation:** Random Variable – Discrete and Continuous Probability Distribution of a Random Variable, Probability, Mass Function, Probability Density Function, Distribution Functions Mathematical Expectation of Probability Distribution, Theorems, Calculation of Mean and Variance using Mathematical Expectation Concept of Bivariate Random Variable, Discrete and Continuous Bivariate Random Variables (Numerical on above topics)	20	13
5	**Special Discrete Probability Distributions:** Bernoulli's Distribution- Derive Mean, Variance, MGF and CGF Binomial Distribution - Derive Mean, Variance, MGF and CGF Poisson Distribution - Derive Mean, Variance, MGF and CGF Numericals on these distributions Derivation of Poisson distribution as a limiting	15	10

	Condition of binomial distribution.		
6	**Special Continuous Probability Distributions:** Uniform Distribution Exponential Distribution Normal Distribution Numericals on above Distributions (finding mean and variance)	15	5
	Total:	100	60

Course References:

Recommended Reference Books:

1. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor
2. Probability and Combinatorics : D. P. Apte
3. Statistical Methods by P. N. Arora , Sumeet Arora and S. Arora
4. Probability & Random Process by T. Veerarajan
5. Statistical Methods by S. P. Gupta

Credit Scheme	Evaluation Scheme		
Credit	Internal	External	Total
2	50	-	50

Course Description:

Course Objectives:

- To enable students to develop a dynamic web application using knowledge of Servlet, JSP, JDBC using MVC.

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Create Web application using JSP and Servlet, JDBC with MVC

SEMESTER IV

Subject Code: IT-41
Subject: Python Programming

Credit Scheme			Evaluation Scheme		
Lecture	Practical	Credit	Internal	External	Total
60	-	4	30	70	100

Course Description:

Prerequisite:
- Object oriented Concepts, Basic programming constructs.

Course Objectives:
- To understand and use the basic of python.
- To understand advance concepts of python and able to apply it for solving the complex problems.
- To understand the reading and writing data through file handling.
- To understand basic database concepts in python.
- To develop the critical thinking and analytical approach by using python libraries.

Course Outcome with Blooms taxonomy :
Student will be able to

CO1: Understand concepts of python.-Understand

CO2: Demonstrate the concepts modular programming -Apply

CO3: Apply the concepts of concurrency control in python -Apply

CO4: Solve the real life problems using object oriented concepts and python libraries –Apply

CO5: Demonstrate the concept of IO, Exception Handling, database --Apply

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Introduction & Components of Python:** Understanding Python Role of Python in AI and Data science Installation and Working with Python Types and Operation Python Object Types-Number, Strings, Lists, Dictionaries, Tuples, Files, User Defined Classes Understanding python blocks Python Program Flow Control Conditional blocks using if, else and elif Simple for loops in python For loop using ranges, string, list and dictionaries Use of while loops in python Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block	15	9
2	**Python Functions, Modules & Packages:** Function Basics-Scope, nested function, non-local statements Arguments Passing, Anonymous Function: lambda Decorators and Generators Module basic usage, namespaces, reloading modules. Package: import basics Python namespace packages	20	12

3	**Python Object Oriented Programming:**	15	9
	Concept of class, object and instances, method call		
	Constructor, class attributes and destructors		
	Real time use of class in live projects		
	Inheritance, super class and overloading operators,		
	Static and class methods		
	Adding and retrieving dynamic attributes of classes		
	Programming using OOPS		
4	**Python Regular Expression:**	10	6
	Powerful pattern matching and searching		
	Power of pattern searching using regex in python		
	Real time parsing of data using regex		
	Password, email, url validation using regular expression		
	Pattern finding programs using regular expression		
5	**Python Multithreading and Exception Handling:**	10	6
	Exception Handling		
	Avoiding code break using exception handling		
	Safe guarding file operation using exception handling		
	Handling and helping developer with error code		
	Programming using Exception handling		
	Multithreading		
	Understanding threads		
	Synchronizing the threads		
	Programming using multithreading		
6	**Python File Operation:**	5	3
	Reading config files in python		
	Writing log files in python		
	Understanding read functions, read(), readline() and readlines()		
	Understanding write		

	functions, write() and writelines()		
	Manipulating file pointer using seek		
	Programming using file operations		
7	**Python Database Interaction:**	5	3
	SQL Database connection using python		
	Creating and searching tables		
	Reading and storing config information on database		
	Programming using database connections		
8	**Python For Data Analysis:**	20	12
	Numpy:		
	Introduction to numpy		
	Creating arrays, Using arrays and Scalars		
	Indexing Arrays, Array Transposition		
	Universal Array Function		
	Array Input and Output		
	Pandas:		
	What is pandas? Where it is used?		
	Series in pandas, pandas DataFrames, Index objects, ReIndex		
	Drop Entry, Selecting Entries		
	Data Alignment, Rank and Sort		
	Summary Statics, Missing Data, Index Hierarchy		
	Matplotlib:		
	Python for Data Visualization		
	Introduction to Matplotlib		
	Visualization Tools		
Total:		100	60

