2015-2018

MCA Syllabus

Faculty of Management

Savitribai Phule Pune University

Savitribai Phule Pune University

Syllabus for Masters of Computer Application

For Academic Year 2015-2018

MCA (Part I) From Academic Year 2015-2016
MCA (Part II) From Academic Year 2016-2017
MCA (Part III) From Academic Year 2017-2018

(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. 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.

3. The new Curricula would focus on learning aspect from four dimensions viz. Conceptual Learning, Skills Learning and Practical / Hands on with respect to four specialized tracks viz.
    1. Software and Application Development
    2. Infrastructure and Security Management
    3. Information Management & Quality Control
    4. Networking

4. The M.C.A. Programme will be a full-time three years Master's Degree Course of Computer Applications. In Second year the students will have to choose one of the four specialized tracks. The Institute should conduct sessions for the students to make them aware about the subjects, career prospects in the tracks. Making it easier for them to select one. Once a student selects a TRACK he/she is not allowed to change the track. Thus it is important for the Institute to guide the students for selecting the track.

5. The need for Specialization / Specialized tracks
    - The curriculum is designed to cater to the challenging opportunities being faced in Information Technology.
    - The specialization approach would help students to develop basic and advanced skills in areas of their interest thereby increasing their level of expertise. This would further promote the Masters programme in focused areas and result in development of expert skills as per the demands of career opportunities.
    - The specialization approach may in future be open to more areas of specialization and hence make this programme successful in academia as well as in Industry.
    - The first year of the specialized course has taken into consideration all fundamental areas and aspects of technical and management training required for this programme. A good mix of computer related courses use microcomputers to introduce standard techniques of programming; the use of software packages such as databases and programming languages for developing applications; system analysis and design tools. The general

business courses include the functional areas of management like information systems and decision support systems and engineering aspects of software development.

6. 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.

7. 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.

8. 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.

9. 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. 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.
6. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.
7. 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.
8. Project work can be carried out in the Institute or outside with prior permission of the Institute.
9. 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	27 credits
Semester – II	27 credits
Semester – III	27 credits
Semester – IV	27 credits
Semester – V	27 credits
Semester – VI	25 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.

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

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

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

Cumulative Grade Point Average (CGPA) for the Entire Course

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

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

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

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

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

Table II: Grade Points & Descriptors

O: Outstanding	**Excellent analysis of the topic, (80% and above)** *Accurate knowledge of the primary material, wide range of reading, logical development of ideas, originality in approaching the subject, Neat and systematic organization of content, elegant and lucid style;*
A+ : Excellent	**Excellent analysis of the topic (70 to 79%)** *Accurate knowledge of the primary material, acquaintance with seminal publications, logical development of ideas, Neat and systematic organization of content, effective and clear expression;*
A: Very Good	**Good analysis and treatment of the topic (60 to 69%)** *Almost accurate knowledge of the primary material, acquaintance with seminal publications,logical development of ideas, Fair and systematic organization of content, effective and clear expression;*
B+: Good	**Good analysis and treatment of the topic (55to 59%)** *Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, effective and clear expression*;
B: Above Average	Some important points covered **(50to 54%)** *Basic knowledge of the primary material, logical development of ideas, Neat and systematic organization of content, good language or expression*;
C: Average	Some points discussed **(45 to 49%)** *Basic knowledge of the primary material, some organization, acceptable language or expression*;
P: Pass	Any two of the above **(40 to 44%)**
F: Fail	None of the above **(0 to 39%)**

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

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

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

(XI) Medium of Instruction:

The medium of Instruction will be English.

(XII)Clarification of Syllabus:

It may be necessary to clarify certain points regarding the course. The 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.

MCA SYLLABUS STRUCTURE 2015-2018

SEMESTER I				
Subject Title	**Subject Code**	**CP**	**EXT**	**INT**
1. Fundamentals of Computer	IT11	4	70	30
2. C Programming with Data Structure	IT12	4	70	30
3. Software Engineering	IT13	4	70	30
4. Database Management System	IT14	4	70	30
5. Principles and Practices of Management and Organizational Behavior	BM11	4	70	30
6. Business Process Domains*	BM12	2	-	70
Practical*				
7. C and DS Lab	IT12L	2	-	50
8. DBMS Lab	IT14L	2	-	50
Soft Skills *				
9. Word Power	SS11	1	-	30
Semester I Total Marks			**E**	**I**
		27	**350**	**350**

SEMESTER II				
Subject Title	**Subject Code**	**CP**	**Ext.**	**Int.**
1. Essentials of Operating System	IT21	4	70	30
2. Web Technologies	IT22	4	70	30
3. Core Java	IT23	4	70	30
4. Essentials of Networking	IT24	4	70	30
5. Discrete Mathematics	MT21	4	70	30
6. Essentials of Marketing*	BM21	2	-	70
Practical *				
7. Mini Project using Web Technology	IT22L	2	-	50
8. Core Java Lab	IT23L	2	-	50
Soft Skills *				
9. Oral Communication	SS21	1	-	30
Semester II Total Marks		**-**	**E**	**I**
		27	**350**	**350**

SEMESTER III				
Subject Title	**Subject Code**	**CP**	**Ext.**	**Int.**
COMMON SUBJECT FOR ALL TRACKS FOR SEMESTER III				
1. Probability and Combinatorics	MTC31	4	70	30
2. Multimedia Tools for Presentation*	ITC31	2	-	70
3. Soft Skills-Presentation *	SSC31	1	-	30
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
4. Advanced Data Structure and C++ programming	T1-IT31	4	70	30
5. Design and Analysis of Algorithms (DAA)	T1-IT32	4	70	30
6. Object Oriented Analysis and Design	T1-IT33	4	70	30
7. Advanced Internet Technology	T1-IT34	4	70	30
Practical*				
8. DS & C++ Lab	T1-IT31L	2	-	50
9. Mini Project using AIT	T1-IT34L	2	-	50
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
4. IT Infrastructure Architecture	T2-IT31	4	70	30
5. Data Centre Architecture & Storage Management	T2-IT32	4	70	30
6. Introduction to Information Security	T2-IT33	4	70	30
7. Office Automation Tools	T2-IT34	4	70	30
Practical*				
8. Mini Project on IT Architecture and Information Security	T2-IT31L	2	-	50
9. Office Automation Tools – Lab	T2-IT34L	2	-	50
TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
4. Enterprise Resource Planning	T3-IT31	4	70	30
5. Data Communication & Computer Networks	T3-IT32	4	70	30
6. Data Warehouse, Mining, BI Tools& applications	T3-IT33	4	70	30
7. Information Security & Audit	T3-IT34	4	70	30
Practical*				
8. DCCN Lab	T3-IT32L	2	-	50
9. BI Tools Lab	T3-IT33L	2	-	50
TRACK IV :NETWORKING				
4. Network Administration I	T4-IT31	4	70	30
5. Windows Server Configurations	T4-IT32	4	70	30
6. IT Infrastructure Monitoring	T4-IT33	4	70	30
7. Linux Administration I	T4-IT34	4	70	30
Practical*				
8. Network Administration Lab – I	T4-IT31L	2	-	50
9. Server Configuration Lab (Windows and Linux)	T4-IT32L	2	-	50

SEMESTER IV				
Subject Title	**Subject Code**	**CP**	**Ext.**	**Int.**
COMMON SUBJECT FOR ALL TRACKS FOR SEMESTER IV				
1. Optimization Techniques	ITC41	4	70	30
2. Research Methodology & Statistical Tools*	ITC42	2	-	70
3. Soft Skills -Interview *	SSC41	1	-	30
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
4. Advanced Java	T1-IT41	4	70	30
5. Python programming	T1-IT42	4	70	30
6. Advance DBMS	T1-IT43	4	70	30
7. Cloud Computing	T1-IT44	4	70	30
Practical *				
8. Adv. Java Lab	T1-IT41L	2	-	50
9. Python Programming Lab	T1-IT42L	2	-	50
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
4. Identity and Access Management	T2-IT41	4	70	30
5. IT Advisory Services	T2-IT42	4	70	30
6. Infrastructure Security Audit	T2-IT43	4	70	30
7. Enterprise Solutions Architecture	T2-IT44	4	70	30
Practical *				
8. Identity and Access Management Lab	T2-IT41L	2	-	50
9. Mini Project on IT Advisory Services and Enterprise Solutions Architecture	T2-IT42L	2	-	50
TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
4. E Commerce & Knowledge Management	T3-IT41	4	70	30
5. Cyber Laws & Intellectual Property Rights	T3-IT42	4	70	30
6. Customer Relationship Mgmt& Supply Chain Mgmt	T3-BM43	4	70	30
7. Software Quality Assurance & Control	T3-IT44	4	70	30
Practical*				
8. Mini Project based on CRM & SCM	T3-IT43L	2	-	50
9. Software Quality Assurance Lab	T3-IT44L	2	-	50
TRACK IV :NETWORKING				
4. Network Administration II	T4-IT41	4	70	30
5. Internet of Things	T4-IT42	4	70	30
6. Linux Administration II	T4-IT43	4	70	30
7. Wireless Networks	T4-IT44	4	70	30
Practical*				
8.Virtulization Lab	T4-IT41L	2	-	50
9.Wireless Network Lab	T4-IT44L	2	-	50

SEMESTER V				
Subject Title	**Subject Code**	**CP**	**Ext.**	**Int.**
COMMON SUBJECT FOR ALL TRACKS FOR SEMESTER V				
1. Software Project Management	ITC51	3	70	-
2.Project *	ITC51P	3	-	100
3.Soft Skills - Group Discussion*	SSC51	1	-	30
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
4. ASP .Net using C#	T1-IT51	4	70	30
5. Service Oriented Architecture	T1-IT52	4	70	30
6. Big Data Analytics	T1-IT53	4	70	30
7. Mobile Application Development	T1-IT54	4	70	30
Practical *				
8. Mini Project using ASP .Net	T1-IT51L	2	-	50
9. Mini Project Using Mobile Application Development	T1-IT54L	2	-	50
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
4. Quality verification	T2-IT51	4	70	30
5. Infrastructure Auditing & Implementation	T2-IT52	4	70	30
6. IT Service Management	T2-IT53	4	70	30
7. Digital and e-business Infrastructure and security mechanism	T2-IT54	4	70	30
Practical*				
8. Mini Project on Infrastructure Audit	T2-IT52L	2	-	50
9. Design of digital and e-business infrastructure and security mechanism	T2-IT54L	2	-	50
TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
4.Software Testing & Tools	T3-IT51	4	70	30
5.Entrepreneurship Development	T3-BM52	4	70	30
6.Decision Support System	T3-IT53	4	70	30
7.Business Architecture	T3-IT54	4	70	30
Practical *				
8. CASE Tools Lab	T3-IT51L	2	-	50
9. Activities based on Entrepreneurship Development	T3-BM52L	2	-	50
TRACK IV :NETWORKING				
4. Network Routing Algorithms	T4-IT51	4	70	30
5. Computer and Network Security	T4-IT52	4	70	30
6. Cloud Architectures and Security	T4-IT53	4	70	30
7. Unified Communication	T4-IT54	4	70	30
Practical *				
8. Computer and Network Security – Lab	T4-IT52L	2	-	50
9. Cloud Building within Organization (Deployment of cloud and cloud based applications)	T4-IT53L	2	-	50

SEMESTER VI				
Subject Title	**Subject Code**	**CP**	**Ext.**	**Int.**
COMMON SUBJECTS				
1. Open subject for each TRACK*	ITC61	3	-	70
Practical *				
2. Open subject LAB	ITC61L	1	-	30
3.Project	ITC61P	15	250	-
		6	-	150

* : 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	Two Servers are mandatory [One Linux server & One Windows server] • Windows Server : Microsoft Windows Server for 20 users for intake of 60 students • Linux Server : Fedora/Ubuntu

