



MCA Syllabus

Faculty of Management

Savitribai Phule Pune University

Savitribai Phule Pune University (SPPU), Pune

Curriculum for Master 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 planning; designing to build Complex Application Software Systems. These are highly valued in all industry sectors including business, health, education and the arts.
3. The basic objective of the education of the Masters programme in Computer Application (M.C.A) is to provide to the country a steady stream of the necessary knowledge, skills and foundation for acquiring a wide range of rewarding careers into the rapidly expanding world of the Information Technology.
4. The MCA Curriculum (AY 2019-22) is design in such a way that the curriculum should follow the 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. The specialized programme would enhance their exposure to variety of roles and responsibilities they can take up in any areas of expertise. For e.g.: In the area of software development they could take up responsibilities in areas of database, product development, product maintenance and support in addition to management activities.
 - Focused grooming would also make it easier for the 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 professional. This would emphasize on domain knowledge of various areas.
6. The Institutes should organize placement programme for the M.C.A students, by interacting with the industries and software consultancy houses in and around the region in which the educational Institution is located.
7. At the end of the syllabus various certifications possible for each semester. Students should try to do maximum Certifications in their learning phase only to make their resume rich.

8. Ordinarily, 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 given below:

a) Scheduled caste and Scheduled caste convert to Buddhism	13.0%
b) Scheduled Tribes including those living outside specified areas	10.5%
c) Vimukta Jati	(14 as specified)
d) Nomadic Tribes (NT1)(28 before 1990 as specified)	2.5%
e) Nomadic Tribes (NT2)(Dhangar as specified)	2.5%
f) Nomadic Tribes (NT3)(Vanjari as specified)	2.5%
g) Other Backward Class	19.0%
Total	50.0%

1. Candidate claiming to belong to categories mentioned against (e),(f) and (g) above will have to furnish certificate from appropriate authority that the candidate's parents do not belong to Creamy Layer as per the relevant orders of the Government.
2. If any of the (a) to (g) categories mentioned above does not get the required number of candidates for the percentage laid down in a University area, the seats so remaining vacant

shall be filled in from among the candidates of remaining reserved categories with reference to the inter-se-merit of all candidates belonging to the reserved categories from the same University area. However, the total reservation shall not exceed 50%. After doing so the seats remaining vacant shall be filled in with reference to inter-se-merit of all the candidates from the same University area.

(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 hr 30 min, 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 started in Semester V. 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. Their respective Institutes should forward the copy of this synopsis to the external panel members, in advance of the project viva dates if asked for.
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. Student must start an industrial project from semester-V and **same project** must be carried for semester-VI.
6. Selected project must have relevant scope for 500 marks.
7. Selected project must belongs to respective track of the student only (Interdisciplinary project may selected with prior permission of project guide).
8. In the fifth semester, student must visit at least once in a week to the respective company.
9. In the sixth semester, student must visit at least once in a week to the institute and the progress of the project must be communicated to college project guide.
10. The project report will be duly accessed by the internal guide of the subject 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.
11. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.

12. The major project work carry 250 marks for internal assessment and 250 marks for external viva. The external viva shall be conducted by a minimum of one external examiner. The mini project work would be departmental.
13. Project work can be carried out in the Institute or outside with prior permission of the Institute.
14. Project viva-voce by the University panel will be conducted in the month of April-May.

(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 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 shall have 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 total credits earned by a student at the end of the semester upon successfully completing a course are 'L + T + P'. The **credit pattern** of the course is indicated as L: T: P.

If a course is of 3 credits then the different credit distribution patterns in L: T: P format could be 3:0:0, 1:2:2, 2:0:2, 2:2:0, etc. The credits of a course cannot be greater than the number of hours (per week for 15 weeks) allotted to it.

Full Credit Course: A course with Weightage of 4 credits is considered as a full credit course.

Half Credit Course: A course with Weightage of 2 credits is considered as a half credit course.

The MCA programme is a combination of:

- a) Full Credit Courses (100 Marks each) : 4 Credits each
- b) Half Credit Courses (50 Marks each) : 2 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 90 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:

Institutes are free to offer at least two specialized tracks. It is envisaged that Institutes offer only those tracks /electives for which they have the required faculty competencies and relevant resources.

It shall be mandatory for the Institutes to provide all information relating to the specialized tracks offered, their respective credits, evaluation pattern, etc. to all the students so as to enable them to make an informed choice. Such information should be hosted on the website/prospectus of the Institute in sufficient advance, prior to commencement of the classes. Other information such as the credits, the prerequisites, and syllabus shall also be hosted on the website of the institute.

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 27 credits in Semester I, II, III, IV, V and 25 Credits in Semester VI.
- v. The maximum number of students to be registered in each specialized TRACK shall depend upon the physical facilities available. Every effort shall be made by the Institute to accommodate as many students as possible.
- vi. The Institute may not offer a specialized track if a minimum of 33% of students are not registered for that course.