Recommended Course References:

- Java Complete Reference Herbert Schildt, TMH.
- The Complete Reference JSP, Phil Hanna, TMH
- Learning Python 5th ed. by Mark Lutz
- Python: The Complete Reference by Martin C. Brown
- Python Data Analytics: With Pandas, NumPy, and Matplotlib 2nd ed. Edition by Fabio Nelli
- Core Python Programming by Wesley J. Chun Publisher: Prentice Hall
- Python Programming: A modular approach by Taneja Sheetal , Kumar Naveen
- Beginner's Guide to Python Programming: Learn Python 3 Fundamentals, Plotting and Tkinter GUI Development Easily by Serhan Yamacli
- Programming Python, Oreilly, by Mark Lutz
- Learning Python, Oreilly, Mark Lutz
- Head First Python, Oreilly, By Paul Barry

Subject Code: BM-41
Subject: Information System and Security Audit.

Credit Scheme			Evaluation Scheme		
Lecture	Practical	Credit	Internal	External	Total
60	-	4	30	70	100

Course Description:

Prerequisite:
- Concepts of computer fundamentals and networking technologies.
- Basic knowledge of database concepts.

Course Objectives:
- To understand and use the basic of python.
- To understand advance concepts of python and able to apply it for solving the complex problems.
- To understand the values of information, threats and vulnerabilities to IT system.
- To study fundamental concepts of CIA of information and information security life cycle.
- To study the information security polices and standards.
- To understand the necessity of information security controls for IT system.
- To gain the understanding of information security audit and IT governance frameworks for information security.

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Interpret the threats and vulnerabilities from IT system of business software applications. - Apply

CO2: Understand Information Security Management System (ISMS) for IT system of business -Understand

CO3: Apply information security policies and standards for business IT System-Apply

CO4: Discuss various IS controls for Business Continuity and Disaster Recovery of business IT system. -Understand

CO5: Describe information security audit and understand information security IT governance framework. – Understand

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Overview of Information Security System:** Basic concept and need of Information Security Classification of Information and Characteristics of Information System. Threats to information system Classification of threats and Vulnerabilities Cybercrimes and attacks. Introduction to Indian IT Act 2000. Case study discussion & identification on threats, vulnerabilities and attacks	15	8
2	**Information Security Management System:** Information Security Life Cycle Risks to Information System The 3 pillar's (CIA) of Information Security (Confidentiality, Integrity, Availability) Components of ISMS and conceptual Framework Steps for developing ISMS ISMS Risk analysis and risk management	15	8
3	**Information Security Policy and Standards:** A structure and framework of security policy Introduction to Information Security Policy, Standards, Procedures, Policy infrastructure Policy Design Life Cycle PDCA Concept Types of Information security policies Security standards- ISO 27001, ISACA-1401. Case Study on Policy writing (Based on Types)	20	14

4	**Information Security Controls:** Introduction to information security controls and needs of IS Controls. Types of IS controls – Based on security Incident and Nature Other types of Control- database, network, Internet access, digital signature Algorithm- RSA, AES Business Continuity Plan and Disaster Recovery Plan (Evidence Collection techniques)	15	8
5	**Information Security Audit:** Introduction to IS Audit Need for Security audits in organizations Responsibilities and functions of IS Auditor IS audit process Types of Audits and approaches to Audits Technology based Audits – vulnerability scanning and penetration testing Key success factors for Security Audits	15	8
6	**Information Security Governance:** Introduction to IT Governance & Good Governance. Objectives and dimensions IT Governance. IT governance framework- COBIT, ITIL. IT governance maturity model. Database security challenge in the modern world. Securing mobile databases. Introduction to Ethical Hacking.	20	14
	Total:	100	60

Recommended Course References:

- Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Godbole.

- The complete reference Information Security by Mark Rhodes
- Information security Theory and practices By Dhiren R Patel
- M. Stamp, "Information Security: Principles and Practice," Wiley
- Information security policies, procedures and standards by Thomas Pettier.
- Information security Management Hand book- 5th Edition-HAROLD F. TIPTON
- Computer security by Alfred Basta, Wolf Halton
- Information security policies- Thomas R.Peltier, Peltier R. Peltier
- Electronic Signature law by L Padmavathi
- Network Security by Ankit Fadia
- Security Plus study guide by Michael Cross, Norrris Johnson
- Information systems control and Audit by Ron Weber, Pearson Pub.
- IS control journals from ISACA
- Information Security policies made easy version 10: Charles Cresson Wood
- Information Security & Audit , Everest Publishing House by Dr. Sunil Khilari.