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

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

Note: NComputing and similar technologies are not recommended

SEMESTER I				
SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
1	IT11	Fundamentals of Computer	30	70
Objective: To give basic knowledge of computer system, it's components and their organization. This will also introduce the basic data representation in the computer.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**Introduction to Digital Computer** 1.1 Concept of Digital Computer 1.2 Types of Software – System software / 1.3 Application software / Utility Software. 1.4 Compilers, Interpreters, Assemblers, Linker, Loader		14	05
2	**Data Representation and Boolean Algebra** 2.1 Binary, Octal, Hexadecimal and their inter-conversion 2.2 1's and 2's complement. 2.3 Binary Arithmetic. & Number Systems – BCD, EBCDIC, ASCII, De-Morgan's Theorem, Duality Theorem, K-Map, Sum of product, Product of Sum, Algebra Rules, Laws, Logic Circuits, NOT,AND, OR, NAND, NOR, XOR, XNOR, Gated diagrams		**15**	06
3	**Combinational Circuits** 3.1 Half / Full Adder 3.2 Decoder / Encoder 3.3 Multiplexer / DeMultiplexer		14	05
4	**Sequential Circuits** 4.1Flip Flops - SR, D, JK, Master – Slave, Edge Triggered D flipflop with timing diagram 4.2 Shift Registers 4.3 Counters, Synchronous & Asynchronous counter, Binary counter, mod-10counter		**14**	05
5	**Memory System** 5.1 Memory Hierarchy 5.2 Primary Memory – DRAM, SDRAM,DDR, RDRAM. ROM, PROM, EPROM, EEPROM 5.3 Cache memory Structure 5.4 DMA, DMA interfacing with processor		15	05
6	**CPU Organization** 6.1 CPU Building Blocks 6.2 CPU Registers, System bus Characteristics, Interface basics with interface block diagram, concept of local bus with name of different local buses (only types) 6.3 Addressing Modes 6.4 Interrupt Concept, Interrupt types 6.5 Instruction and Execution cycle 6.6 Hardwired and Micro Program control 6.7 RISC vs. CISC		28	14

	6.8 Pipelining – Data Path, Time Space Diagram, Hazards		

Reference Books

1. Computer Organization & Architecture Carpinell, Pearson
2. Computer System Architecture Morris Man, Pearson, 3rd Edition.
3. Ad. Computer Architecture Kaithwang, Tata McGraw-Hill.
4. Digital Computer Electronics Malvino, Tata McGraw-Hill,4th Edition
5. Micro Computer Systems Yu Cheng Liu & Glann Gibson
6. Digital Electronics By Bartee, Mc-Graw-Hill
7. Introduction to Digital Computer Design V. Rajaraman & Radhakrishnan, PHI
8. Computer Organization and Architecture W. Stalling, Pearson, 8th Edition
9. Intel Micro Processors Barry Brey, Pearson, 7th Edition
10. Computer Organization & Design Pal Chaudhary,PHI, 3rd Edition
11. Microprocessor Architecture Ramesh Gaonkar, Penram International Publishing, 6th Edition.
12. Computer Architecture & Organization J.P. Hayes, McGraw-Hill,3rd Edition
13. Computer Organization Hemchar, Tata McGraw-Hill,5th Edition
14. Digital Logic and Computer Design Morris Mano
15. An Introduction to Intel Family of Processors -James Antonolcos,Pearson,3rd Edition
16. Foundations of computing 3rd Edition Pradeep K. Sinha & Priti Sinha

Semester I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
2	IT-12	C Programming with Data Structure	30	70

Objective: This is the first programming language subject student will learn. This subject will teach them programming logic, use of programming instructions, syntax and program structure. This subject will also create foundation for student to learn other complex programming languages like C++, Java etc. By the end of the course students will be able to write C and basic DS programs.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	1 **An Overview of C** 1.1 A Brief History of C 1.2 Features & characteristics of C 1.3 Structure of a 'C' Program 1.4 Program Development Life Cycle 1.5 Complier Vs Interpreters 1.6 Compilation & Execution of C Program On DOS& UNIX, Linux	3	1
2	**2 Variables, Data Types, Operator & Expression** 2.1 Character Set , C Tokens - Keywords & Identifiers Constants, Integer, Floating Point, Character, String, Enumeration 2.2 Backslash characters / Escape sequences 2.3 Data Types in C , Variables- Declaration & Definition, User-Defined Type declarations 2.4 Operators & Expressions - Arithmetic, Relational, Logical, Increment , Decrement , Bit wise, Assignment,	5	2

	Conditional, Type conversions in Expressions - Implicit Type Conversion, Explicit Type Conversions 2.5 Precedence & Associability of Operators. 2.6 Built in I/O Functions - Introduction, Console Input & Output functions, Formatted Input & Output (scanf/printf), sprintf & sscanf		
3	**3 Control Statements** 3.1 Introduction 3.2 Selection Statements 3.3 If, Nested if, if….else, else if Ladder 3.4 ternary operator, switch, Nested switch, conditional expression 3.5 Iterative Statements - while loop, do-while loop, for loop, break & continue, 3.6 Jump Statements - Goto & label, 3.7 exit() function 3.8 Compound Statements, Null Statements	5	2
4	**4 Array & String** 4.1 Single Dimension Arrays - Declaration, Initialization, Accessing array Elements, Memory Representation 4.2 Multidimensional Arrays - Declaration, Initialization, Accessing arrayElements, Memory Representation. 4.3 String (character array) - Declaration, Initialization, String Manipulation Functions.	8	3
5	**5 Pointers** 5.1 Introduction- Basics of Pointer, Memory Organization, Application of Pointer, Declaration Of pointer, Initializing Pointer 5.2 Pointer Expressions , De-referencing Pointer Void Pointer, Pointer Arithmetic 5.3 Precedence of &, * operators , Pointer to Pointer, Constant Pointer, 5.4 Pointers and Arrays, Pointers and character string, Array of pointers 5.5 Dynamic Memory Allocation - sizeof(), malloc(), calloc(), realloc(), free()	10	4
6	**6 Function** 6.1 Introduction - Types of functions , Declaration & Definition, Arguments & local variables 6.2 Parameter passing – Call by value & Call by reference 6.3 Passing arrays, strings to functions, Pointers to functions 6.4 Recursion	8	3
7	**7 Structure, Union, Enumeration & typedef** 7.1Structures - Declaration and Initializing Structure, Accessing Structure members, Structure Assignments, Array of Structures, Nested structure, Passing Structure to function, Structure Pointer, typedef keyword 7.2 Unions - Declaration and Initializing Union 7.3 Accessing union members, Difference between Structure & Union, Enumerated data type	12	4
8	**8.Introduction to File Handling** 8.1 Introduction 8.2 Opening a File Closing a File 8.3 Input/Output Operations on Files 8.4 Error Handling During I/O Operation 8.5 Random Access To Files	10	4

9	**9. Searching and Sorting** 9.1 Linear search and Binary search 9.2 Sorting- Selection sort, Insertion sort, Bubble sort	8	4
10	**10 Basics of Data Structure** 10.1 Data Structure 10.2 Implementation of Data Structure	2	1
11	**11 Array as Data Structure** 11.1Storage Representation of Arrays 11.2 Applications of Arrays 11.3 Polynomial Representation Using Arrays Addition of Two Polynomial Multiplication of Two Polynomial 11.4 Sparse Matrices Addition of Sparse Matrices Transpose of a Sparse Matrix	5	2
12	**12 Stack** 12.1 Introduction 12.2 Definition 12.3 Operation on Stack 12.4 Static Implementation of a Stack 12.5 Application of Stack 12.6 Recursion 12.7 Infix, Prefix & Postfix expression	12	5
13	**13 Queue** 13.1 Introduction 13.2 Definition of a Queue 13.3 Operation on a Queue 13.4 Static Implementation of Queue 13.5 Types of Queue - Circular Queue, Priority Queue 13.6 DEQueu e13.7 Application of Queue 13.8 Reversing Stack using Queue	12	5

Reference Books

1. C: The Complete Reference: Herbert Schildt, Tata Mc-Graw Hill, 6th Edition
2. Magnifying C : PHI : Arpita Gopal
3. Let us C Solutions: Y.P. Kanetkar, BPB,10th Edition
4. Spirit Of "C": Moolish Cooper, JAICO.
5. Programming in C : S. Kochan, CBS.
6. C Programming Language: Kernighan & Ritchie, PHI,2nd Edition
7. Programming in C: R. Hutchison.
8. Graphics Under C: Y. Kanetkar, BPB.
9. Programming in ANSI C, E. Balgurusamy, Tata Mc-Graw Hill,5th Edition
10. Data Structures Using C and C++ : Langsam Y, PHI,2nd Ed.
11. Magnifying Data Structures : Arpita Gopal
12. C & Data Structures: Dreamtech publications
13. DS using C : Y.P. Kanetkar
14. www.cplusplus.com
15. www.cprogramming.com

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
3	IT13	Software Engineering	30	70
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**Overview of systems Analysis and design** 1.1 Basic System Development Life Cycle 1.2 Different approaches and models for System Development: Waterfall Prototyping Spiral (including WIN-WIN Spiral) RAD 1.3 Group Based Approach: JAD 1.4 Role & Skills of system Analyst		10	4
2	**Software Requirements Specification Techniques** 2.1 Requirements Anticipation 2.2 Requirements Investigation Fact finding methods 2.3 Requirements Specifications • Software requirement Specification (SRS) • Structure and contents of the requirements Specification • types of requirements - functional and non- functional • Quality criteria, • requirements definition, • IEEE standard SRS format, • Fundamental problems in defining requirements **Case studies on SRS should be covered**		20	8
3	**Information requirement Analysis** 3.1 Decision Analysis Tools Decision Tree, Decision Table, Structured English 3.2 Functional Decomposition Diagram 3.3 Process modeling with Data Flow Diagrams 3.4 Entity Relationship Diagram: Identify Entity &Relationships 3.5 Data dictionary **Case Studies on Decision analysis tools FDDs, DFDs should be covered**		23	9
4	**Designing of Input, Output and Program** 4.1 Design of input & Control Objectives of Input Design, Data Capture Guidelines Design of Source Document, Input Validations 4.2 Design of output Objectives of Output Design Types Of Output 4.3 User Interface design:		15	6

	Elements of good design, Design issues Features of modern GUI, Menus, Scroll bars, windows, buttons, icons, panels, error messages etc. 4.4 Design of program Specification 4.5 Code Design **Case studies should be covered on the above topic**		
5	**Maintenance** 5.1 Types of Maintenance and maintenance cost 5.2 Introduction to legacy systems 5.3 Reverse Engineering Role of documentation in maintenance and types of documentation	10	4
6	**CASE Tools** 6.1 Introduction to CASE tools, 6.2 Types of CASE tools Project Management Tools. Analysis tools, Design tools, Programming tools, Prototyping tools, Maintenance tools, Advantages and disadvantages of CASE Tools	10	4
7	**Current trends in Software Engineering** 7.1 Software Engineering for projects & products. Introduction to Web Engineering and Agile Methodology-Scrum, Extreme Programming	12	5

Reference Books

1. Software Engineering by Pressman, TMH,7th Ed.
2. System Analysis and Design by Jalote,Narosa Pub, 3rd Ed
3. Software Engineering by Sommerville,Pearson,8th Ed
4. Software Engineering by W S Jawadekar,TMH.
5. System Analysis & Design methods by Whiten, Bentley,TMH,7th Ed.
6. System Analysis & Design by Elias Awad, Galgotia Pub,
7. Object Oriented Modeling & Design James Rumbaugh, PHI
8. Analysis & Design of Information System James Senn, TMH, 2nd Ed.
9. Analysis & Design of Information System V. Rajaraman,PHI,3rd Ed.
10. Software Engineering Concepts Richard Fairley,TMH.

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	IT14	Database Management System	30	70
Objective: The concepts related to database, database models, SQL and database operations are covered in this subject. This creates a strong foundation for application database design.				