(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 paper, 30% marks will be based on internal assessment and 70% marks for semester and examination (external assessment), unless otherwise stated.
2. The division of the 30marks allotted to internal assessment of theory papers is on the basis of tutorial paper and assignments of 15 marks and seminars / presentations and attendance of 15 marks.
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 / Caselet's / 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.

$$\sum \{C * GPI\}$$

SGPA = -----for a semester.

$$\sum C$$

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) <i>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;</i>
A+ : Excellent	Excellent analysis of the topic (70 to 79%) <i>Accurate knowledge of the primary material, acquaintance with seminal publications, logical development of ideas, Neat and systematic organization of content, effective and clear expression;</i>
A: Very Good	Good analysis and treatment of the topic (60 to 69%) <i>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;</i>
B+: Good	Good analysis and treatment of the topic (55to 59%)

	<i>Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, effective and clear expression;</i>
B: Above Average	Some important points covered (50to 54%) <i>Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, good language or expression;</i>
C: Average	Some points discussed (45 to 49%) <i>Basic knowledge of the primary material, some organization, acceptable language or expression;</i>
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 syllabus Committee should meet at least once in a year to study and clarify any difficulties from the Institutes.

(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	DBMS	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 101	IT11L	2	-	50
10	Practical based on Open Subject	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 Organisational Behaviour	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 202	IT22L	2		50
10	Practical based on Open Subject	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 301	IT31L	2		50
10	Practical based on Open Subject	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 401	IT41L	2		50
10	Practical based on Open Subject	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 501	IT51L	1		25
9	Practical based on Open Subject	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	270

* : Departmental Subject

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	<p>Two Servers are mandatory [One Linux server & One Windows server]</p> <ul style="list-style-type: none"> • Windows Server : Microsoft Windows Server for 20 users for intake of 60 students • Linux Server : Fedora/Ubuntu
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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
<p>Course Objective:</p> <ol style="list-style-type: none"> 1. To learn advanced features of the C++ programming language as a continuation of the previous course. 2. To learn the characteristics of an object - oriented programming language: data abstraction and information hiding, inheritance, and dynamic binding of the messages to the methods. 3. To learn the basic principles of object-oriented design and software engineering in terms of software reuse and managing complexity. 4. To enhance problem solving and programming skills in C++ with extensive programming projects. <p>Course Outcome:</p> <p>After the completion of this course, a successful student will be able to do the following:</p> <ol style="list-style-type: none"> 1. Use the characteristics of an object-oriented programming language in a program. 2. Use the basic object-oriented design principles in computer problem solving. 3. Use the basic principles of software engineering in managing complex software project. 4. Program with advanced features of the C++ programming language. 5. Develop programs in the UNIX/Linux programming environment. 				
Sr. No	Topic Details		% Weightage	No. of Sessions

1	<p>1. Introduction to Computers and C++ Programming</p> <p>1.1 COMPUTER SYSTEMS Hardware, Software High-Level Languages, Compilers, History Note</p> <p>1.2 PROGRAMMING AND PROBLEM-SOLVING Algorithms, Program Design Object-Oriented Programming The Software Life Cycle</p> <p>1.3 INTRODUCTION TO C++ Origins of the C++ Language, A Sample C++ Program</p> <p>1.4 TESTING AND DEBUGGING Kinds of Program Errors</p>	4	2
2	<p>2 C++ Basics</p> <p>2.1 VARIABLES AND ASSIGNMENTS Variables, Identifiers, Variable Declarations Assignment Statements</p> <p>2.2 INPUT AND OUTPUT Output Using cout, Include Directives and Namespaces Escape Sequences</p> <p>2.3 DATA TYPES AND EXPRESSIONS The Types int, double, char, bool C++11 Types Type Compatibilities Arithmetic Operators and Expressions</p> <p>2.4 PROGRAM STYLE Indenting, Comments, Naming Constants</p>	6	2
3	<p>3 More Flow of Control</p> <p>3.1 USING BOOLEAN EXPRESSIONS Relational operators, Logical operators, Bitwise operators Evaluating Boolean Expressions</p> <p>3.2 MULTIWAY BRANCHES If – else Statement, Nested Statements Multiway if-else Statements The switch Statement</p> <p>3.3 MORE ABOUT C++ LOOP STATEMENTS The while Statements Increment and Decrement Operators The for Statement The break Statement, The continue Statement, Nested loop</p>	6	3
4	<p>4 Functions</p> <p>4.1 PREDEFINED FUNCTIONS Using Predefined Functions, Random Number Generation Type Casting Older Form of Type Casting</p>	8	3

	<p>4.2 PROGRAMMER-DEFINED FUNCTIONS Function Definitions, Functions That Return a Value</p> <p>4.3 STORAGE CLASSES auto, register, static, extern</p> <p>4.4 OVERLOADING FUNCTIONNAMES</p> <p>4.5 CALL-BY-REFERENCE PARAMETERS A First View of Call-by-Reference, Call-by-Reference in Detail</p> <p>4.6 RECURSION Recursive Design Techniques Direct and indirect recursion</p>		
6	<p>6 Arrays and Strings</p> <p>6.1 INTRODUCTION TO ARRAYS Declaring and Referencing Arrays Use for Loops with Arrays Arrays in Memory</p> <p>6.2 ARRAYS IN FUNCTIONS Indexed Variables as Function Arguments Entire Arrays as Function Arguments Functions That Return an Array</p> <p>6.3 MULTIDIMENSIONAL ARRAYS Multidimensional Array Basics Multidimensional Array Parameters</p> <p>6.4 ANARRAY TYPE FOR STRINGS C-String Values and C-String Variables Other Functions in <cstring></p> <p>6.5 THE STANDARD string CLASS Introduction to the Standard Class string I/O with the Class string</p>	8	4
7	<p>7 Pointers and Dynamic Arrays</p> <p>7.1 POINTERS Pointer Variables, Pointer Arithmetic Basic Memory Management Dangling Pointers</p> <p>7.2 DYNAMIC ARRAYS Creating and Using Dynamic Arrays Multidimensional Dynamic Arrays</p>	5	2
8	<p>8 Classes and Objects</p> <p>8.1 STRUCTURES AND UNION Structures/Unions for Diverse Data Structures/Unions as Function Arguments Use Hierarchical Structures</p> <p>8.2 CLASSES Defining Classes and Member Functions Public and Private Members</p>	8	3