Recommended Reference websites:

1. www.searchsecurity.techtarget.com
2. www.secure-byte.com
3. www.security-internal-audit.com
4. www.ngssecure.com/services
5. www.pcisecuritystandards.org
6. www.isaca.org

Subject Code: MT-41
Subject: Optimization Techniques.

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:

Prerequisite:
- Basic Mathematics foundation.

Course Objectives:
- To understand the role and principles of optimization techniques in business world.
- To understand the process of problem statement formulation of the business scenario.
- To understand the implementation of various decision making techniques in the process of decision making.
- To gain the techniques and skills on how to use optimization techniques to support the decision making in business world.

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Understand the role and principles of optimization techniques in business world - Understand

CO2: Demonstrate specific optimization technique for effective decision making -Apply

CO3: Apply the optimization techniques in business environments -Apply

CO4: -Illustrate and infer for the business scenario- Analyze

CO5: analyze the optimization techniques in strategic planning for optimal gain. - Analyze

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Linear Programming:** Various definitions, statements of basic theorems and properties, Advantages and Limitations, Application areas of Linear programming	15	9

	Linear Programming – Concept of Graphical method Simplex Method and Problems Two Phase Simplex Method and problems, (Case study based problems from the areas like production, transportation etc.)			
2	**Markov Chains & Simulation Techniques:** Markov chains: Applications related to technical functional areas, Steady state Probabilities and its implications, Decision making based on the inferences Monte Carlo Simulation.	10	6
3	**Sequential model and related Problems:** Processing n jobs through 2 machine Processing n jobs through 3 machine Processing n jobs through m machine	10	6
4	**Queuing Theory:** Characteristics of Queuing Models Transient and Steady states of the System Model – I [(M/M/1) : (FCFS / ∞ /∞)] Case study based problems (Cost comparison problems) Miscellaneous Problems	10	6
5	**Replacement Theory:** Replacement of items that deteriorates with time when value of money remains same when value of money changes with time Replacement of items that fails suddenly (Comparison between Individuals and Group Replacement Policy) & Miscellaneous Problems	15	9
6	**PERT & CPM:** Basic differences between PERT and CPM. Network diagram ,	15	9

	Time estimates (Forward Pass Computation , Backward Pass Computation			
	Critical Path			
	Probability of meeting scheduled date of completion,			
	Calculation on CPM network.			
	Various floats for activities			
	Event Slack			
	Calculation on PERT network.			
	Application of schedule based on cost analysis and crashing			
	Case study based problems			
7	**Game Theory:** Introduction n X m zero sum game with dominance Solution using Algebraic , Arithmetic and Matrix strategy	10	6
8	**Decision Analysis:** Introduction to Decision Analysis Types of Decision making environment Decision making under uncertainty and under risk Concept of Decision Tree Decision making with utility	15	9
	Total:	100	60

Recommended Text Books

1. Operations Research by H. A. Taha

2. Operation Research by Hira & Gupta

3. Operations Research   Theory and Application by J. K. Sharma –Mac-Millan Publication

4. Statistical and Quantative   Methods – Mr. Ranjit Chitale

Recommended Reference Books:

1. Operations Research by Kanti Swaroop, P. K. Gupta and Man Mohan

2. Operations Research by Pannerselvam

3. Operation Research by V. k. Kapoor

4. Statistical Methods – S.P.Gupta, Sultan Chand, NewDelhi

5. Introduction to Operations Research by Hiller & Lieberman, Tata Mc Graw Hill

Recommended Reference websites:

1. **www.orsi.in**
2. **www.atozoperationalresearch.com**

Recommended Journals:

- International Journal of Operations Research and Management science
- International Journal of Operations and Quantitative Management
- Indian Journal of Advance Operations Management.

<h1 style="text-align:center;color:red">Subject Code: IT-42
Subject: Essentials of Architectural Framework.</h1>

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
60	-	4	30	70	100

Course Description:
Prerequisite:
- Basic knowledge of software architecture and software frameworks.
- Basic knowledge of software engineering and object oriented programming.