Sr. No	**Topic Details**	% Weightage	No. of Sessions
1	**Basic concepts** 1.1 Database and Need for DBMS 1.2 Characteristics of DBMS 1.3 Database Users 1.4 3-tier architecture of DBMS (its advantages over 2-tier) 1.5 Views of data-schemas and instances 1.6 Data Independence	5	2
2.	**Data Models** 2.1 **I**ntroduction to various data models – 2.2 Record based & Object based 2.3 Cardinality Ratio & Relationships 2.4 Representation of entities, attributes, relationship attributes, relationship set 2.5 Generalization, aggregation 2.6 Structure of relational Database and different types of keys 2.7 Structure of no-SQL database	13	5
3.	**Relational Model** 3.1 Codd's rules 3.2 Relational data model & relational algebra Relational model concept Relational model constraints Relational Algebra 3.3 Relational database language 3.4 Data definition in SQL, Views and 3.5 Queries in SQL, Specifying constraints and Indexes in SQL, Specifying constraints management systems Postgre SQL / MySQL	15	6
4	**Relational Database design** 4.1 Database Design – ER to Relational 4.2 Functional dependencies 4.3 Normalization Normal forms based on primary keys (1 NF, 2 NF, 3 NF, BCNF, 4 NF, 5 NF) 4.4 Loss less joins and dependency preserving decomposition	**17**	**7**
5	**Transaction And Concurrency control** 5.1 Concept of transaction, ACID properties 5.2 Serializibility 5.3 States of transaction, 5.4 Concurrency control 5.5 Locking techniques 5.6 Time stamp based protocols 5.7 Granularity of data items	**18**	**7**

	5.8 Deadlock		
6	**Crash Recovery and Backup** 6.1 Failure classifications 6.2 storage structure 6.3 Recovery & Atomicity 6.4 Log base recovery 6.5 Recovery with concurrent transactions 6.6 Failure with loss of Non-Volatile storage 6.7 Database backup & recovery from catastrophic failure 6.8 Remote Backup System	15	6
7	**Security and privacy** 7.1 Database security issues 7.2 Discretionary access control based on grant & revoking privilege 7.3 Mandatory access control and role based access control for multilevel security 7.4 Encryption & public key infrastructures	15	6
8	No- SQL Database-Introduction,Types of NOSQL,Need of NoSQL databases, Use Cases	**2**	1

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 Arpita Gopal Excel Books
5. Fundamentals of Database Sysems Elmasri Navathe, 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

Note:

1. PL/SQL to be covered as lab sessions
2. Postgre SQL/ MySQL Lab will be covered as Lab demo sessions.
3. Relational Calculus need not be covered in depth.
4. Case studies on ER diagram, Normalization and SQL should be covered

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	BM11	Principles and Practices of Management and Organizational Behavior	30	70
Objective: The basic management concepts and use of management principles in the organization will be introduced to student through this elaborative subject.				

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Management** 1.1 The need, scope 1.2 Meaning and Definition 1.3 The process of Management 1.4 Managerial levels/Hierarchy 1.5 Managerial functions : Planning , Organizing , Staffing , Directing, Controlling 1.6 Managerial skills : Technical, Conceptual, Human Resource 1.7 Types of managers : Functional, Specialize, Generalize 1.8 Line and staff managers	10	4
2	**Evolution of Management Thought** 2.1 Historical perspective 2.2 Classical Theories : Taylor, Fayol 2.3 Behavioral : HR Approach Behavioral Science and Approach 2.4 Management Science Approach 2.5 System approach-with reference to management, organization and MIS 2.6 Contingency approach	10	4
3	**Managerial Decision Making** 3.1 Introduction 3.2 Decision making environment Open Systems, Closed system Decision making under certainty, under uncertainty, under risk 3.3 Decision Types /models Structured , Unstructured , Programmable &Non programmable Decisions Classical Model Administrative model 3.4 Decision making tools Autocratic, Participative, Consultative, 3.5 Decision Making Tools 3.6 Herbert Simon's Model 3.7 Principle of Rationality / Bounded Rationality	10	4
4	**Organization** 4.1 Introduction -definition 4.2 Need for Organization 4.3 Process of Organizing 4.4 Organizational structure	10	4

	Functional organization, Product Organization, Territorial Organization		
5	**Organizational Behavior** 5.1 Definition / Concepts 5.2 Need /importance/ relevance 5.3 An overview	5	2
6	**Individual Behavior and Understanding Self** 6.1 Ego State 6.2 Transactional Analysis 6.2 Johari Window	10	4
7	**Group and Group Dynamics**	10	4
8	**Team Building**	10	4
9	**Leadership**	8	3
10	**Conflict Management**	10	4
11	**Motivation : Concept, Theory X, Y and Z**	7	3

Important Note: The topics in Units 3,4,5 and 6 should be covered with the help of at-least one exercise each. All topics in Organizational Behavior should be covered with the help of role plays, case studies, simulation, games etc.

Reference Books

1. Principles and Practices of Management Shejwalkar
2. Essential of management 7th edition Koontz H &Weitrich H TMH
3. Management Today Principles And Practices Burton & Thakur
4. Mgmt. Principles and Functions Ivancevich & Gibson, Donnelly
5. Organizational behavior Stepheb Robbins Pearson 13th edition
6. Organizational behavior Keith Davis
7. Organizational behavior Fred Luthans TMH 10th edition
8. Organizational behavior Dr.Ashwatthapa THI 7th edition

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	BM12	Business Process Domains*	70	-

Objectives:

1. To learn & understand the processes and practices in business and their applications
2. To introduce advance business applications like CRM and SCM.
3. To learn the financial aspect of business and management
4. To learn and analyze the financial statements of a business.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Sales & Distribution** 1.1 Sales Budgeting – Market Segments / Customers / Products Sales Analysis (While explaining this application consider an organization manufacturing multiple products with sales outlets spread across the country)**Retail Marketing- New trends – Growth**	7.5	3
2	**Human Resource** 2.1 Employee Database 2.2 Recruitment – Techniques 2.3 Employee Appraisal – Performance, efficiency Leave Accounting and Payroll – Salary calculation and reporting, Income Tax calculation and reporting, Loan Accounting, PF and gratuity, Bonus, Ex-Gratia, Incentive, Super-annuation, Arrears Calculation **E-HR Software: Introduction**	7.5	3
3	**Banking and e-Commerce** Savings Bank Accounting - Real time, **ATM and E-Banking**	7.5	**3**
4	**Supply Chain Management(SCM) –** 4.1 Introduction, Concept, Scope and advantages 4.2 Customer Relationship management (CRM) – Introduction, Concept, Scope and advantages 4.3Forecasting : Demand forecasting and Planning	7.5	3
5	**Financial Accounting** 5.1 Double Entry Accounting system, Concepts and conventions in accounting, Accounting process, Depreciation 5.2 Journal Entries – Rules for Journal entries, posting in a Ledger, subsidiary books, preparation of Trial balance 5.3 Final Accounts – Preparation of Trading and profit and loss, Account and Balance sheet of a Proprietary Firm	30	12

6	**Cost Accounting** 6.1 Scope and Objectives of Cost Accounting – Classification and elements of cost, Advantages of Cost Accounting, Comparison between cost accounting and financial accounting. 6.2 Techniques of Cost Accounting a) Marginal costing, Break-even chart, cost, volume profit analysis b) Standard costing advantages, Variance analysis c) Budgetary Control -Types of budgets and Flexible Budget Vs Fixed Budget, Preparation of Simple cash budget & Flexible budgets 6.3 Concept of Management Accounting – Objectives of Management Accounting, Comparison with Cost accounting	40	16

Reference Books

1. Supply Chain Management - Strategy, Planning & Operation by Sunil Chopra, Peter Meindl, D. V. Kalra, Pearson Education.
2. Management Information Systems by Jaiswal and Mittal, Oxford University Press
3. e-Commerce A Manager's Guide to e-Business by Parag Diwan & Sunil Sharma
4. Personnel/ Human Resource Management by David DeCenzo, Stephen Robbins, Prentice Hall of India,2008, 3rd Edition
5. Human Resource Management by J. John Bernardin, Tata McGraw Hill Publishing, 4thEdition
6. Personnel Management C B Mammoria, Himalaya,29th Ed.
7. Business Applications Dr. Milind Oka, Everest Pub
8. Cost and Management accounting Satish Inamdar,Everest Pub,18th Ed.
9. Management Accounting Dr.Sanjay Patankar
10. Management Accounting Khan and Jain, TMH.

Semester I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	IT-12L	C & DS LAB	50	-

Objective :

To give hands on practice for writing C & DS programs and to inculcate good programming skills.

Assignments:

1. Find Area, Perimeter of Square & Rectangle.
2. Find max. Among 3 nos.
3. Check leap year
4. Factorial of Number
5. Calculate a^b
6. Prime Number.
7. Perfect Number.
8. Armstrong Number.
9. Floyd's Triangle
10. Fibonacci Series
11. Inter conversion of Decimal, Binary & Hexadecimal no.
12. LCM & GCD of numbers
13. Write a program to convert a number into words.
14. Insert & Delete an element at given location in array.
15. Transpose of matrices
16. Multiplication of matrices
17. Display upper & lower diagonal of matrices
18. Array of Structure e.g. student result, Employee pay slip , Phone bill
19. Function with no parameter & no return values
20. Function with parameter & return values
21. Function with parameter & no return values
22. Function with call by reference and return by reference.
23. Function with Default arguments
24. Write an inline function to obtain the largest of three numbers.
25. Recursion function e.g. sum of digit, reverse of digit
26. String manipulation function e.g. string copy, concatenation, compare, string length, reverse
27. Pointer Arithmetic
28. Write program to which gives all rotations of string.
29. Write program to deal with denominations of any amount.
30. Write a program to store the personal information of a person and display it in formatted form.
31. Basic File Handling programs(only text mode) – Displaying the contents of a file, Writing Contents to the file , copying the contents of one file into other.
32. Linear search and binary search in an array of Elements.
33. Selection Sort , Insertion sort, Bubble sort. (Only for Integer array)

Data Structure:

1.Addition and Multiplication of Two Polynomials.
2. Addition and Transpose of Sparse Matrices.
3. Static Implementation of Stack Implementation.
4. Stack Application: Inter conversion of Infix, Prefix & Postfix
5. Stack Application: Palindrome & Matching Parenthesis.
6. Static Implementation of Queue
7. Queue Application: Job Scheduling, Priority Queue, Circular Queue
8.Reversing Stack using Queue

* Note : Only Static implementation of Stack and Queue.

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	IT14L	DBMS Lab *	50	-

Objective :
To develop database handling, data manipulation and data processing skills through SQL & PL/SQL, which will help students to develop data centric computer applications.

Topics

1. Overview of RDBMS, Introduction to Postgre SQL
2. Start, stop and restart PostgreSQL database
3. Introduction of SQL- DDL, DML, DTL, Basic Data Types
4. Create Database, Select Database, Drop Database
5. Create Table, Drop Table, Insert Query, Select Query
6. Operators, Expressions, Where Clause, AND & OR Clauses
7. Update Query, Delete Query, Like Clause, Limit Clause
8. Order By, Group By, With Clause, Having Clause, Distinct Keyword
9. Constraints, Joins, Unions Clause, NULL Values, Alias Syntax
10. Alter Command, Truncate Table, Transactions Locks, Sub Queries, Autoincrement, Privileges
11. Functions: Date & Time, String Functions, Aggregate Functions
12. Postgre SQL Interface: C/C++ / Java/PHP/Python
13. Synonym – introduction, Create, synonym as alias for table & view, drop
14. Sequence- Introduction, alter sequence, drop
15. View- Introduction, types, alter , drop
16. Index - Introduction, types, alter, drop
17. Primary introduction to DBA-User create, alter User,Grant,Revoke
18. Report writer using SQL Title, Btitle, skip, pause, column, SQL, Break on, computer sum
19. PL/SQL - Introduction of PL/SQL,Advantages of PL/SQL,Support of SQL, Executing PL/SQL
20. PL/SQL character set & Data Types
21. PL/SQL blocks Attribute % type, %rowtype, operators
22. Control structure Condition – if Interactive- loop, for, while Sequential – goto
23. Procedures- Definition, creating, Parameter
24. Function-Definition, creating, Parameter
25. Cursor- types
26. Database Triggers- Definition, syntax, parts of triggers ,Types of triggers, enabling & disabling triggers

Reference Books:

1. PostgreSQL by Korry Douglas, Susan Douglas ISBN #0735712573, New Riders
2. PostgreSQL Essential Reference by Barry Stinson ISBN #0735711216, New Riders
3. Beginning Databases with PostgreSQL by Richard Stones, Neil Matthew ISBN #1861005156, Wrox Press Inc
4. Practical PostgreSQL John C. Worsley, Joshua D. Drake ISBN #1565928466, O'Reilly

SEMESTER I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	SS11	Soft Skill – Word Power*	30	-

Objective :
To improve the vocabulary of English and competency for business English. Use of language lab / English learning tools such as mobile apps like Sling etc. are also encouraged and lot of listening practice, reading and understanding exposure should be given to the students. Interested students may appear for Cambridge English exam after completion of 1st year.