	<p>Constructors and Destructors</p> <p>Overloaded Constructors</p> <p>8.3 ABSTRACT DATA TYPES</p> <p>Classes to Produce Abstract Data Types</p>		
9	<p>9 Friends, Overloaded Operators, and Arrays in Classes</p> <p>9.1 FRIEND FUNCTIONS</p> <p>Need of Friend Function</p> <p>9.2 OVERLOADING OPERATORS</p> <p>Overloading Operators</p> <p>Constructors for Automatic Type Conversion</p> <p>Overloading Unary Operators</p> <p>Overloading Binary Operators</p> <p>Overloading >>, <<, [], ()</p> <p>9.3 ARRAYS AND CLASSES</p> <p>Arrays of Classes</p> <p>Arrays as Class Members</p> <p>9.4 DATA CONVERSION</p> <p>Conversions between Basic Types</p> <p>Conversions between Objects and Basic Types</p> <p>Conversions between Objects of Different Classes</p> <p>Conversions: When to Use What.</p>	12	5
10	<p>10 Inheritance</p> <p>10.1 INHERITANCE BASICS</p> <p>Derived Classes</p> <p>Constructors in Derived Classes</p> <p>The protected Qualifier</p> <p>Redefinition of Member Functions</p> <p>Redefining Versus Overloading</p> <p>Access to a Redefined Base Function</p> <p>10.2 INHERITANCE DETAILS</p> <p>Functions That Are Not Inherited</p> <p>Assignment Operators and Copy Constructors in Derived Classes</p> <p>Destructors in Derived Classes</p> <p>10.3 POLYMORPHISM</p> <p>Late Binding</p> <p>Virtual Functions in C++</p> <p>Virtual Functions and Extended Type Compatibility</p>	12	4
11	<p>11 Separate Compilation and Namespaces</p> <p>11.1 NAMESPACES</p> <p>Namespaces and using Directives</p> <p>Creating a Namespace</p> <p>Qualifying Names</p> <p>Unnamed Namespaces</p>	2	1

12	<p>12 Exception Handling</p> <p>12.1 EXCEPTION - HANDLING BASICS</p> <p>Defining Your Own Exception Classes</p> <p>Multiple Throws and Catches</p> <p>Throwing an Exception in a Function</p> <p>12.2 PROGRAMMING TECHNIQUES FOR EXCEPTION HANDLING</p> <p>When to Throw an Exception</p> <p>Uncaught Exceptions</p> <p>Nested try-catch Blocks</p> <p>Exception Class Hierarchies</p> <p>Rethrowing an Exception</p>	5	2
13	<p>13 I/O Streams</p> <p>13.1 STREAMS AND BASIC FILE I/O</p> <p>Why Use Files for I/O?, File I/O</p> <p>Stream Classe, Stream Errors</p> <p>13.2 TOOLS FOR STREAM I/O</p> <p>Formatting Output with Stream Functions</p> <p>Manipulators</p> <p>Streams as Arguments to Functions</p> <p>13.3 CHARACTER I/O</p> <p>The Member Functions get and put</p> <p>The putback Member</p> <p>13.4 FILE PONTERS</p> <p>Specifying the Position, Specifying the Offset</p> <p>Random access file</p>	10	3
14	<p>14 Templates</p> <p>14.1 TEMPLATES FOR ALGORITHM ABSTRACTION</p> <p>How to Define Templates</p> <p>Templates for Functions</p> <p>14.2 TEMPLATES FOR DATA ABSTRACTION</p> <p>Syntax for Class Templates</p>	6	2
15	<p>15 Standard Template Library</p> <p>15.1 ITERATORS</p> <p>Using Declarations, Iterator Basics, Kinds of Iterators</p> <p>Constant and Mutable Iterators, Reverse Iterators</p> <p>Other Kinds of Iterators</p> <p>15.2 CONTAINERS</p> <p>Sequential Containers</p> <p>Container Adapters – stack, and queue</p> <p>Associative Containers - set and map</p> <p>15.3 GENERIC ALGORITHMS</p> <p>Nonmodifying Sequence Algorithms</p> <p>Container Modifying Algorithms</p> <p>Set Algorithms, Sorting Algorithms</p>	8	4

Referance 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

SEMESTER I					
Sr. No.	Subject Code	Subject Title	Internal	External	
1	IT12	Software Engineering using UML	30	70	
<p><u>Course Objectives:</u></p> <ol style="list-style-type: none"> 1. To study basic concepts of software engineering 2. To study phases of SDLC and different process models 3. Students learn & understand the Requirement analysis and system Design. 4. Students get acquainted with the agile software development methodology <p><u>Course Outcome:</u></p> <p>Student will able to</p> <p>CO1: Distinguish different process model for a software development. (Understanding)</p> <p>CO2: Design software requirements specification solution for a given problem definitions of a software system.(Application)</p> <p>CO3: Apply software engineering analysis/design knowledge to suggest solutions for simulated problem</p> <p>CO4: Recognize and describe current trends in the area of software engineering</p>					
Sr. No	Topic Details		% Weightage	No. of Sessions	Reference Books
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.		10	5	1,2,3, 4,14