Course Objectives:
- To provide the students with a critical understanding of architecture framework concepts, properties and aspects.
- To understand and differentiate Architecture Framework designs.
- To understand and analyze real time based Architecture Framework

Course Outcome with Blooms taxonomy :

Student will be able to
CO1: Understand Basics Fundamentals of Architecture and Framework. (Understand)
CO2: Understand appropriate Architecture Framework design. (Understand)
CO3: Select appropriate technical and industry specific frameworks. (Understand)
CO4: Apply the software development process (Apply)
CO5: Apply the quality of Architecture (Apply)

Course Structure:

Sr. No	Topic Details	% Weightage	No. of Sessions

1	**Introduction to Architecture**
	1.1 Overview of Architecture
	    1.1.1 Definition, Need and Characteristics
	    1.1.2 Importance of Architecture
	    1.1.3 Architecture domains
	    1.1.4 Architecture Process
	1.2 Standards and regularity requirements
	1.3 Scope of The Architecture work
	1.4 Software Architecture:
	    1.4.1 Architectural Views and Viewpoints
	    1.4.2 Architecture Patterns and Styles
	    1.4.3 Architectural Design and Design Patterns
		15	9

2	**Enterprise Architecture Frameworks**
	2.1 Overview and Domains of Enterprise Architecture
	2.2 Objectives of Enterprise Architecture
	2.3 Introduction to key Enterprise Architecture Frameworks in IT industry
	    2.3.1 The Open Group Architecture Framework (TOGAF)
	    2.3.2 ZACHMAN Framework
	    2.3.3 Control Objectives for Information and Related Technology (COBIT)
	    2.3.4 The Department of Defense Architecture Framework (DoDAF)
	    2.3.5 The Federal Enterprise Architecture Framework (FEAF)
	    2.3.6 Treasury Enterprise Architecture Framework (TEAF)
		20	12

3	**Technical &Industry Specific Frameworks**
	3.1 DevOps
	3.2 Microservices
	3.3 Services Oriented architecture
	3.4 Application Development Frameworks
	    3.4.1 Programming Language Frameworks
	    3.4.2 Frameworks for developing Web Applications
	    3.4.3 Frameworks for Android application developments
	3.5 Business Process Framework (eTOM)
	3.6 BAIN (Banking Industry Architecture Network)
	
	(Case studies should be covered)
		20	12

4	**Application Support Framework** (with example as ITIL Framework) 4.1 Applications Architecture Structure and Behavior 4.2 Design for Applications Security 4.3 Application Platform and Service Management 4.4 Application Architecture implementation 4.5 Application Architecture in operations **(Case studies should be covered)**	15	9
5	**Applicability of Frameworks** (various stages of SDLC) 5.1 Understanding the context of framework 5.2 Architecture Framework for Enterprise Transformation 5.3 Architecture Framework for Solutions Architecture 5.3.1 IT Solution Architecture for Package-Based Solutions 5.4 Architecture Function and Design Authority 5.5 Architecture Framework Roadmaps **(Case studies should be covered)**	15	9

| 6 | **Software Development Process & Quality Assurance**
  6.1 The Quality Attributes of Architecture
  6.2 The Capability Maturity Model Integration (CMMI)
  6.3 International Standard Organization (ISO)
  6.4 Six Sigma (6σ) and Lean
      6.4.1 Six Sigma (6σ)
      6.4.2 Lean
      6.4.3 Lean Six Sigma
  6.5 Projects IN Controlled Environments (PRINCE2)
  6.6 Managing Successful Programme (MSP)
  6.7 PMI - the Project Management Body of Knowledge (PMBOK)

(Case studies should be covered) | 15 | 9 |

Recommended Reference Books

1. Business Architecture: A Practical Guide by Jonathan Whelan and Graham Meaden. Gower Pub Co,2012
2. Erich Gamma, Richard Helm, Ralph Johnson, & John Vlissides Design Patterns: Elements of Reusable Object-Oriented Software, Addison Wesley.
3. Martin Fowler, Patterns of Enterprise Application Architecture, Addison Wesley
4. Marc Lankhorst. Enterprise architecture at work. Modelling, Communication and Analysis. EE series. Springer, 2009
5. The Integrated Architecture Framework Explained-Why, What, How by van'tWout, J., Waage, M., Hartman, H., Stahlecker, M., Hofman, A., 2010, Springer.
6. Software Architecture in Practice, Second Edition, by Len Bas, Paul Clements, Rick Kazman, Pearson Publication
7. Togaf, the open group architecture framework: a management guide. Zaltbommel: Van Haren. Sante, T. van., & Bent, H. van den.
8. Itil: service management implementation and operation. Boca Raton, FL: CRC Press. Shuja, A. K.
9. Lean Six Sigma. New York: McGraw-Hill Shaffie, S., &Shahbazi, S.
10. DevOps: a software architects perspective. New York: Addison-Wesley. Bass, L., Weber, I. M., & Zhu, L.
11. Pmp: project management professional study guide. Hoboken, NJ: Wiley Pub. Heldman, K., Baca, C., & Jansen, P.

Recommended Reference websites:
1. http://www.opengroup.org
2. www.itgi.org

Case Study
- Development of Model – Self Paced (Home Work). Elapsed time 1 week. Students should work in group and develop the framework assigned to their group
- Presentation – Each group will present for 45 minutes followed by 15 minutes of Q&A

Subject Code: IT-43
Subject: Knowledge Representation and Artificial Intelligence.