Reference Books:

1. Essential English Grammar – Raymond Murphy- Cambridge University Press
2. Cambridge IELTS – Cambridge University Press
3. Murphy's English Grammar - Raymond Murphy- Cambridge University Press
4. Speaking English Effectively - Krishna Mohan/N.P.Singh-Macmillan
5. English Conversation Practice - Grant Taylor-The McGraw-Hill Companies

SEMESTER II

SEMESTER II

Sr. No.	Subject Code	Subject Title	Internal	External
1	IT21	Essentials of Operating system	30	70

Objective : To Learn and understand the fundamentals of Operating systems

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction** 1.1 OS Definition, features and functionalities 1.2 Logical View , User View, 1.3 Concept of System Calls & System Programs (Only concept) 1.4 Concept of OS structure 1.5 Concept of Virtual Machine	10	4
2	**Process Management** 2.1 Process Concept 2.2 Process Control Block 2.3 Process operations : Create, Kill, suspend, resume, wakeup, 2.4 Interprocess Communication, IPC types 2.5 IPC in Client-Server, RTOS	**15**	**6**
3	**CPU Scheduling** 3.1 Scheduling Concept 3.2 Scheduling Criteria 3.3 Scheduling algorithms 3.4 Numerical exercise based on algorithms 3.5 Scheduling Evaluation 3.6 Simulation Concept	**15**	**6**
4	**Process Synchronization &Deadlock** 4.1 Synchronization concept 4.2 SynchronizationRequirement 4.3 Critical Section Problem & Solutions 4.4 Monitors 4.5 Deadlock concepts 4.6 Deadlock prevention & avoidance with single instance and multiple instances of resources 4.7 Deadlock Detection with single instance and multiple instances of resources 4.8 Numerical exercise based on Deadlock 4.9 Deadlock Recovery	**20**	**8**
5	**Memory Management** 5.1 Concept 5.2 Memory Management Techniques 5.3 Contiguous & Non Contiguous allocation 5.4 Logical & Physical Memory 5.5 Conversion of Logical to Physical address 5.6 MFT and MVT with search algorithms 5.7 Numerical exercise based on search algorithms 5.8 Paging, Segmentation	**20**	**8**

	5.9 Numerical exercise based on logical to physical address conversion using Paging and segmentation. 5.10 Segment with paging 5.11 Virtual Memory Concept 5.12 Demand paging Page Replacement algorithm with numerical exercises Allocation of Frames 5.13 Thrashing		
6	**File management** 6.1 File Structure 6.2 Protection 6.3 FILE system Implementation 6.4 Directory structure 6.5 Free Space Management 6.6 Allocation Methods 6.7 Efficiency & Performance 6.8 Recovery	**10**	**4**
7	**Disk Management** 7.1 Disk Structure 7.2 Disk Scheduling algorithm 7.3 Numerical exercise based on Disk algorithms 7.4 Disk management 7.5 Swap Space concept and Management 7.6 RAID structure 7.7 Disk performance issues	**10**	**4**

Reference Books

1. Operating System : Achyut Godbole,TMH,2nd Ed.
2. Operating System : Galvin,Wiley,8th Ed.
3. System Programming & OS : D.M. Dhamdhere, TMH,2nd Ed.
4. Red Hat Bible Core Fedora Linux : Christopher Negus (Wiley Pub.)
5. Operating System : Andrew Tanenbaum, PHI,3rd Ed.

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
2	IT22	Web Technologies	30	70

Objectives:
This course enables students to understand web page site planning, management and maintenance. The course explains the concepts of developing advanced HTML pages with the help of frames, scripting languages, and evolving technologies like DHTML.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**HTML** 1.1. Introduction To HTML, WWW, W3C, Common HTML 1.2. Tags and attributes, Ordered & Unordered Lists, 1.3. Inserting image 1.4. Client server image mapping 1.5. Text and image links 1.6. Tables 1.7. Frames 1.8. Forms 1.9. Introduction with text box, text area, buttons, List box, radio, checkbox etc.	25	10
2	**CSS** 2.1 Introduction to Style Sheet 2.2 Types of style Sheets 2.3 Inline, External, Embedded CSS. 2.4 CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display properties 2.5 Use of Id & classes in CSS 2.6 use of & 2.7 Introduction of CSS3 : Gradients, Transitions, Animations, multiple columns	20	5
3	**Javascript** 3.1 Concept of script, Types of Scripts,Introduction to javascript 3.2 Variables, identifiers constants in javascript and examples of each. 3.3 Operators in javascripts, various types of javascript operator 3.4 Examples on javascript operators, 3.5 Control and looping structure, examples on control and looping structures (if, if…else, for, while, do while, switch, etc….) 3.6 Concept of array, how to use it in javascript , types of an array, examples 3.7 Methods of an array, examples on it. 3.8 Event handling in javascript with examples 3.9 Math and date object and examples on it. 3.10 String object and examples on it, and some predefined functions 3.11 DOM concept in javascript, DOM objects	30	15

	3.12 Window navigator, History object and its methods, 3.13 Location object with methods and examples 3.14 Validations in javascript , examples on it..		
4	**ASP** 4.1 Introduction to ASP 4.2 How to install IIS 4.3 ASP syntax ,variables,procedures 4.4 ASP Forms 4.5 ASP Session and Cookies 4.6 ASP Global.asa 4.7 ASP Objects- Request,Response,Application,Server. 4.8 ASP Database related operations –Insert ,Retrive,Update,Delete. Programs on Database related operations	25	10

Reference Books

1. Complete reference HTML, TMH,
2. JavaScript Bible, Wiley Pub.
3. HTML, DHTML, JavaScript, Perl & CGI Ivan Bayross, BPB Pub
4. VB Script Programmer' s reference by Wrox Press
5. Programming the World Wide Web by Robert W. Sebesta
6. Web enabled Commercial Application Development using HTML, DHTML
7. VBScript Programmers reference wrox Press
8. VBScript in Nutshell

Reference Sites:

1. http://www.w3schools.com
2. www.devguru.com

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
3.	IT23	Core Java	30	70

Objective:
To enable the students to understand the core principles of the Java Language and use visual tools to produce well designed, effective applications and applets

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Fundamentals of OOP** What is OOP Difference between Procedural and Object oriented programming Basic OOP concept - Object, classes, abstraction, encapsulation, inheritance, polymorphism	**5**	2
2	**Introduction to JAVA** History of Java Features of Java Difference between C++ & JAVA JDK Environment Java Virtual Machine Java Runtime environment	2.5	1
3	**Programming Concepts of Basic Java** Identifiers and Keywords Data Types in Java Java coding Conventions Expressions in Java Control structures, decision making statements Arrays and its methods Garbage collection & finalize() method	5	2
4	**Java classes** Define class with instance variables and methods Object creation of class Accessing member of class Argument passing Constructors Method overloading static data, static methods, static blocks this keyword Nested & Inner classes Wrapper Classes String (String Arrays, String Methods, StringBuffer)	10	4

5	**Inheritance** Super class & subclass Abstract method and classes Method overriding final keyword super keyword Down casting and up casting Dynamic method dispatch	10	4
6	**Packages and Interfaces** Importing classes User defined packages Modifiers & Access control (Default, public, private, protected, private protected) Implementing interfaces User defined interfaces Adapter classes	10	4
7	**Exception handling** Types of Exceptions try, catch, finally, throw, throws keywords Creating your own exception Nested try blocks Multiple catch statements User defined exceptions	7.5	3
8	**Java Input Output** Java IO package File Class Byte/Character Stream Buffered reader / writer File reader / writer Print writer File Sequential / Random Serialization and de serialization	7.5	3
9	**Multithreading** Multithreading Concept Thread Life Cycle Creating multithreading Application Thread Priorities Thread synchronization Inter thread communication	10	4
10	**Abstract Window Toolkit** Components and Graphics Containers, Frames and Panels Layout Managers a. Border Layout b. Flow Layout c. Grid Layout	10	4

	d. Card Layout AWT all Components Event Delegation Model e. Event Source and Handlers f. Event Categories, Listeners, adapters Anonymous Classes		
11	**Applets** Applet life cycle Creating applet Displaying it using Web Browser with appletwiewer.exe The HTML APPLET Tag with all attributes. Passing Parameters to applet Event handling in applet Advantages and Disadvantages of Applet Vs Applications	5	2
12	**Swing** Features of swing Model view Controller design pattern Swing components JButton, JRadio Button, JtextArea , JComboBox, JTable, JProgressBar, JSlider ,J Dialog	5	2
13	**Java Collection Framework** Collections Overview The Collection Interfaces a. Collection Interface, List Interface, Set Interface, b. Sorted Set Interface c. The Collection Classes d. Array List Class, Linked List Class, Hash Set Class, Tree Set Class e. Accessing a Collection via an Iterator The Map Interfaces f. Map Interface, Sorted Map Interface g. The Map Classes h. Hash Map, Tree Map The Legacy Interfaces i. Enumeration Interface **j.** The Legacy Classes Vector , Stack Hash table	12.5	5

Reference Books

1. Just Java by Peter Van der Liden
2. OOP with Java An ultimate Tutorial by Jaffry A Borror,
3. Java 6 Programming Black Book By Kogent Solution Inc, dreamTech Pub
4. Core Java 2 Volume - I Cay S Horstmann, Fary Cornell, Sun Microsystems Press
5. Core Java 2 Volume - II Cay S Horstmann, Fary Cornell, Sun Microsystems Press
6. Programming with Java, A Primer E.Balguruswami, McGraw-Hill, 4th Ed.
7. Object oriented programming with java, Essentials and applications ,Mc Graw Hill publications, RajkumarBuyya, S ThamaraiSelvi, Xingchen Chu
8. A programmer's Guide to java SCJP certification, Pearson,Khalid A. Mughal, Rolf W. Rasmussen.

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4.	IT24	Essentials of Networking	30	70

Objective:
To learn and understand fundamentals of computer network , network architectures, protocols and applications

Sr. No	**Topic details**	*% Weightage*	**No. of Sessions**
1	**Introduction:** What is a Computer communication, communication system, Signal and Data, Channel Characteristics, Transmission Modes, Synchronous and asynchronous transmission. Transmission Media: a)Guided Media – Twisted Pair, Coaxial and Fiber-optic cables, b)Unguided Media: Radio, VHF, Micro Waves and Satellite Multichannel Data Communication: Circuits, channels and multichanneling Multiplexing: FDM, TDM, CDM and WDM	12	5
2	**Common Network Architecture** Connection oriented N/Ws vs Connectionless N/Ws Peer to peer networks X.25 networks Ethernet (Standard and Fast): frame format and specifications Wireless LANs - 802.11(Architecture, issues, features etc.), 802.11x	13	5
3	**The OSI Reference Model** Protocol Layering ISO/OSI reference Model TCP/IP Model OSI vs.TCP/IP	13	5
4	**Local Area Networks** Components & Technology, Access Technique, Transmission Protocol & Media	7	3
5	**Broad Band Networks** Integrated Service Digital Networks (ISDN), Broad Band ISDN, ATM and ATM Traffic Management Very Small Aperture Terminal (VSAT)	10	4

6	**IP Addressing & Routing** IP addresses – Network part and Host Part Network Masks, Network addresses and Broadcast addresses, Address Classes, Loop back address, IP routing concepts, Routing Tables, Stream & Packets Sliding Windows Role and Features of IP, TCP TCP Connections types and working. IPV6: The next generation Protocol	25	10
7	**Application Layer**: Domain Name System (DNS) and DNS servers, Electronic Mail: Architecture and services, Message Formats, MIME, message transfer, SMTP, Mail Gateways, Relays, Configuring Mail Servers, File Transfer Protocol, General Model, commands World Wide Web: Introduction, Architectural overview, static and dynamic web pages, WWW pages and Browsing, HTTP	20	8

Reference Books

1.Computer Networks Andrew S. Tanenbaum, Pearson,5th Ed
2. Data Communications and Networking Behrouz A. Forouzan , TMH,4th Ed.
3. Cryptography and Network Security AtulKahate , TMH, 2nd Ed.
4. Network Essential Notes GSW MCSE Study Notes
5. Internetworking Technology Handbook CISCO System
6. Computer Networks and Internets with
7. Internet Applications Douglas E. Comer
8. Cryptography and Network Security William Stalling