	<p>1.1.2. Different Approaches and Models for System Development.</p> <p>1.1.2.1. Waterfall Model</p> <p>1.1.2.2. Spiral Model</p> <p>1.1.2.3. Prototyping Model</p> <p>1.1.2.4. RAD</p> <p>1.1.2.5. Rational Unified Process</p>			
2	<p>2. Requirement Engineering</p> <p>2.1. Types of Requirements – Functional and Nonfunctional</p> <p>2.2. Four Phases of Requirement Engineering</p> <p>2.3. Software requirement Specification (SRS)</p> <p>2.3.1. Structure and contents of SRS</p> <p>2.3.2. IEEE standard format for SRS</p> <p>Case studies should be covered on the above topic</p>	20	8	1,3, 10,13
3	<p>3. Use-case Driven Object oriented Analysis</p> <p>3.1. Introduction to oops concepts</p> <p>3.1.1. Class and object</p> <p>3.1.2. Abstraction and encapsulation</p> <p>3.1.3. Method and messages</p> <p>3.1.4. Interface, Inheritance and polymorphism</p> <p>3.1.5. Structural Diagram - Class Diagram and Object diagram</p> <p>3.1.6. Associations and links</p> <p>3.1.7. Aggregation , Composition and containment</p> <p>3.1.8. Inheritance, Sub Types and IS-A hierarchy</p> <p>3.2. Behavioral Diagram</p> <p>3.2.1. Use case Diagram</p> <p>3.2.1.1. Identify Actors</p> <p>3.2.1.2. Identify Use cases: describing how the user will use the system</p> <p>3.2.1.3. Develop use-case Model</p> <p>3.2.1.4. Description of Use case Diagram.</p> <p>3.2.2. Activity Diagram</p> <p>3.2.3. Sequence diagram</p> <p>3.2.4. Collaboration Diagram.</p> <p>3.2.5. State Transition Diagram</p> <p>Case studies should be covered on the above topic</p>	40	18	5,6,7,8,11,12,13,14,15,16

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, buttons, icons, panels, error messages etc. Case studies should be covered on the above topic	10	6	1,13
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	8	1,9,13

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	<ol style="list-style-type: none"> 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	<p>CO1: Describe the basic concepts of DBMS and various databases used in real applications.</p> <p>CO2: Design relational database using E-R model and normalization</p> <p>CO3: Demonstrate nonprocedural structural query languages for various database applications</p> <p>CO4: Apply concepts of Object Based Database, XML database and non-relational databases.</p> <p>CO5: Explain transaction management and recovery management for real applications</p>			
Sr. No.	Topic Details		Weightage (%)	No. of Sessions
1	<p>Basic concepts</p> <p>1.1 Introduction</p> <p>1.2 Database and Need for DBMS,</p> <p>1.3 Characteristics, Users, Views, schema,</p> <p>1.4 3-tier architecture,</p> <p>1.5 Introduction of Parallel, Distributed Databases, Mobile databases and Cloud databases.</p> <p>1.6 Models (Relational model, Object Models)</p> <p>1.7 Advantages and disadvantages of each model.</p>		10	5
2	<p>Data Modeling and Relational Database Design</p> <p>2.1 Entities-attributes,</p> <p>2.2 Relationship</p> <p>2.3 Attributes, relationship set, Keys,</p>		25	10

	<p>2.4 Codd's rules,</p> <p>2.5 Generalization, aggregation, ER diagrams,</p> <p>2.6 Normalization (1 NF, 2 NF, 3 NF, BCNF),</p> <p>2.7 Introduction to SQL, DDL, DML Queries.</p>		
3	<p>Specialty databases and applications</p> <p>3.1 Obstacles using Relational Data Model & Emergence of Special Databases</p> <p>3.2 Object Oriented Databases (OODBMS)</p> <p>3.2.1 Feature</p> <p>3.2.2 Advantages of OODBMS Architecture</p> <p>3.2.3 ODL,OQL</p> <p>3.2.4 OODBMS Vs RDBMS</p> <p>3.2.4 Object Relational Database, Schema, Mapping</p> <p>3.2.5 OODBMS Vs ORDBMS</p> <p>3.3 XML</p> <p>3.3.1 Structure of XML Data</p> <p>3.3.2 XML Document Schema</p> <p>3.3.3 Querying and Transformation</p> <p>3.3.4 Application Program Interfaces to XML</p> <p>3.3.5 Storage of XML Data</p> <p>3.3.6 XML Applications</p>	15	7
4	<p>Transaction processing and Concurrency</p> <p>4.1 Concept of transaction processing, ACID properties, States of transaction</p> <p>4.2 Serializability and testing for serializability</p> <p>4.3 Concurrency control, schemes</p> <p>4.4 Locking techniques</p> <p>4.5 Timestamp based protocols</p>	25	9

	4.6 Granularity of data items 4.7 Deadlocks		
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	7
6	No SQL Database 6.1 Introduction ,Need& Advantages 6.2 Types of No SQL Database 6.3 No SQL database vs RDBMS	2	2

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
1	IT14	Essential of Operating System		30	70

Course Objectives:

1. To learn the fundamentals of Operating Systems and handle processes and threads and their 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
7. To know about Basic Administration of Linux

Course Outcome:

Student will able to

CO1: Analyze the overview, structure of OS and process management and synchronization.