Credit Scheme			Evaluation Scheme		
Lecture	**Practical**	**Credit**	**Internal**	**External**	**Total**
40	-	4	30	70	100

Course Description:

Prerequisite:

- Basic Mathematics foundations.

Course Objectives:

- To gain a historical perspective of AI and its foundations.
- To become familiar with basic principles of AI toward problem solving and its methods such as Uninformed Search methods, Informed Search methods, local search algorithms and Adversarial Search.
- To create an understanding of the basic issues of knowledge representation and Propositional Logic.
- To brief about the different approaches of Planning and Learning in the field of Artificial Intelligence.
- To explore the different application fields of Artificial intelligence and their real world examples.

Course Outcome with Blooms taxonomy :

Student will be able to

CO1: Develop a basic understanding of AI building blocks presented in intelligent agents- Develop.

CO2: Choose an appropriate problem solving method and knowledge representation technique – Choose.

CO3: Apply the different Propositional Logic concepts for knowledge representation-Apply.

CO4: Analyze and understand the models for reasoning with uncertainty and different planning and learning approaches in the field of Artificial Intelligence – Analyze and understand.

CO5: Demonstrate awareness and a fundamental understanding of various applications of AI – Demonstrate.

Course Structure:

Unit No.	Topics Details	Weightage in %	No of Sessions
1	**Introduction:** Introduction to Artificial Intelligence Role of AI in daily life applications The History of AI What is Intelligence and Artificial Intelligence Different task domains of AI Programming methods Limitations of AI What is Intelligent Agents Task environment of Agents Classification of Agents Architecture of Agents	15	4
2	**Problem Solving:** Define Problems, problem spaces and search: Define the problem as a state space search, Problem characteristics Define Production systems and its characteristics **Uninformed Search Methods:** Breadth First Search (BFS), Depth First Search (DFS) , Depth Limited Search, Depth First Iterative Deepening(DFID) **Informed Search Methods:** Greedy best first Search, A* Search, Memory bounded heuristic Search. **Local Search Algorithms and Optimization Problems:** Hill climbing search Simulated annealing, Local beam search, Genetic algorithms **Adversarial Search:** Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning	20	10
3	**Knowledge representation:** Need of knowledge Representation Knowledge Representation and Mapping schemes Properties of good knowledge based system Types of knowledge Knowledge Representation issues AND-OR Graph The Wumpus World, The Propositional logic First Order Logic: Syntax and Semantic, Inference in FOL	15	5

	Forward chaining, backward Chaining		
4	**Propositional Logic:** Language Semantics and Reasoning Syntax and Truth Values, Valid Arguments and Proof Systems Rules of Inference and Natural Deduction Axiomatic Systems and Hilbert Style Proofs The Tableau Method The Resolution Refutation Method	15	6
5	**Uncertain Knowledge and Reasoning:** Uncertainty, Representing knowledge in an uncertain domain The semantics of belief network Inference in belief network	10	5
6	**Planning** The planning problem Planning with state space search Partial order planning Hierarchical planning Conditional Planning	10	3
7	**Learning:** Forms of Learning Inductive Learning Learning Decision Tree.	5	3
8	**Applications of AI:** Natural Language Processing(NLP) Expert Systems Artificial Neural Network Case study based on Market Basket Analysis	10	4
	Total:	100	40

Recommended Reference Books:

- Artificial Intelligence, 3rd Edition, Elaine Rich, Kevin Knight, S.B. Nair, Tata McGraw Hill.
- Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education
- Patrick Henry Winston , "Artificial Intelligence", Addison-Wesley, Third Edition.

- N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press.
- Deepak Khemani, "A first course in Artificial Intelligence", McGraw Hill edition, 2013.

Recommended Reference Sites:

1. https://nptel.ac.in/content/syllabus_pdf/106106140.pdf
2. https://nptel.ac.in/courses/112103280/
3. https://nptel.ac.in/courses/106105078/

Subject Code: IT-41L
Subject: Practical based on Python Programming

Credit Scheme			Evaluation Scheme		
Lecture	Practical	Credit	Internal	External	Total
-	4	4	50	-	50

Course Description:

Course Objectives:
- To understand and use the basic of python.
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.
- Performing matrix operation using numpy.
- Fetching, analysis and visualize data in different form
- To connect with database and perform insert, delete, update and view operations.
- To write programs using concurrent programming and handling exceptions
-

Course Outcome with Blooms taxonomy :
Student will be able to

CO1: Implement Python programs with conditionals and loops.(Apply)

CO2: Develop Python programs step-wise by defining functions and calling them.
(Apply)

CO3: Apply Python lists, tuples, dictionaries for representing compound data. (Apply)

CO4: Apply file handling function in Python. (Apply)

CO5: Apply NumPy, pandas, matplot modules. (Apply)

Course Structure:

Practical assignments based on all the topics should be covered.