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	MT21	Discrete Mathematics	30	70
Objective: This is the first mathematics subject which revises the knowledge acquired previously by the student. Logic, Relations and Functions, Algebraic Functions and Graph Theory will be introduced in this course.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**MATHEMATICAL LOGIC** Propositions (Statements), Logical connectivity's, $\neg, \wedge, \vee, \rightarrow, \leftrightarrow$, Compound statements form, truth tables, tautology, implications and equivalence of statements forms logical identities. Normal forms: disjunctive normal form and, simplification. Conjunctive normal form, logical implications, valid arguments, methods of proof. Theory of inference of statement calculus, predicate calculus, qualifiers free and bound variables, theory of inference of predicate calculus.		30	13
2	**RELATIONS AND FUNCTIONS** Relation defined as ordered n-tuple, Unary, binary, ternary, n-ary, Restrict to binary relations, Complement of a relation, converse Relation, compositions, matrix representation and its properties, Graphical representation of relation –Digraphs Properties of binary relation –Reflexive, irreflexive, symmetric, Asymmetric, transitive, Equivalence, equivalence classes, partitions, covering, compatible relation, maximal compatibility block, transitive closure– Warshall's algorithm. Partial ordering relation – Hasse diagram, minimal elements, upper bound , lower bound, definitions Functions – definitions, Partial function, hashing functions, characteristic functions, floor functions, ceiling functions, surjective, injunctive and bijective functions, Inverse functions, Non-denumerable sets.		20	7
3	**ALGEBRAIC STRUCTURES** Operations on sets – Unary, binary, ternary. Definitions of algebraic systems(Restrict to binary operations). Properties – closure, idempotent, communicative, associative, commutative, identity, inverse. Semigroup, sub-semigroup, Monoid, sub-monoid group, abelian group, permutation group, multiplicative abelian group, cyclic group Subgroups: Cosets, right cosets, left cosets, normal subgroups, quotient groups, isomorphism, homomorphism. Group codes: Weight and Hamming distance, minimum distance		20	7

	of code , generation of codes using parity checks – even parity, odd parity , parity check matrix – Hamming code, for detection and correction errors , formation of encoding function, decoding, Application of residue –arithmetic to computers group codes.		
4	**GRAPH THEORY** Basic terminology, simple and weighted graph, adjacency and incidence, hand-shaking lemma, underlying graph of a digraph, complete graph, regular graph, bipartite graph, complete bipartite, Isomorphism, complement of graph, connected graphs, paths-simple, elementary, circuit – simple, elementary Edge connectivity, vertex connectivity, Eulerian path and Eulerian circuit, planar graph – regions Euler's formula Trees : Definition – leaf, root, branch node, internal node, Rooted and binary trees, regular m-ary tree	30	13
Reference Books			
1. Discrete Mathematical Structures for Computer S Science by Kolman B and Bushy R 2. Discrete Mathematical Structures with applications to Computer Science by Tremblay and Manohar 3. Discrete Mathematics by C L Liu 4. Discrete Mathematics by Rosen			

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	BM 21	Essentials of Marketing	70	-

Objectives:

1. To make students understand the essentiality of Marketing in business Environment.
2. To comprehend the functionalities of Marketing and IT enabled practices for organizations

Sr. No	**Subject Topic details**	*% Weightage*	**No. of Sessions**
1	**Marketing : Introduction** 1.1 Definitions, Scope , Core concepts of marketing such as Need, Want, Demand, Customer Value, Exchange, Customer & Consumer, Customer Satisfaction, Customer Delight, Customer Loyalty, Marketing v/s Market 1.2 **Markets:** Definition of Market, Competition, Key customer markets, Marketplaces, Market spaces, Metamarkets 1.3 **Company Orientation towards Market Place:** Product, Production, Sales, Marketing, Societal, Transactional, Relational, Holistic Marketing Orientation. Selling versus Marketing, e-marketing	15	6
2	**Marketing Mix:** 2.1 Concept of Marketing Mix 2.2 7Ps of Marketing (People, Processes & Physical Evidence)	15	6
3	**Consumer Behaviour** 3.1 Definition & importance of consumer behavior, 3.2 Comparison between Organizational Buying behavior and consumer buying behaviour, 3.3 Buying roles, 3.4 Steps buyer decision process	20	8
4	**Segmenting and Targeting Online Customers:** 4.1 Business – Government and Customer Markets, 4.2 Geographic segments for E-Marketing, Demographic segments, Psychographic segments, Behavior segments, Targeting online customers. **4.3 Differentiation and Positioning Strategies** Product – Service – Personnel – Channel and Image differentiation. 4.4 Differentiation Strategies – site atmospherics, making the intangible tangible, building trust,	20	8

	efficient and timely order processing, pricing, customer experience.		
5	**E-Marketing:** **5.1 Product Mix** Product, Creating Customer Value online, Product benefits, Enhanced product development, **5.2 Price:** Buyers & sellers perspectives, Pricing strategies, Distribution System	20	8
6	Cases/ Marketing Plans/ Mix, e- marketing	10	4

Note: Formulation of Marketing Mix and e-marketing plans should be prepared in a group of 5 students. Presentation of those plans to be carried out in the class hours so as to create interest between students.

Reference Books

1. Marketing Management: A South Asian Perspective, 14th Edition(English),Philip Kotler, K. Keller, Abraham Koshy and Mithileshwar Jha
2. Marketing Management by S A Sherlekar
3. E- Marketing by Judy Strauss, Adel Ansary, Raymond Frost, Prentice Hall
4. Digital Marketing for Dummies by Carter-Brooks-Catalano-Smith
5. Guide to E-Marketing by Prasad Gadkari
6. e-Service-New Directions in Theory & Practice by Roland T. Rust and P.K. Kannan

http://www.marketingteacher.com
http://www.emarketingstrategiesbook.com/

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	IT22L	Mini Project using Web Technology *	50	-

Objective: Student should able to develop a small dynamic web application.

A small dynamic web application will be developed by the students using knowledge of HTML, DHTML, JavaScript and ASP.

SEMESTER II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	IT23L	Core Java Lab *	50	-
Objective : This lab work will provide hands on practice to student to enhance their Java Programming Skills. Assignments on Java concepts such as Interfaces, Packages, Exception Handling, Applet, multithreading, Abstract Windows Toolkit, Java Input Output & Java collection can be included.				

Semester II				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	SS21	Soft Skill - Oral Communication*	30	-
Objectives: To enhance the verbal communication of students. To focus on conversation with colleagues, Dialogues with Higher authorities. To focus on Formal and Informal Conversation, etiquettes				

Internal [30] Marks Breakup	
Unit Test Marks	5
Prelim Marks	5
Assignment	5
Presentations/Case-Study/Group Activity/Oral	10
Attendance	5
Total Marks	**30**

Practical[50] Marks Breakup	
Practical Hands on	40
Viva-voce	5
Assignments	5
Total Marks	**50**

Note :

Guidance should be given to students for selecting a track before the start of the semester III by conducting expert sessions for the tracks which are offered by the Institute. The Institute should assist the student for selecting the tracks based on their subject strengths.

Reference Books :

1. Careers in Information Technology By Christine Wilcox
2. Global Success @ IT Careers By Dr. Deepak Shikarpur, Dr. Deepali Sawai
3. Excellence in IT –Achieving Success in an Information Technology Career By Warren C. Zabloudil

SEMESTER III

COMMON SUBJECTS FOR SEMESTER III

Sr. No.	Subject Code	Subject Title	Internal	External
1	MTC31	Probability & Combinatorics	30	70

Objectives:

i. Count similar things in sophisticated ways.
ii. Understand the mathematical underpinnings of probability.
iii. Use probability theory to solve interesting problems.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**COUNTING PRINCIPLES** 1.1 Addition and Multiplication Principles 1.2 Permutations of n Objects, Circular Permutation, Permutation with repetitions 1.3 Combinations and combinatorial identities 1.4 Binomial and Multinomial Theorems and its applications	10	4
2	**PRINCIPLE OF INCLUSION AND EXCLUSION** 2.1 Principle of Inclusion and Exclusion 2.2 Derangements – Nothing in its right place 2.3 Non-negative integer solutions to linear equations	15	6
3	**INTRODUCTION TO PROBABILITY** 3.1 Trials, Events, Sample Space – Types and Examples 3.2 Mathematical Probability, Axioms of Probability, Some elementary theorems in probability 3.3 Independent and Dependent Events, Conditional Probability 3.4 Baye's Theorem	15	6
4	**RANDOM VARIABLES AND MATHEMATICAL EXPECTATION** 4.1 Random Variable – Discrete and Continuous 4.2 Probability Distribution of a Random Variable, Probability Mass Function, Probability Density Function, Distribution Functions 4.3 Mathematical Expectation of Probability Distribution, Theorems, Calculation of Mean and Variance using Mathematical Expectation 4.4 Moment Generating Functions and Cumulant Generation Functions 4.5 Concept of Bivariate Random Variable, Discrete and Continuous Bivariate Random Variables with examples	20	8
5	**SPECIAL DISCRETE PROBABILITY DISTRIBUTIONS** 5.1 Bernoulli Distribution 5.2 Binomial Distribution 5.3 Poisson Distribution 5.4 Calculation of Mean and Variance of above distributions by – Expectation, MGF, CGF. 5.5 Special properties of above distributions.	20	8
6	**SPECIAL CONTINUOUS PROBABILITY DISTRIBUTIONS** 6.1 Uniform Distribution 6.2 Normal Distribution 6.3 Laplace Distribution 6.4 Calculation of Mean and Variance of above distributions by –	20	8

	Expectation, MGF, CGF 6.5 Special properties of above distributions.		

Reference Books

1. Discrete Mathematics by C L Liu
2. Discrete Mathematics by Rosen
3. Probability & Random Process by T. Veerarajan
4. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor
5. Statistical Methods by S. P. Gupta

COMMON SUBJECTS FOR SEMESTER III				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
2	ITC31	Multimedia Tools for Presentation*	70	-

Objective :
To Learn and understand various multimedia tools and software to make the presentation effective
The Institute can decide the Tools / Software to teach the subject. More assignments, case studies should be taken.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Content Management And Disseminations** E-learning – Models WBT, CBT, Virtual Campus, LMS & LCMS, Video Conferencing, Chatting Bulleting, Building Online Community, asynchronous/ Synchronous Learning, Case Study	25	10
2	Creating contents using PowerPoint Presentation, Flash, Adobe Photoshop, Adobe Presenter 9	20	8
3	Open Source Tools- like Prezi, Empressr, Present.me	25	10
4	**Creating Online Courses Using Moodle** Planning and designing online training materials, Installing the Moodle LMS platform software, Adding media features to online courses, Each learner will be responsible to creating on online course with explores a subject area and offer features like automatic quizzes and tests, topic discussion areas, media players, etc	30	12

Reference Sites:

1. www.prezi.com
2. www.empressr.com
3. www.moodle.org

Note: Use of hands on sessions are expected.

COMMON SUBJECTS FOR SEMESTER III				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
3	SSC31	Soft Skill – Presentation*	30	-
Objective: Non verbal communication-Personal appearance-Posture- Gestures-Facial expressions-Eye contact-Space distancingBusiness Presentations: Preparing successful presentations, Planning for audience Making effective use of visual aid, Delivering presentation, using prompts, dealing with questions and interruptions, Mock presentations. Effective usage of Tools (MS PowerPoint)				
Reference Books:				
1. Business Communication By Asha Kaul, Prentice- Hall of India, Pvt.Ltd, New Delhi. 2. Developing Communication skills By Krishna Mohan/Meera Banerji, Macmillan India Ltd. 3. Communication Skills By Leena Sen-PHI Learning Pvt Ltd.New Delhi				

SEMESTER III TRACK 1 : SOFTWARE & APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T1-IT31	Advanced Data Structure and C++ programming	30	70
Objective: By the end of the course students will be able to write **C++ as well as DS programs with CPP** using advanced language features, utilize OO techniques to design C++ programs, use the standard C++ library, exploit advanced C++ techniques.				