CO2: Analyze and design Memory Management.

CO3: Analyze the various OS like Multiprocessor OS and Mobile OS

CO4: Interpret the mechanisms adopted for file sharing in distributed Applications

CO5: Know about current Linux Distributions-Distros examples and environment.

CO6: Conceptualize the components and can do Shell Programming.

CO7: Know Basic Linux System Administration and Kernel Administration.

Sr. No	Topic Details	Reference Bo No.	% 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	1,8,9,10	25	12
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	1,8,9,10	15	7
3	Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation-	3	15	6

	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			
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	5	10	4
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.	4,6,7	10	3
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.	4,6,7	15	5
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).	4,6,7	10	3

Reference Books:

1. Operating System Concepts, 9th Edition, John Wiley & Sons, Inc. by Avi Silberschatz, Peter Baer Galvin, Greg Gagne,
2. Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 by William Stallings.
3. Modern Operating system by Andrew Tenenbaum.
4. Linux Administration, A Beginner's, Guide by Wale Soyinka, Tata McGraw Hill
5. Distributed Operating System by Andrew Tanenbaum
6. Linux Shell Scripting By Ganesh Naik
7. Linux Bible By Christopher Negus

8. D.M Dhamdhare: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw-Hill, 2012.

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
1	BM11	Business Process Domain	30	70
<u>Course Objectives:</u>				
<ol style="list-style-type: none"> 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. 				
<u>Course Outcome:</u>				
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 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 %	9
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 %	7
3	E commerce 3.1 Business model of ecommerce: B2B, B2C, C2C, B2G and other models of ecommerce. 3.2 Electronic payment system:		15 %	7

	Credit card, debit card, operational and legal risks of e-payments, risk management options for e-payment system, order fulfillment for e-commerce.		
4	Supply Chain Management (SCM) 4.1 what is supply chain, 4.2 Major drivers of Supply chain, 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)	20 %	9
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 %	6
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 %	7

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, 4th Edition
4. E-Commerce concept-model-strategies, C.S.V. Murthy, Himalaya 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

SEMESTER II					
Sr. No.	Subject Code	Subject Title		Internal	External
1	IT21	Data Structure and Algorithm		30	70
<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart the basic concepts of data structure and algorithms To understand concepts about searching and sorting techniques To understand basic concepts about stacks, queues, lists, trees and graphs To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures <p>Course Outcome:</p> <p>Student will able to</p> <p>C01: analyze algorithms and algorithm correctness C02: summarize searching and sorting techniques C03: describe stack, queue and linked list operation C04: have knowledge of tree and graphs concepts</p>					
Sr. No	Topic Details		Reference Book No.	% Weightage	No. of Sessions
1	<p>Introduction to Data Structure</p> <p>1.1 Fundamentals of Data Structure</p> <p>1.2 Operations of Data Structure</p> <p> 1.2.1 Traversing</p> <p> 1.2.2 Searching (Linear and Binary Search)</p> <p> 1.2.3 Sorting (Bubble, Insertion, Selection, Quick and Merge sort)</p> <p> 1.2.4 Inserting and Deleting</p> <p>1.3 Arrays as Data Structure</p> <p>1.4 Storage Representation of Arrays</p> <p>1.5 Polynomial Representation of Arrays</p> <p> 1.5.1 Addition of Two Polynomial</p> <p> 1.5.2 Addition of Sparse Matrix</p>			20	4
2	<p>Stacks</p> <p>2.1 Introduction and Definition</p> <p>2.2 Representation of Stacks</p> <p>2.3 Operations on Stacks</p> <p>2.4 Applications of Stacks</p> <p>2.5 Representation of Arithmetic Expressions</p> <p> 2.5.1 Infix</p> <p> 2.5.2 Postfix</p> <p> 2.5.3 Prefix</p>			15	3
3	<p>Queues</p> <p>3.1 Introduction and Definition</p> <p>3.2 Representation of Queues</p>			15	3

	3.3 Operation on Queues 3.4 Applications of Queues 3.5 Dequeue 3.6 Circular Queue 3.7 Priority Queue			
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	3
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 Inorder Traversal 5.6.3 Postorder Traversal 5.7 Threaded Binary Tree 5.8 AVL Tree 5.9 B-Tree 5.10 Operations on B-Tree		20	4
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 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)		20	4

Books :

1. Lipschutz Schaum's, "Data Structure", Outline Series, TMH, ISBN-0-07-060168-2.

2. D. Samanta, "Classical Data Structure", PHI, ISBN: 8120318749.
3. Fundamental of DS using C++ by Horowitz Sahani, Galgotia pub.
4. Practical Approach to Data Structures by Hanumanthappa.