Savitribai Phule Pune University, Pune
Faculty of Commerce and Management
Master of Computer Application (MCA)

Programme Curriculum
(2019-2022)

SEMESTER V				
Sr. No.	Course Code	Course Title	Internal	External
1	501	**Social Media & Digital Marketing**	30	70

Course Objectives:

1. To understand the concept of Social Media and Digital Marketing
2. To learn various tools of Social Media and Digital Marketing
3. To acquaint with the techniques of SEO and SEM
4. To develop a mindset to solve real world problems using digital marketing

Course Outcome:

Student will able to
CO1: Explain use of Social Media in Marketing (Understand)
CO2: Demonstrate Digital Marketing Strategy (Apply)
CO3: Summarize various tools of Social Media and Digital Marketing (Understand)
CO4: Make use of SEO techniques for websites (Apply)
CO5: Interpret SEM tools and techniques (Understand)

Sr. No	Topic Details	Reference s	% Weightag	No. of Sessions
1	**Introduction to Social media** ● Introduction to Social media ● Types of Social Media ● Roles of Social Media in Marketing ● Goals and Strategies		10	6
2	**Introduction to Digital Marketing:** ● What is digital marketing? How is it different from traditional marketing? ● ROI (Return on Investment) between Digital and traditional marketing? ● Digital Marketing and Ecommerce ● New trends in Digital Marketing		20	12

	Strategies for Digital Marketing ● SWOT analysis of business ● Media and promotion plan. ● Online Reputation Management **EXERCISE: Define a target group (working in groups)**			
3	**Tools of Social Media & Digital Marketing** ● Facebook Marketing ● Email Marketing ● Word Press blog creation ● Twitter marketing ● LinkedIn Marketing ● Google plus marketing ● Pinterest, Instagram ● Google Analytics **Exercise: Social Media Marketing plan (working in groups) analysis** **Exercise: based on social media tools-Like Making a Facebook page, Add creation, promotion tools, Email marketing plan, E-mail marketing campaign analysis**		**20**	**12**
4	**Search Engine Optimization (SEO)** **Introduction to SEO** ● <u>On page optimization.</u> o How does Search Engine work? o Bot and Spider o Keywords and different types o Keyword Density o Google Sandbox o Understanding of Page rank o Title Tags o Description Tags o Keyword Tags o Image Optimization o SEO Friendly Content Writing o Generating/Uploading robots file o Generating/Uploading Google Analytics code o Importance of Sitemap o All Redirects (Ex: 404/301/302) o Alexa Report o SEO Tools o Competitor Analysis ● <u>Off page optimization concepts</u> o Back links and its importance o Search Engine submissions o Directory submissions o Blog writing and submission o Article writing and submission o Social book-marking		**30**	**18**

	o Free Classifieds o Press Release writing and submission o Forum Posting o Really Simple Syndication Feeds **Exercise: Writing the SEO content (working in-groups)**			
5	**Search Engine Marketing**: ● Introduction to Search Engine Marketing ● Tools used for Search Engine Marketing ● PPC (Pay Per Click) /Google AdWords Tool ● Display advertising techniques ● Report generation **Exercise: Digital Marketing Budgeting**		**20**	**12**

Reference Books:

1. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
2. The Beginner's Guide to Digital Marketing (2015). Digital Marketer. Pulizzi, J. (2014) Epic Content Marketing, McGraw Hill Education.
3. Lorrie Thomas. The McGraw-Hill 36-Hour Course: Online Marketing, McGraw Hill.

Reference Links: (Suggested not restricted)

1.https://learndigital.withgoogle.com/digitalunlocked

2.https://www.ankuraggarwal.in/

3.https://dsim.in/knowledgebase/#video-tutorials

4. https://www.expertinstitute.in/digital-marketing-course.html

5. https://alison.com/courses/digital-marketing

6. https://www.wordstream.com/

Online certifications (Suggested not restricted) are available on following websites:

1. https://learndigital.withgoogle.com/digitalunlocked

2. https://swayam.gov.in/

3. https://www.udemy.com/

4. https://www.simplilearn.com/advanced-digital-marketing-certification

Sr. No	Course Code	Course Title	Internal	External
1	IT 52	**Mobile Application Development**	30	70

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: -

The students will be able to –
CO1: Understand Various Mobile Application Architectures (Understand)
CO2: Use 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)
C05: Demonstrate Hybrid Mobile App Framework. (Apply)