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Basics of C++** 1.1 A Brief History of C & C++ , C Vs C++ 1.2 A Simple C++ Program , Application of C++ 1.3 Structure & Class, Compiling & Linking	5	2
2	**C++ Expression** 2.1Tokens, Keywords, Identifiers & Constants 2.2 Basic Data Types, User-Defined Data Types 2.3 Symbolic Constant, Type Compatibility 2.4 Reference Variables, Operator in C++ 2.5 Scope Resolution Operator, Member De-referencing Operators, Memory Management Operators, Manipulators, Type Cast Operator	5	2
3	**Functions In C++** 3.1 The Main Function, Function Prototyping 3.2 Call by Reference, Call by Address, 3.3 Call by Value, Return by Reference 3.4 Inline Function, Default Arguments 3.5 Const Arguments, Function Overloading, 3.6 Friend Function	**3**	2
4	**Classes & Objects** 4.1 A Sample C++ Program with class, Access modifiers 4.2 Defining Member Functions, Making an Outside	7	4

	Function Inline 4.3 Arrays within a Class 4.4 Memory Allocation for Objects 4.5 Static Data Members, Static Member 4.6 Functions, Arrays of Objects 4.7 Object as Function Arguments 4.8 Friend Functions, Returning Objects, Const member functions 4.9 Pointer to Members, Local Classes 4.10 Constructor - Parameterized Constructor, Multiple Constructor in a Class , Constructors with Default Arguments 4.11 Destructor		
5	**Operator Overloading & Type Conversion** 5.1 Defining operator Overloading 5.2 Overloading Unary Operator, Overloading Binary Operator, Overloading Binary Operator Using Friend function. 5.3 Manipulating of String Using Operators 5.4 Type Conversion 5.5 Rules for Overloading Operators	10	4
6	**Inheritance & Polymorphism** 6.1 Defining Derived Classes 6.2 Types of Inheritance-Single, Multilevel, Hierarchical, Multiple Inheritance, Hybrid Inheritance 6.3 Virtual Base Classes, Abstract Classes 6.4 Constructor in Derived Classes 6.5 Nesting of Classes 6.6 Pointer to Derived Class 6.7 Virtual Function	10	4
7	**The C++ I/O System Basics** 7.1 C++ Streams, C++ Stream Classes 7.2 Working with Files – Introduction 7.3 Classes for File Stream Operation , Opening & Closing Files 7.4 Detection of End of File , More about Open( ): File modes 7.5 File pointer ,Sequential Input & output Operation **7.6** Updating a File : Random Access, Command Line Arguments	10	4
8	**Exception handling** 8.1 Exception Handling Fundamentals 8.2The try Block, the catch Exception Handler 8.3 The try/throw/catch sequence 8.4 Uncaught Exception	6	2
9	**Fundamentals of DS with CPP** 9.1 Stacks 9.2 Queues 9.3 linked lists	8	3
10	**Tree**	12	5

	10.1 Tree Terminology 10.2 Binary Tree 10.3 Binary Tree Representation 10.4 Binary Search Tree (BST) Creating a BST 10.5Binary Search Tree Traversal Preorder Traversal Inorder Traversal Postorder Traversal		
11	**Binary Threaded Tree** 11.1 AVL tree 11.2 B tree Introduction to B tree Insertion in B tree Deletion from B tree Introduction to B+, B* tree 11.3 Expression Tree 11.4 Threaded Binary Tree	14	4
12	**Graph** 12.1 Introduction 12.2 Graph Representation Adjacency Matrix Adjacency List 12.3 Graph Traversals Depth First Search Breadth First Search 12.4 Applications of Graph	10	4

Note : As OOP concepts are covered earlier in Java, more emphasis need to be given on concepts not covered in Java.

Reference Books

1. C++: The Complete Reference Herbert Schildt,TMH,5th Ed
2. Let us C++ by Kanetkar,BPB,2nd Ed
3. Object Oriented Programming with C++ by E. Balagurusamy,TMH,4th Ed.
4. C++ Primer by Stanley Lippman & Lajoi,Pearson,3rd Ed
5. C++ Programming Language by Bjarne Stroustrup, Pearson, 3rd Ed.
6. C++ Programming by Bible Al Stevens & Clayton Walnum, Wiley Pub.
7. Data Structures Using C and C++ by Langsam Y, PHI,2nd Ed.
8. The Essence of Data Structures using C++ by Brownesy,Kan
9. Magnifying Data Structures by Arpita Gopal
10. Data Structures Using C ++ by Malik D S
11. Data Structures in C ++ by Kutty N.S., Padhye P.Y.
12. Practical Approach to Data Structures by Hanumanthappa
13. Data Structure Using C++ by Kasiviswanath N.
14. Principles of Data Structures Using C and C++ by Das Vinu V.
15. Data Structure and Algorithms in C++ by Joshi Brijendra Kumar

16. Data Structures and Algorithms in C++ by Drozdek Adam
17. Data Structures Using C++ by Malik D S, CENGAGE Learning Pub.
18. Data Structures with C++: Schaums Outlines by Hubbard John
19. Data Structure through C++ by Y.P. Kanetkar, BPB,2nd Ed.
20. Fundamental of DS using C++ by Horowitz Sahani, Galgotia pub.
21. DS using C++ by Abhyankar

SEMESTER III
TRACK 1 : SOFTWARE & APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
5	T1-IT32	Design And Analysis of Algorithm	30	70

Objective: To understand and learn advance algorithms and methods used in computer science to create strong logic and problem solving approach in student..

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction** 1.1 Algorithm, analysis 1.2 Time complexity and space complexity 1.3 O-notation, Omega notation and Theta notation	10	4
2	2.1 Heaps and Heap sort 2.2 Sets and disjoint set 2.3 Union and find algorithms. 2.4 Sorting in linear time. 2.5 Tower of Hannoi	12.5	5
3	**Divide And Conquer** 3.1 Divide and Conquer 3.2 General Strategy 3.3 Exponentiation. Binary Search 3.4 Quick Sort 3.5 Merge Sort	10	4
4	**Greedy Method** 4.1 General Strategy, Knapsack problem 4.2 Job sequencing with Deadlines 4.3 Optimal merge patterns 4.4 Minimal Spanning Trees 4.5 Dijkstra's algorithm.	17.5	7
5	**Dynamic Programming** 5.1 General Strategy 5.2 Multistage graphs 5.3 OBST, 0/1 Knapsack 5.4 Traveling Salesperson Problem 5.5 Flow Shop Scheduling	15	6
6	**Backtracking** 6.1 Backtracking: General Strategy 6.2 N- Queen's problem 6.3 Graph Coloring	15	6

	6.4 Hamiltonian Cycles, 0/1 Knapsack		
7	**Branch and Bound** **7.1** General Strategy, 0/1 Knapsack **7.2** Traveling Salesperson Problem	12.5	5
8	**NP-HARD AND NP-COMPLETE PROBLEMS** Basic concepts, of NP-Hard And NP-Complete Problems (Only concepts should be covered)	7.5	3

Reference Books

1. Bressard, "Fundamental of Algorithm." PHI
2. Horowitz/Sahani, "Fundamentals of computer Algorithms", Galgotia.
3. Magnifying Data Structures, Arpita Gopal : PHI Publications
4. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" PHI
5. A. V. Aho and J.D. Ullman, "Design and Analysis of Algorithms", Addison Wesley

SEMESTER III
TRACK 1: SOFTWARE AND APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
6	T1-IT33	Object Oriented Analysis And Design	30	70

Objectives:

After completing this course students will be able to: Understand the issues involved in implementing an object-oriented design, Analyze requirements and produce an initial design. Develop the design to the point where it is ready for implementation. Design components to maximize their reuse. Learn to use the essential modeling elements in the most recent release of the Unified Modeling Language.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction** 1.1 Two views of software Developments: SSAD and OOAD. Why Object –Orientation? **The Object Paradigm** 1.2 Object and classes 1.3 Abstraction and encapsulation 1.4 Methods and Message 1.5 Interfaces, Inheritance and Polymorphism 1.6 Access Control	7	3
2	**Introduction to UML & Modeling** 2.1 Review of the object Oriented Methodologies by Booch, Rumbaugh, Cood Yourdon, Ivar Jacobson 2.1 Unified Approach : Diagramming and Notational Techniques using the UML 2.2 UML Diagrams and software Development Phases	7	4
3	**Object-Oriented Systems DevelopmentProcess** 3.1 Rational Unified Process 3.2 Four Major phases:- Inception , Elaboration, Construction, Transition. 3.3 Requirements Engineering 3.4 Problem analysis - Understanding Stockholders need	12	5

	Type of requirements. 3.5 Road Map For OOA & OOAD : Analysis & Design Road Map 3.6 Steps in UML Based Process		
4.	**Structural Modeling** 4.1 Common Structural Modeling Techniques – Approaches to find classes 4.2Modeling Structural Elements : Classes, Relationships, Interfaces , Packages 4.3Class Diagrams 4.4 Difference between ERD & Class Diagram 4.5Object Diagram	25	7
5.	**Behavioral Modeling** 5.1Common Behavioral Modeling Techniques 5.2 Interactions 5.3Use Cases and Use Case Diagrams 5.4Interaction Diagrams : Sequence Diagrams, Collaboration Diagrams , Activity Diagrams, State chart Diagram 5.5Forward & Reverse Engineering	25	7
6.	**Architectural Modeling** 6.1 Common Architectural Modeling Techniques 6.2 Modeling Architecture of the system 6.3 Components & Component Diagrams 6.4 Deployment & Deployment Diagrams 6.5 Collaborations	7	3
7	**Persistent Object and Database Issues** 7.1 The Cood Data Management Domain. 7.2 Object Persistence 7.3 Object-oriented Database Management System 7.4 Object- Oriented verses Relational Database. 7.5 Mapping object to Relational Data structure.	**7**	3
8	**Testing of Object oriented applications** 8.1 Introduction to Testing Strategies. 8.2 Impact of Object Orientation on Testing. 8.3 Testing Business Process.	5	2
9	**Patterns** 9.1 Benefits of patterns. 9.2 Using patterns During Analysis. 9.3 Using Pattern During Design	**5**	2
10	**CASE Tools (Hands on in Lab)** Any Tool to draw UML diagrams Assignment based on Tools can be given to students	-	4

Reference Books

1. Object Oriented Analysis and Design with Applications by Grady Booch., Benjamin / Cummings , 1994., Pearson Pub.
2. Object – Oriented Modeling and Design by J Rumbaugh, M Blaha, W . Premerlani ,PHI Pub.
3. Magnifying Object Oriented Analysis and Design by Arpita Gopal and Netra Patil : PHI Publication
4. Principles of Object- Oriented Software Development - Anton Eliens , Addison Wesley.
5. Object Oriented System Development - Ali Bahrami McGRAW-HILL International Edition.

6. Object-Oriented Software Engineering - Ivar Jacobson Pearson Education INC
7. Applying UML And Pattern by Craig Larman Pearson Education INC
8. UML Distilled Martin Flowler - Pearson Education INC
9. The Unified Modeling Language User Guide -Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC
10. The Unified Modeling Language Reference Guide -Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC
11. Design Object- Oriented Software - Rebecea Wrifs- Brock. Brian Wilkerson, Lauren Wiener
12. Object Oriented Analysis and Design- Bennett , Simon McGraw Hill.
13. Designing Flexible Object Oriented System with UML - Charless Richter, Techmedia
14. Instant UML – Muller – Apress LP
15. UML Instant – Thomas A Pendar – Wiley Publication
16. UML in Nutshell ,O'reilly Pub.

Note: The Subject should be taught through **case study approach**. The **focus should be on various UML diagrams.**

SEMESTER III
TRACK 1 : SOFTWARE & APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
7	T1-IT34	Advance Internet Technologies	30	70

Objectives:
To provide extension to web development skills acquired in 2nd semester. HTML 5, XML, jQuery, AJAX and PHP are introduced for student to enhance their skills

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**HTML5** 1.1 Basics of HTML5 – Introduction, features, form new elements & attributes in HTML5 1.2 <canvas>, <video>, <audio>. 1.3 Introduction to Scalable Vector Graphics (SVG) Angular JS 1.4 Introduction 1.5 MVC architecture (Model, Controller) 1.6 Directives 1.7 Filters	15	6
2	**XML** 2.1 Concept of XML, features of XML 2.2 Writing XML elements, attributes etc. 2.3 XML with CSS, programs on it. 2.4 XML with DSO, programs on it. 2.5 XML Namespace, XML DTD, programs on it. 2.6 XML schemas, writing simple sheet using XSLT 2.7 SAX Parser, DOM Parser 2.8 Introduction to SOAP, Examples on XML	**15**	**6**
3	**jQuery** 3.1 Introduction to jQuery, Syntax Overview 3.2 Anatomy of a jQuery Script, Creating first jQuery	25	10

	script 3.3 Traversing the DOM, Selecting Elements with jQuery, 3.4 Refining & Filtering Selections, Selecting Form Elements 3.5 Working with Selections - Chaining, Getters & Setters 3.6 CSS, Styling, & Dimensions 3.7 Manipulating Elements - Getting and Setting Information about Elements, Moving, Copying, and Removing Elements, Creating New Elements 3.8 Manipulating Attributes, Utility Methods 3.9 Events - Connecting Event to Elements, Namespacing Events, Event handling, Triggering Event handlers, Event Delegation 3.10 JQuery Effects –hide/show, fade, slide, animate, callback, stop 3.11 Interactions – Draggable, Droppable, Resizable, Selectable, Sortable 3.12 Widgets - Accordian, DatePicker, Menu, Tabs 3.13 Plugins – Using readymade plugins, Create a basic plugin, Writing Plugins		
4	**AJAX** 4.1 AJAX Overview 4.2 jQuery's AJAX related methods, 4.3 Ajax and Forms 4.4 Ajax Events	**10**	3
5	**PHP** 5.1 Obtaining, Installing and Configuring PHP 5.2 Introduction • PHP and the Web Server Architecture • Model, Overview of PHP Capabilities 5.3 CGI vs. Shared Object Model • PHP HTML Embedding Tags and Syntax 5.4 Simple PHP Script Example 5.5 PHP and HTTP Environment Variables 5.6 PHP Language Core • Variables, Constants and Data Types, and • Operators 5.7 Decision Making , Flow Control and Loops 5.8 Working with Arrays 5.9 Working with Strings and functions • Outputting Data, 5.10 Include and Require Statements 5.11 File and Directory Access Operations 5.12 Error Handling and Reporting Considerations 5.13 Processing HTML Form Input from the User 5.14 Creating a Dynamic HTML Form with PHP 5.15 Login and Authenticating Users 5.16 Using GET, POST, SESSION, and COOKIE variables	35	15