References :

1. Tenenbaum," Data Structures Using C and C++", Second Edition, PHI, ISBN-81317-0328-2
2. Data Structures Using C and C++ by Langsam Y, PHI,2nd Ed.
3. The Essence of Data Structures using C++ by Brownesy,Kan
4. Data Structure and Algorithms in C++ by Joshi Brijendra Kumar
5. Data Structures with C++: Schaums Outlines by Hubbard John

Sr. No.	Subject Code	Subject Title	Internal	External
1	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:

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	<p>1.1 Introduction to HTML5,What Is HTML5? Features of HTML5 Introduction to Web 2.0 and Web 3.0</p> <p>1.2 History And Major Actors</p> <ul style="list-style-type: none"> • A Little Retrospective • What Is The W3C? • What Is The WHATWG? <p>1.3 Getting Started With HTML5</p> <ul style="list-style-type: none"> • Feature Detection • Support For Legacy Browsers <p>1.4 Structure of a Web Page</p> <ul style="list-style-type: none"> • HTML5 DOCTYPE • Page Encoding • New And Updated Elements • New Attributes • Deprecated Elements And Attributes <p>1.5 Audio and Video</p> <ul style="list-style-type: none"> • The State of Web Audio And Video Based On Plug-in • Attributes And Methods • Understanding Audio/Video Events <p>1.6 HTML5 Canvas</p>	20	10

	<ul style="list-style-type: none"> • Overview Of Graphics In The Browser • Canvas Vs. SVG • Using A Canvas 1.7 Forms 1.8 Working With Paths <ul style="list-style-type: none"> • Drawing Straight Lines • Drawing Circles Or Arcs • Drawing Text • Drawing Images 1.9 Understanding Transforms <ul style="list-style-type: none"> • Translation • Rotation • Scaling 		
2	CSS3 2.1 Introducing CSS3 <ul style="list-style-type: none"> • What is CSS3? • The History of CSS 2.2 Selectors and Pseudo Classes <ul style="list-style-type: none"> • Attribute Selectors • The Target Pseudo-Class • UI Element States Pseudo-Classes 2.3 Fonts and Text Effects <ul style="list-style-type: none"> • Fonts on the Web • Font Services • The @font-face Rule 2.4 Colours, Gradients, Background Images, and Masks <ul style="list-style-type: none"> • Colour • The Opacity Property • Backgrounds 2.5 Transitions, Transforms and Animations <ul style="list-style-type: none"> • Transitions and Transforms 2.6 Embedding Media <ul style="list-style-type: none"> • Video Formats • Styling Video 	15	6
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	9
4	Jquery 4.1 Intro to jQuery <ul style="list-style-type: none"> • Need of jQuery • Advantages of jQuery 	25	9

	<ul style="list-style-type: none"> • JQuery versions • Features 4.2 Retrieving Page Content <ul style="list-style-type: none"> • Using selectors • Using filters • Child,visibility, and content filters in jquery 4.3 Manipulating Page Content <ul style="list-style-type: none"> • 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		
5	PHP 5.1 Installing and Configuring PHP 5.2Introduction <ul style="list-style-type: none"> • PHP and the Web Server Architecture, PHP Capabilities • PHP and HTTP Environment Variables 5.3 PHP Language Core <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Connection with MySql Database • Performing basic database operations(DML) Insert, Delete, Update, Select) 5.8 Using GET, POST, SESSION, and COOKIE Variables	20	11

Text 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

Reference Books:

1. Introducing HTML5 - Bruce Lawson, Remy Sharp

2. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed

3. JavaScript The Complete Reference 3rd Edition (Paperback, Powell Thomas)

4. Learning jQuery - Jonathan Chaffer, Karl Swedberg

5. HTML5 & CSS3 , Castro Elizabeth 7th Edition

6. Head First PHP & MySQL – by Lynn Beighley & Michael Morrison

7. The Joy of PHP Programming: A Beginner’s Guide – by Alan Forbes

Reference Websites:

1. <https://www.w3schools.com>

2. <https://www.html-5-tutorial.com>

3. <https://openclassrooms.com>

4. <https://www.javascript.com>

5. <https://www.tutorialspoint.com/javascript>

6. <https://www.w3schools.com/jquery/>

7. <https://www.tutorialspoint.com/jquery/>

8. <http://www.apache.org>

9. <https://www.guru99.com/php-tutorials.html>

<https://www.w3schools.com/php/>

Sr. No	Subject Code	Subject Title		Internal	External
3	MT21	BUSINESS STATISTICS		30	70
	Objectives: To understand the importance of data-driven business decisions. To understand the basic role of probability in business decision making. To learn the basics of business decision-analysis. To summarize business data numerically and graphically. Learn the basics of beginning predictive business modeling To understand the importance of business sampling methods, and be able to describe different business sampling methods.				

	<p>To understand probability distributions common in business and the relationships between sampling, probability, and uncertainty in business decision making. To learn how to use model-based estimation and prediction methods with business applications</p> <p>To understand the process associated with statistical decisions, defining and formulating problems, analyzing the data, and using the results in decision making.</p>			
	<p>Course Outcome:</p> <ol style="list-style-type: none"> 1. explain basic statistical concepts such as statistical collection, species characteristics, statistical series, tabular and graphical representation of data, measures of central tendency, dispersion and asymmetry, correlation and regression analysis, time series analysis 2. Students will be able to analyze and apply computer-generated statistical output to solve problems. 3. independently calculate basic statistical parameters (mean, measures of dispersion, correlation coefficient, indexes) 4. based on the acquired knowledge to interpret the meaning of the calculated statistical indicators 5. choose a statistical method for solving practical problems in business world and statistically thinking and selecting data analysis techniques for decision-making under uncertainty. 			
Sr. No	Topic Details	Reference book no.	% Weightage	No. of Sessions
1	<p>Unit 1- Introduction to Statistics:</p> <p>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.</p> <p>Need of Data, Types of Data, Principles of Measurement, Source of Data, Data Classification, Tabulation and Presentation.</p>	1,2,4	5	2
2	<p>Unit-2-Measures of Central Tendency and Dispersion:</p>	1,2	10	4