Sr. No.	Topic Details	% Weightage	No. of Sessions
1	**Mobile application development architectures** 1.1 Introduction to Mobile Application technologies 1.2 Android Architecture 1.3 IOS Architecture 1.4 Windows Architecture 1.5 Hybrid Architecture (Should cover all the features and necessary prerequisites)	14	5
2	**Creating Android Application** 2.1 Creating Android project 2.2 Project Structure 2.3 Activity and Activity Life Cycle 2.4 Fragment and Fragment Life Cycle 2.5 Views and View groups	20	10
3	**Interactivity Tools** 3.1 Intents and Filters 3.2 Adapters 3.3 Dialogs 3.4 Menus 3.5 Notifications	20	10
4	**Interaction with Database** 4.1 Introduction to Database (SQLite and Firebase)	16	10

	4.2 Cursors and content values 4.3 CURD Operations			
5	**Web Services and Web View** 5.1 Introduction to web services 5.2 Receiving HTTP Response (JSON, XML) 5.3 Parsing JSON and XML 5.4 Introduction to Web View	12	10
6	**React Native** 6.1 Introduction 6.2 Environment Setup 6.3 JavaScript ES6 Overview 6.4 Create React Native App 6.5 React Native Alert API 6.6 React Native Geolocation API 6.7 Third Party Libraries	10	10
7	**Introduction Flutter** 7.1 Overview of Flutter 7.2 Installation of Flutter 7.3 Architecture of Flutter 7.4 Introduction to Dart Programming 7.5 Demonstration of Simple application	8	5

Guidelines:
- Course must be taught in laboratory only.

Web References:
- https://developer.android.com
- https://facebook.github.io/react-native/docs/tutorial
- https://flutter.dev/docs/get-started/install

Sr. No.	Course Code	Course Title	Internal	External
1	IT 53	Software Project Management	30	70

Course Objective:
1. To learn process of Software Project Management.
2. To Study role of Project Manager in Project Management.
3. To learn Agile Project Management Framework.
4. To study various role of Agile Team and Tools.
5. To understand project planning and estimation.

Course Outcomes: Student will able to:
CO1: Understand the process of Software Project Management Framework and Apply estimation techniques. (Understand)
CO2: Learn the philosophy, principles and lifecycle of an Agile project. (Understand)
CO3: Demonstrate Agile Teams and Tools. (Apply)
CO4: Apply Agile project constraints and trade-offs for estimating project size and schedule (Apply)
CO5: Explain Project Tracking and Interpretation of Progress Report. (Understand)

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**1.0 Linear Project Management Framework** 1.1 Overview of project Management 1.2 Project management life cycle 1.3 Project Management Process 1.4 Role of Project Manager 1.5 Risk Management Process (Case Based)	15	10
2	**2.0 Linear Software Project Estimation** 2.1Different methods of Cost estimation 2.1.1 Introduction to COCOMO model 2.1.2 Delphi cost estimation 2.1.3 Function point analysis. 2.2 The SEI Capability Maturity Model CMM 2.3 Estimation with MS Project	20	12
3	**3. Agile Project Management Framework** 3.1 Introduction and Definition Agile, Agile Project Life Cycle 3.2 Agile Manifesto: History of Agile and Agile Principles 3.3 Key Agile Concepts: 3.3.1 User stories, Story points 3.3.2 Product Backlog 3.3.3 Sprint Backlog, 3.3.4 Sprint, Velocity 3.3.5 Swim lanes 3.3.6 Minimum Viable Product (MVP) 3.3.7 Version and Release 3.4 Defect Management Process 3.5 Agile Project Management v/s Traditional Project Management	15	8

4	**4. Agile Teams and Tools**
	4.1 Dynamic System Development Method
	4.2 Value-Driven Development
	4.3 Team and roles of an Agile Team
	    4.3.1 Scrum Master
	    4.3.2 Product Owner
	    4.3.3 Development Team
	4.4 Agile Tools
	    4.4.1 Burndown chart
	    4.4.2 Kanban/Agile Board
	    4.4.3 Sticky Notes
	    4.4.4 Other (e.g. JIRA)
		15	8

5	**5.Estimating Agile Project Size and Schedule** 5.1 Product Vision and Product Roadmap 5.2 Project Objective and Key Metrics 5.3 Introduction to User Stories 5.4 Estimate the Product Backlog 5.5 Techniques for estimating Story Points 5.6 Plan Product Releases 5.7 Product Prioritization **5.8 CASE STUDY** (Designing Product Vision, Product Backlog, Sprint Backlog, Estimate Story Points using Technique.)	20	12

6	**6.Tracking Agile Project and Reports**
	6.1Introduction
	6.2 Plan and Execute Iteration
	6.3 Facilitate Retrospective, Making Team Decisions and Closing out Retrospective
	6.4 Agile Reports
	    6.4.1 Daily Reports
	    6.4.2 Sprint Burndown Chart and Reports
	6.5 Benefits of Agile Project Management
		15	10

	Reference Books:
	1. Software engineering principles and practice, McGraw-Hill, Waman S. Javadekar
	2. Software Engineering by Pressman
	3. Agile Project Management for Dummies, 2nd Edition
	Mark C. Layton, Steven J. Ostermiller
	4. Agile Estimating and Planning by Mike Cohn Robert C Martin Series
	5. Introduction to Software Project Management by Adolfo Villafiorita, CRC Press
	6. Agile Project Management with Scrumby Ken Schwaber, Microsoft Press © 2004
	7. Agile Project Management: Creating Innovative Products (2nd Edition) by Jim Highsmith, Addison-Wesley Professional
	8. Agile Project Management QuickStart Guide: The Simplified Beginners Guide to Agile Project Management by Clyde Bank Business
	9. Agile Product Management with Scrum: Creating Products that Customers Love by Roman Pichler.
	