	5.17 Session Management and Variables 5.18 Working with Cookies, 5.19 Sending Email 5.20 Introduction to Object-oriented PHP: Classes & Constructors 5.21 PHP with AJAX 5.22 Database Operations with PHP Built-in Database Functions, Connecting to a MySQL(or Any Other Database), Creating Database, Dropping Database, Selecting a Database, Building and Sending the Query to Database Engine, Retrieving , Updating and Inserting Data Note: Apache Http server is used at server side		

Reference Books

1. Introducing HTML5 - Bruce Lawson, Remy Sharp
2. AngularJS - Brad Green, Shyam Seshadri
3. Learning jQuery - Jonathan Chaffer, Karl Swedberg
4. Professional Ajax, 2nd Edition Wrox Press
5. Internet Technology at work Hofstetter fred, TMH.
6. Beginning XML Wrox Press
7. XML how to program Deitel & Deitel, Pearson Pub.
8. Programming the World Wide Web Robert W. Sebesta,Pearson,4th Ed.
9. HTML5 & CSS3 , Castro Elizabeth 7th Edition
10. Beginning PHP5
11. Complete Ref. PHP
12. Beginning PHP, Apache, MySql web development.

Reference Sites:

1. http://www.w3schools.com
2. http://www.apache.org

Semester III TRACK I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	T1-IT31L	DS & C++ Lab *	50	-
Objective: This lab work provides hands-on for C++ & DS programs using C++ language learnt in theory session. C++ Programming assignments based on class, inheritance, abstraction, encapsulation, dynamic binding, polymorphism, I/O systems, exception handling should be covered DS using C++ assignments should be based on Stacks, Queue, Linked List and mainly it should cover Tree , Binary Threaded Tree & Graph programs				

Semester III TRACK I				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	T1-IT34L	Mini Project using AIT *	50	-
Objective: To get the practical knowledge of advanced Web Technologies. Students should able to develop web based systems using HTML5, XML, PHP, AJAX, JQuery and MySQL.				

SEMESTER III
TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT

SEMESTER III TRACK II : INFRASTRUCTURE AND SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T2-IT31	IT Infrastructure Architecture	30	70

Objective :
This course enables the students to acquire knowledge of advance computer architecture and Operating System concepts

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**IT Infrastructure** Introduction, Challenges in IT Infrastructure Management, Design Issues of IT Organizations and IT Infrastructure, IT System Management Process, IT Service Management Process, Information System Design Process	10	4
2	**Service Delivery Process** Service Level Management, Financial Management, IT Service Continuity Management, Capacity Management & Availability Management	15	6
3	**Service Support Process** Configuration Management, Incident Management, Problem Management, Change Management & Release Management	25	10
4	**Storage Management** Storage, Backup, Archive and Retrieve, Disaster Recovery, Space Management, Database and Application Protection and Data Retention	25	10
5	**Security Management** Computer Security, Internet Security, Physical Security, Identity Management, Access Control System and Intrusion Detection	25	10

Reference Books

1. IT Infrastructure & Its Management: Phalguni Gupta, Surya Prakash & Umarani Jayaraman, Tata McGraw-Hill Education
2. Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation: W. Ronald Hudson, Ralph C. G. Haas, Waheed Uddin
3. I.T. Infrastructure Management (2nd Edition): Anita Sengar

SEMESTER III
TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT

Semester III

Sr. No.	Subject Code	Subject Title	Internal	External
5	T2-IT32	Data Centre Architecture & Storage Management	30	70

Objective:

i) To gain knowledge and understand the following areas, the design of a Data Centre, best practice of design in the Data Centre and appropriate understanding of the options in the running of an efficient Data Centre.

ii) To understand the value of data to a business, Information Lifecycle, Challenges in data storage and data management, Solutions available for data storage.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**DATA CENTRE** 1.1 Introduction 1.2 Site Selection and Environmental Considerations 1.3 Hierarchical or Layered Architecture 1.4 Architect Roles, Goals and Skills 1.5 Architecture Precursors	5	2
2	**DATA CENTRE DESIGN** 2.1 Architecture Design and Standards Recommendations 2.2 Raised Access Floor and Design Best Practices, connecting the infrastructure with copper and fibre. 2.3 IT Hardware 2.4 Cooling System Options and Environmental Control 2.5 Electrical Power Systems 2.6 Room Layout 2.7 Fire Protection and Security Systems 2.8 Building Automation and Energy Management Systems 2.9 Commissioning and Handover	20	8
3	**STORAGE MANAGEMENT** 3.1 Introduction to Storage Technology 3.2 Storage Systems Architecture 3.3 Physical and logical components of a connectivity environment 3.4 Major physical components of a disk drive and their functions 3.5 Concept of RAID and its components 3.6 Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6 3.7 Integrated and Modular storage systems 3.8 high-level architecture and working of an intelligent storage system	10	4

4	**NETWORKED STORAGE** 4.1 Evolution of networked storage 4.2 Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN 4.3 Benefits of the different networked storage options 4.4 Need for long-term archiving solutions and describe how CAS fulfil the need 4.5 Appropriateness of the different networked storage options for different application environments	15	6
5	**MANAGING DATA CENTER** 5.1 Reasons for planned/unplanned outages 5.2 Impact of downtime 5.3 Difference between business continuity (BC) and disaster recovery (DR), RTO and RPO 5.4 Identification of single points of failure in a storage infrastructure and solutions to mitigate these failures 5.5 Architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity 5.6 Remote replication technologies and their role in providing disaster recovery and business continuity capabilities 5.7 Key areas to monitor in a data center 5.8 Industry standards for data center monitoring and management 5.9 Key metrics to monitor storage infrastructure.	30	12
6	**SECURING STORAGE AND STORAGE VIRTUALIZATION** 6.1 Information Security 6.2 Critical security attributes for information systems 6.3 Storage security domains, Analyze the common threats in each domain 6.4 Storage Virtualization: Forms, Configurations and Challenges 6.5 Types of Storage Virtualization: Block-level and File-Level.	20	8

Reference Books

1. Data Center Fundamentals by Mauricio Arregoces, Cisco Press; 1 edition (4 December 2003)
2. Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyondby Gustavo Santana, Cisco Press; 1 edition (21 June 2013)
3. EMC Education Series, "Information Storage and Management", by G.Somasundaram, AlokShrivastava, Wiley, Publishing Inc., 2011.
4. "Storage Networks: The Complete Reference", by Robert Spalding, TataMcGrawHill,Osborne, 2003.
5. "Building Storage Networks", by Marc Farley,TataMcGraw Hill, Osborne. 2001.
6. Storage Area Network Fundamentals, by MeetaGupta, Pearson Education Limited, 2002

SEMESTER III
TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT

Semester III

Sr. No.	Subject Code	Subject Title	Internal	External
6.	T2-IT33	Introduction to Information Security	30	70

Objectives:
To create awareness about the values of Information and how the Information security practices are meticulously implemented in IT companies worldwide. .

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Information Systems** 1.Introduction 1.1 Security concepts 1.2 Computer Security Concepts 1.3. Threats, Attacks, and Assets 1.4. Security Functional Requirements 1.5. A Security Architecture for Open Systems 1.6. Computer Security Trends 1.7. Computer Security Strategy	15	6
2	**Cryptographic Tools** 2.1. Confidentiality with Symmetric Encryption 2.2. Message Authentication and Hash Functions 2.3. Public-Key Encryption 2.4. Digital Signatures and Key Management 2.5. Practical Application: Encryption of Stored Data	15	5
3	**Models, Frameworks , Standards & Legal Framework** 3.1 A structure and framework of compressive security policy, 3.2 policy infrastructure, 3.3 policy design life cycle and design processes, 3.4 PDCA model, 3.5 Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799 3.6 Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity 3.7 Indian IT Act 3.8 Laws of IPR 3.9 Indian Copyright Act	25	10
4	**Controls** 4.1. Access Control Principles 4.2. Subjects, Objects, and Access Rights 4.3. Discretionary Access Control 4.5. Role-Based Access Control 4.6. Case Study	15	7

5	**Virus and Malware** 5.1. Introduction & types of Malicious Software (Malware) 5.2. Propagation–Infected Content–Viruses 5.3. Propagation–Vulnerability Exploit–Worms 5.4. Propagation–Social Engineering–SPAM E-mail, Trojans 5.5. Payload–System Corruption 5.6. Payload–Attack Agent–Zombie, Bots 5.7. Payload–Information Theft–Keyloggers, Phishing, Spyware 5.8. Payload–Stealthing–Backdoors, Rootkits 5.9. Countermeasures	15	6
6	**Security issues** 6.1 Database security challenge in the modern world, 6.2 Federated Databases, 6.3 securing Mobile databases 6.4 Network Security, 6.5 trusted & un trusted networks, 6.6 network attacks, network security dimensions, 6.7 network attack – the stages; using firewalls effectively; 6.8 Privacy – Privacy invasion due to direct marketing, outsourcing, using data masking ; privacy issues in smart card applications 6.9 Ethical Hacking ;Role of Cryptography in information security, 6.10 digital signatures	15	6

Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Gobole
2. The complete reference Information Security by Mark Rhodes –ousley
3. Information security Theory and practices By Dhiren R Patel
4. M. Stamp, “Information Security: Principles and Practice,” Wiley
5. G. McGraw, “Software Security: Building Security In,” Addison Wesley
6. Electronic Signature law by L Padmavathi
7. Network Security by Ankit Fadia
8. Security Plus study guide by Michael Cross, Norrris Johnson
9. Information Security policies made easy version

Reference websites:

- www.cengage.com/resource_uploads/downloads/1111138214_259146.pdf
- www.searchsecurity.techtarget.com
- www.secure-byte.com
- www.security-internal-audit.com
- www.ngssecure.com/services
- www.pcisecuritystandards.org

SEMESTER III
TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT

Semester III

Sr. No.	Subject Code	Subject Title	Internal	External
7	T2-IT34	Office Automation Tools	30	70

Objective: To enable the students to acquire basic knowledge in the various office automation tools and its applications in the various areas of business.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Concept of Office Automation** Purpose of an office, activities in an office ,structure of an office, office manual, document flow management in an office, need for office automation and its advantages and disadvantages, Office automation tools.	15	6
2	**Office Automation Technology:** Office equipment, Workstation communication and convergence of technologies.	10	4
3	**Writer** -Introducing Writer -Working with Text - Formatting Pages - Printing, Faxing, Exporting, and E-mailing - Introduction to Styles - Working with Styles - Working with Graphics - Working with Tables - Working with Templates in Writer - Using Mail Merge - Creating Tables of Contents, Indexes, and Bibliographies - Working with Master Documents - Working with Fields - Using Forms in Writer- Customizing Writer	25	10
4	**Calc** Introducing Calc, Entering, Editing, and Formatting Data, Using Charts and Graphs, Using Styles and Templates, Using Graphics in Calc, Printing, Exporting, and E-mailing, Formulas and Functions, Using the DataPilot, Data Analysis, Linking Calc Data, Sharing and Reviewing, Calc Macros	25	10
5	**Impress Guide** Introducing Impress, Using Slide Masters, Styles, and Templates, Adding and Formatting Text, Adding and Formatting Pictures, Managing Graphic Objects, Formatting Graphic Objects, Spreadsheets, Charts, and Other Objects, Slides, Notes, and Handouts, Slide Shows: Transitions, Animations, Printing, E-mailing, Exporting, and Saving Slide Shows, Setting Up and Customizing Impress	25	10

Reference Books

1. http://www.openoffice.org/
2. https://wiki.openoffice.org/wiki/Documentation

SEMESTER III TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT			
Semester III			
Sr. No.	**Subject Code**	**Subject Title**	**Internal**
8	T2-IT31L	Mini Project On IT architecture & Information Security*	50
Case studies and practical's on Information Security with the illustration on encryption, decryption using public and private keys etc are expected.			