	<p>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</p>			
3	<p>Unit-3- Theory of Probability and Theoretical Probability Distributions:</p> <p>Introduction - Definition of probability - Basic terminology used in probability theory, Approaches to probability , Rules of Probability - Addition rule - Multiplication rule , Conditional Probability, Steps Involved in Solving Problems on Probability, Random Variables</p> <p>Probability Distributions - Discrete probability distributions - Continuous probability distributions , Bernoulli Distribution - Repetition of a Bernoulli experiment , Binomial Distribution - Assumptions for applying a binomial distribution - Examples of binomial variate - Recurrence formula in case of binomial distribution - Case study on binomial distribution Poisson Distribution - Assumptions for applying the Poisson distribution -Real life examples of Poisson variate - Recurrence relation -Case study on Poisson distribution, Normal Distribution - Standard Normal Distribution</p>	1,2	15	6
4	<p>Unit-4- Sampling, Sampling Distributions and Testing:</p> <p>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</p>	1,2,3,5	37.5	15

<p>Sampling, Determination of Sample Size, Central Limit Theorem</p> <p>Estimation:</p> <p>Introduction , Reasons for Making Estimates , Making Statistical Inference, Types of Estimates - Point estimate - Interval estimate , Criteria of a Good Estimator – Unbiasedness – Efficiency – Consistency – Sufficiency, Point Estimates ,Interval Estimates, Case study on calculating estimates - Making the interval estimate Interval Estimates and Confidence Intervals - Interval estimates of the mean of large samples - Interval estimates of the proportion of large samples - Interval estimates using the Student’s ‘t’ distribution, Determining the Sample Size in Estimation</p> <p>Testing of Hypothesis in Case of Large and Small Samples:</p> <p>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</p> <p>Chi – Square Test:</p> <p>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 -</p>			
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	<p>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</p> <p>Distribution and Analysis of Variance (ANOVA):</p> <p>Introduction, Analysis of Variance (ANOVA), Assumptions for F-test - Objectives of ANOVA - ANOVA table - Assumptions for study of ANOVA, Classification of ANOVA - ANOVA table in one-way ANOVA - Two way classifications</p>			
5	<p>Unit-5- Simple Correlation and Regression:</p> <p>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</p>	1,2,3	12.5	5
6	<p>Unit-6- Forecasting and Time Series Analysis:</p> <p>Introduction, Types of forecasts, Timing of forecast, Forecast methods-Quantitative and Qualitative Forecasting Methods,</p> <p>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,</p>	1,2	10	4

	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			
7	<p>Unit-7- Index Numbers:</p> <p>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</p>	1,2	10	4
	Reference Books			
	<p>1. Business Statistics, J. K. Sharma, Pearson Education-2nd Edition</p> <p>2. Business Statistics, Naval Bajpai, Pearson Education-2nd Edition</p> <p>3. The Art of Computer systems Performance Analysis, Raj Jain, Wiley India Pvt Ltd,</p> <p>4. Complete Business Statistics, Amir Aczel, Jayavel Sounderpandian, (Seventh Edition), <i>Tata McGraw-Hill</i> Education Pvt. Ltd - 2012</p> <p>5. Business Statistics Theory and Applications, by Jani P.N , PHI</p>			

Sr. No.	Subject Code	Subject Title	Internal	External
1	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:

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 IP V4 , IP V6 Address and concept of sub netting with numerical

CO3: Understand routing concept and working of routing protocols such as RIP, OSPF and BGP

CO4: Have basic understanding of wireless networks and protocols

CO5: Understand various encryption techniques

Sr. No	Topic Details	% Weightage	No. of Sessions
1	<p>Introduction to Data Communication and Computer Networks</p> <p>1.1 Overview of basic concepts and components. [Data communication characteristic, Data representation, data flow, Network Criteria, Physical structures and topologies, Network types, switching]</p> <p>1.2 Connection Oriented N/Ws Vs Connectionless N/Ws,</p> <p>1.3 Ethernet [goals, frame format, all types and implementations]</p> <p>1.4 Wireless LAN [Architectural Comparison, Characteristics, Access Control, 802.11 architecture, Frame format and its specifications]</p> <p>1.5 Protocol Layering (Principals, Logical connections)</p> <p>1.6 TCP/IP protocol suite</p> <p>1.7 The OSI model</p> <p>1.8 TCP/IP Model,</p> <p>1.9 OSI vs TCP/IP</p>	15	9
2	<p>Physical communication:</p> <p>2.1 Hardware Architecture</p> <p>2.2 Transmission Media (Guided and unguided i.e. Twisted pair, Coaxial cable, Fiber optics, Wireless Transmission etc.)</p>	10	3