	Reference website:
	    1. **https://learning.tcsionhub.in/**
	    2. **www.agilealliance.org**
	    3. **http://www.pmi.org**		

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.
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 must 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 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 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

Chapter No		Details
1		**Introduction**
	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.)
2		**Proposed System**
	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
3		**Analysis and Design**
	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.)
4		**Coding**
	4.1	Algorithms
	4.2	Code snippets
5		**Testing**
	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		**Limitations of Proposed System**

Chapter No		Details
7		**Proposed Enhancements**
8		**Conclusion**
9		**Bibliography**
10		**Publication / Competition certificates**
11		**Appendix – Cost sheet, Data sheet**
12		**User Manual** (All screens with proper description/purpose Details about validations related to data to be entered.)

2. Embedded Systems / IoT

Chapter No		Details
1		**Introduction**
	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)
2		**Proposed System**
	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
3		**Analysis and Design**
	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
4		**Coding**
	4.1	Algorithms
	4.2	Code snippets (if applicable)

Chapter No		Details
5		**Testing**
	5.1	Results & reports
	5.2	Test cases
	5.3	Acceptance Testing
	5.4	Test reports in IEEE format
6		**Limitations of Proposed System**
7		**Proposed Enhancements**
8		**Conclusion**
9		**Bibliography**
10		**Publication / Competition certificates**
11		**Appendix – Cost sheet, Data sheet**
12		**User Manual** (All screens with proper description/purpose Details about validations related to data to be entered.)

3. ETL Projects

Chapter No		Details
1		**Introduction**
	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 1.3.4 Establish the User Acceptance Criteria client)
	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)
2		**Proposed System**

	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)
3		**Analysis and Design**
	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
4	**4.1**	**Design of strategy for Visualization** 4.1.1 Visualizations in support of comparison of performance of various ETL strategies 4.1.2 Data visualization using different techniques (if any)
5		**Drawbacks and Limitations Proposed Enhancements**
6		**Conclusion**

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.

Sr. No	Course Code	Course Title	Internal	External
1	IT51L	Practical based on IT51 - Social Media and Digital Marketing	25	--

Course Objectives:

1. To understand digital and social media marketing
2. To learn various tools of Social Media and Digital Marketing
3. To acquaint with the techniques of SEO and SEM
4. To develop a mindset to solve real world problems using digital marketing

Course Outcome:

Student will able to

CO1: Create Marketing Strategy using various tools of Social Media and Digital Marketing. (Create)

List of Practicals

1. Establish Your Presence
   – Create Social Media Presence on the following platforms
      a. Facebook
      b. Instagram
      c. WhatsApp
      d. Twitter
      e. LinkedIn
      f. YouTube
2. Establish Your Presence for Businesses
   – Create Social Media Business Accounts and Pages
3. Introduction to Business Description, SMART Goal, KPI's
   – Create Business Description, Goals and Strategies with SMART Goal Planner and define three Key Performance Indicators (KPI's).
   Specific – What needs to be done?
   Measurable – Can it be measured?
   Achievable – Can it be done?
   Relevant – Should it be done?
   Time-Bound – When will it be done?
4. Introduction to SWOT analysis of business, Media and promotion plan
   – Create Social Media Marketing plan with 1-month Content Calendar
5. Social Media Content Management
   – Create Social Media Marketing Designs as per Content Calendar
6. Social Media Posting
   – Create Social Media Posting about your college as per Content Calendar
7. Social Media Tools
   – Create Social Media Posts using Tools as per Content Calendar
8. WordPress blog creation
   – Create WordPress Blog for your Business OR Full Website using WordPress of

your own

9. Email Marketing Campaign
   – Create Email Marketing Campaign for your Business
10. Search Engine Optimization (SEO)
    – Create Search Engine Optimization (SEO) content for your Business

Recommended Website References:

1. https://learndigital.withgoogle.com/digitalunlocked
2. https://www.ankuraggarwal.in/
3. https://dsim.in/knowledgebase/#video-tutorials
4. https://www.expertinstitute.in/digital-marketing-course.html
5. https://alison.com/courses/digital-marketing