	2.3 Communication Devices (Switch, Router etc.) 2.3, Switching and its types (Circuit Switching, Message Switching, Packet Switching)		
3	Link Layer Communication 3.1 Error detection and correction techniques with numerical 3.2 Framing and its types 3.3 Flow and error control 3.4 HDLC protocol 3.5 P2P Protocol	15	7
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 4.6 Numerical based on IP addressing 4.7 Routing [IP routing concept, Routing tables and Routing protocols (all Interior and Exterior routing protocols)] 4.8 TCP connections 4.9 IPV6 [Introduction, IPV6 packet format, Addressing schemes, Applications and limitations, IPV4 Vs IPV6]	15	6
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 and DNS security 5.5 DHCP & Scope Resolution	10	3
6	Network Applications (HTTP, Email, etc) 6.1 Hyper Text Transfer Protocol (HTTP) 6.2 HTTP communications –HTTP request, Request Headers, Responses, Status Code, Error Status Code 6.3 Email- Sending & Receiving Email, Email, Addressing Message Structure 6.4 MIME- Multipurpose Internet Mail Extensions 6.5 SMTP – Simple Mail Transfer Protocol 6.6 POP – Post Office Protocol 6.7 IMAP- Internet Message Access Protocol 6.8 FTP- File Transfer Protocol 6.9 Telnet – Remote Communication Protocol 6.10 Proxy Servers and its types	15	8
7	Network Security 7.1 Threat: Active attack, Passive Attack	10	2

	7.2 Cryptography: Symmetric and Asymmetric Key Cryptography, Digital signature 7.3 VPN and VPN Protocols 7.4 Firewall: Packet filter, application gateway		
8	Advance Network Technologies 8.1 WiMax, LTE, VOIP, Unified Communication 8.2 Introduction to IoT and Sensor networks	10	2

Text 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. |

Reference Books:

- | | |
|---|----------------------|
| 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
<p>Objective: This course aims to improve students understanding of Management & human behavior in organization and the ability to lead people to achieve more effectively toward increased organizational performance. After completing this course, students should be able to:</p> <ul style="list-style-type: none"> • Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories. • Understand group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations. • Understand the organizational system, including organizational structures, culture, human resources, and change. 				
<p>Course Outcomes:</p> <p>CO1. Describe various aspects of management.</p> <p>CO 2. Analyze the interactions between multiple aspects of management.</p> <p>CO 3. Justify the role of leadership qualities.</p> <p>CO 4. Evaluate the impact of changing external factors.</p> <p>CO 5. Analyze the role of planning and decision making.</p> <p>CO 6. Compare and contrast the controlling process.</p>				

Sr. No.	Topic Details	% Weightage	No. of Sessions (Ref. Book)	Reference Book
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	1,2,3
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	4	1,2
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 3.5 Information Technology & Decision Making 3.6 Herbert Simon's Model & Principle of Rationality	10	4	1,2,3,4
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	4	5,6
5	Organizational Dynamics: 5.1 Organizational Change and Learning Organizations Leadership skills and techniques for effective organizations 5.2 Behaviouristic and Strategic leadership styles in organization 5.3 Organization Development Techniques – Background and historical perspective	7	3	5,6,7
6	Motivation:	7	3	7,8,9,10

	6.1 Concept of Motivation, Benefits to organization and Manager 6.2 Maslow's need Hierarchy theory 6.3 Herzberg's Motivation- Hygiene Theory 6.4 McClelland's Need Theory 6.5 Theory X and Y, Theory Z			
7	Leadership: 7.1 Definition, Nature, Qualities of Leader, Leader V/s Manager 7.2 Leadership Theories (Great Man Theory, Trait Theory, Behavioral Theories, The Contingency or Situational Theory, Path-Goal Theory of Leadership) 7.3 Leadership Styles(Autocratic, Participative, Laissez faire or subordinate-centered ,Bureaucratic leadership, Transformational leadership, Transactional leadership)	10	4	8,9,10
8	Group and Group Dynamics: 8.1 Concept of Group, Effect & Characteristics of group, Types of groups 8.2 The Five-Stage Model of Group Development 8.3 Group Properties (Roles, Norms, Status, Size, and Cohesiveness)	10	4	5,6,8,9,10
9	Team Building: 9.1 Concept of Team, Nature, Benefits from team, 9.2 Types of Teams 9.3 Creating Effective Teams, Turning Individuals into Team Player.	10	4	10
10	Stress Management and Conflict management: 10.1 Work stress: Meaning of stress, Stressors, Sources of Stress, Types of stress 10.2 Stress Management strategies 10.3 Concept of Conflict, Functional versus Dysfunctional Conflict 10.4 Five stage Conflict Process, Types of Conflict (Task Conflict, Relationship Conflict, Process Conflict, Personality Conflict, Intergroup Conflict) 10.5 Managing Conflict (Styles for Handling Dysfunctional Conflict, Third-Party Interventions)	8	3	10,11,12,13
11	Personality and Understanding Individual Behavior: 11.1 Introduction, Definition of Personality - Determinants of Personality 11.2 Personality Theories -Personality and Organisation 11.3 Personality Structure -Personality and Behavior 11.4 Ego State, Johari window- Transactional Analysis	8	3	11,12,13

Reference Books:

1. Principles and Practices of Management- Shejwalkar
2. Essential of management- 7th edition Koontz H & Weirich H TMH
3. Management Today Principles And Practices - Burton & Thakur
4. Mgmt. Principles and Functions - Ivancevich & Gibson, Donnelly
5. Organizational behavior Keith Davis
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