SEMESTER III TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT			
Semester III			
Sr. No.	**Subject Code**	**Subject Title**	**Internal**
9	T2-IT34L	Office Automation Tools – Lab*	50
Guidelines: Lab exercise on Writer, Calc and Impress Guide. Students have to study and analyze the existing Office automation tools (office equipment, hardware and software) available present comparative analysis.			

SEMESTER III TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4.	T3-IT31	Enterprise Resource Planning	30	70
Objective : To learn ERP systems its structure, modules, benefits, implementation and post implementation issues through real-life cases				

Sr. No	**Subject Topic details**	*% Weightage*	**No. of Sessions**
1	**Enterprise Resource Planning** 1.1 Introduction 1.2 Disadvantages of non-ERP systems 1.3 What Is ERP? 1.4 Need of ERP. 1.5 Advantage of ERP 1.6 Risks of ERP 1.7 Growth of ERP	10	4
2	**ERP Modules** 2.1 Finance 2.2 Production Planning, Control and Management 2.3 Sales and Distribution 2.4 Human Resource Management 2.5 Inventory Control System	20	8

	2.6 Quality Management 2.7 Plant Maintenance		
3	**ERP Implementation** 3.1 ERP Implementation (Transition) strategies 3.2 ERP Implementation Life Cycle 3.3 Implementation Methodologies 3.4Evaluation and selection of ERP package 3.5ERP Project Team: Vendors, Employees, Consultants 3.5 Training & Education 3.6 Project management & Monitoring 3.7 Post Implementation Activities 3.8 Operation & maintenance of ERP system 3. 9 Measuring the Performance of ERP System 3.10 Success & failure factors of an ERP Implementation	20	8
4	**ERP Market and Vendors** 4.1ERP Marketplace and Marketplace Dynamics 4.2 Comparison of Current ERP Packages and Vendors, like; SAP, Oracle, PeopleSoft, BAAN etc.	10	4
5	**ERP and related technologies** 5.1 Business Process Re-Engineering (BPR) 5.2 Information Systems -Management Information System (MIS), Decision Support System (DSS), Executive Support System (ESS) 5.3 Data Warehousing, Data Mining 5.4 On-Line Analytical Processing (OLAP) 5.5 Supply Chain Management 5.6 Customer Relationship Management	20	8
6	**ERP Case Studies** 6.1 ERP systems implemented in – for example :TISCO, SKF Automotive Bearings Co. Ltd, Qualcomm CDMA, California 6.2 Post Implementation review of ERP packages - in Manufacturing, Services and Others Organizations, 6.3 Customization of ERP for different types of Industries.	20	8
Reference Books			
1. ERP Demystified: Alexis Leon, TMH New Delhi ,2nd Ed. 2. ERP Ware: ERP Implementation Framework : V.K. Garg &N.K. Venkita Krishnan, PHI. 3. ERP Concepts & Planning : V.K. Garg &N.K. Venkita Krishna, PHI, 2nd Ed.			

SEMESTER III TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5.	T3-IT32	Data Communication and computer Networks	30	70

Objective : Various computer networks, technologies behind networks and application protocols, e-mail and communication protocols along with introduction to advance network technologies like LTE, Cloud computing, Grid computing will be introduced to the students through this subject.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Data Communication Networks and Reference Models** Components, Data Representation, Data Flow Network Criteria, Network Models, Categories of Networks, Gigabit Ethernet, 10 Gigabit Ethernet (Goals, Specifications, Frame format) TCP/IP protocol suite Physical Communication & Switching Techniques	**20**	**06**
2	**Link Layer Communication [No algorithms for different techniques]** Error detection and correction techniques Protocols Framing Flow and error control HDLC P2P protocol Numerical Exercises on CRC, Ckecksum, Hamming Code, Parity Check	10	04
3	**IP Addressing & Routing** Role of Internet Protocol, IP packet format, Addressing: Physical Addresses, Logical Addresses, Port Addresses, Specific Addresses. IP addresses – Network part and Host Part Network Masks, Network addresses and Broadcast addresses, Address Classes, Loop back address, **Routing**: IP routing concepts, Routing Tables, Types of routing protocol, Border Gateway Protocol (BGP), Routing Information Protocol (RIP), Open Shortest Path First (OSPF). Role of TCP, TCP packet format and TCP connections in detail	15	**06**

	Numerical problems on IP addressing are expected.		
4	**IPv6** Introduction, Packet format and addressing scheme, Security, applications and limitations of IPv6. IPv4 Vs IPv6.	7.5	**03**
5	**Domain Network Services (DNS)** Domain Names, Authoritative Hosts, Delegating Authority, Resource Records, SOA records, DNS protocol, DHCP & Scope Resolution	7.5	**03**
6	**Network Applications** (HTTP, Email, etc) Hyper Text Transfer Protocol (HTTP) HTTP communications - HTTP request, Request Headers, Responses, Status Code, Error Status Code MIME–Multipurpose Internet Mail Extensions SMTP–Simple Mail Transfer Protocol with examples POP – Post Office Protocol IMAP – Internet Message Access Protocol FTP – File Transfer Protocol Telnet – Remote Communication Protocol Proxy Servers and types	20	**10**
9	**Network Security** Threat: Active attack, Passive Attack, Cryptography: Symmetric and Asymmetric key cryptography, Security services : SSL, VPN and VPN protocols, Firewall: Packet filter, application gateway	10	**04**
10	**Advance Network Technologies** 802.4, Wi-Max LTE, Cloud Computing, Grid computing, HSPA, IPTV, FTTH,	5	**04**

Reference Books

1.	Computer Networks	Andrew S. Tanenbaum, Pearson,5th Ed
2.	Data Communications and Networking	Behrouz A. Forouzan , TMH,4th Ed.
3.	Cryptography and Network Security	Atul Kahate , TMH, 2nd Ed.
4.	Network Essential Notes	GSW MCSE Study Notes
5.	Internetworking Technology Handbook	CISCO System
6.	Computer Networks and Internets with	
7.	Internet Applications	Douglas E. Comer
8.	Cryptography and Network Security	William Stalling

SEMESTER III TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6.	T3-IT33	Data Warehouse, Mining , BI Tools and Applications	30	70

Objective:
At the end of the course students would be familiarized with the data-warehousing and data-mining techniques and other advanced topics. You would also understand the importance of BI in emerging world.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Data Warehousing** Introduction to Data warehousing Architecture , Data Mart Warehouse schemas, Dimensional data modeling- star, snowflake schemas, fact constellation OLAP and data cubes Operations on cubes ETL : Data preprocessing -need for preprocessing, data cleaning, data integration & transformation, data reduction	15	6
2	**Knowledge Base Systems & Expert Systems** Basic concepts of Expert System Structure of Expert System How Expert System works Expert System Application Comparison of Conventional & Expert System Data mining as a part Knowledge Discovery process Introduction to machine learning & data mining Predictive & Descriptive Mining	10	4
3	**Association, Classification , Clustering** Association rules : Market-basket Model, support & confidence , Apriori Algorithm , Sampling Algorithm , Frequent-pattern Tree Algorithm ,Partition Algorithm Classification : Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Clustering : Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Outlier Analysis - Mining Streams, k-means algorithm	25	10
4	**Other Approaches data mining problems** Discovery of sequential patterns Discovery of patterns in time series Linear Regression for Prediction Neural Networks Genetic Algorithms Text mining Web Mining Data-visualization Applications of Data Mining Fraud Detection	25	10

	Targeted Marketing Customer Retention On-line Advertising WEKA tool		
5	**Business Intelligence** Definition of Problem :(Corporate problems & Issues) Designing physical database Deploying and supporting DW/BI system BI Architecture – spread sheets, concept of dashboard, OLAP, decision engineering, LIS Business performance management, including Key performance indicators and operational metrics Balanced scorecard Six Sigma Dashboards Data visualization BI Application in various domains BI Analytics (discriminant analysis and logistic regression, cluster analysis, principle component analysis)	25	10

Reference Books

1. Data Mining Concepts by Han And Kamber
2. Data Mining by Margaret Dunham
3. Database Management System by Korth, Sudarshan
4. Database Management System by Nawathe,
5. Management Information System by Gordan Devis, Margrethe H. Oison,TMH,3rd Ed.
6. Information Systems for Modern Management by Robert Murdick, Joel e. Ross, PHI, 3rd Ed.
7. Decision Support & Intelligent System by Efraim Turban, Pearson, 8th Ed.
8. Management Information System by Waman S..Jawadekar, TMH,4th Ed.
9. Analysis and Design of Information System by V.Rajaraman,PHI,2nd Ed.
10. Business Intelligence: Practices, Technologies, and Management by Rajiv Sabherwal, Irma Becerra-Fernandez
11. Management Information systems by Dr. Shubhalaxmi Joshi, Smita Vaze, Himalaya PubBusiness Intelligence: Practices, Technologies, and Management- Rajiv Sabherwal, Irma Becerra-Fernandez

Reference website:

www.ibm.com/in/en/
www.pentaho.com/
www.jaspersoft.com/
www.amazon.com/Data-Mining-Business-Intelligence-Applications
www.ibm.com/insights/in
www.sas.com

SEMESTER III TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7.	T3-IT34	Information Security and Audit	30	70

Objectives:

To create awareness about the values of Information and how the Information security practices are meticulously implemented in IT companies worldwide. .

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Information Systems** History of Information Systems Importance of Information Systems & its basics New Technologies open door to threats Introduction to cyber crimes and attacks Information Security : Threats & Attacks Classification of Threats and Assessing Damages	12	5
2	**Information Security Management in Organizations** Information Security Management (ISM) Security Policy , Standards, Guidelines & Procedures ISMS The 3 pillars CIA of Information Security Information Classification Risk Analysis & Management	15	6
3	**Models, Frameworks , Standards & Legal Framework** A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000 BS7799 Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity Indian IT Act Laws of IPR Indian Copyright Act	25	10
4	**Controls** Input, process, validation, output, logical access, physical access , Database, network, environment Internet access, e-mail, digital signature, outsourcing, software development and acquisition, hardware acquisition Network and telecom, BCP and DRP, security organization structure. Evidence collection, evaluation and Reporting methodologies	18	7

5	**Auditing for Security** Security Audits what are they? Need for Security audits in organizations Auditors responsibility in Security audits Types of Audits & approaches to Audits Technology based Audits – vulnerability scanning and penetration testing Resistance to Audits Key success factors for Security Audits	15	6
6	**Security issues** Database security challenge in the modern world, Federated Databases, securing Mobile databases Network Security, trusted & un trusted networks, network attacks, network security dimensions, network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, outsourcing, using data masking ; privacy issues in smart card applications Ethical Hacking ;Role of Cryptography in information security, digital signatures	15	6

Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Gobole
2. Information systems control and Audit by Ron Weber, Pearson Pub.
3. Information security policies, procedures and standards by Thomas Pettier.
4. Information security Management Hand book- 5th Edition-HAROLD F. TIPTON
5. Computer security by Alfred Basta, Wolf Halton
6. Information security policies- Thomas R.Peltier, Peltier R. Peltier
7. Electronic Signature law by L Padmavathi
8. Network Security by Ankit Fadia
9. Security Plus study guide by Michael Cross, Norrris Johnson
10. Information Security policies made easy version 10: Charles Cresson Wood

Reference websites:

- http://www.isaca.org
- www.searchsecurity.techtarget.com
- www.secure-byte.com
- www.security-internal-audit.com
- www.ngssecure.com/services
- www.pcisecuritystandards.org

Semester III				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8.	T3-IT32L	DCCN Lab *	50	-
Objective : Different practical have to be covered including crimping, setting LAN,WLAN, dealing with network management tools like Pandora, wireshark etc. , Virtualization, configuring IP addresses, router configuration, firewall configuration.				

Semester III				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9.	T3-IT33L	BI Tools Lab *	50	-
Objective : To Introduce students with business intelligence techniques such as MOLAP, data mining, data warehousing etc. Demonstration on various tools is expected. 1. Data Mining Techniques to get practical overview of classification, clustering, apriori analysis. 2. Data Visualization 3. Cube Generation and Cube Operations 4. Demonstration of Business Intelligence Tool like Pentaho 5. Spreadsheet based data mining tool & BI tools such as XLMiner				

SEMESTER III				
SEMESTER III **TRACK IV : NETWORKING**				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T4-IT31	Network Administration I	30	70
Objective: 1. To offer fundamental knowledge about the network administration along with the practical exposure by creating LAN'S, WAN'S etc. 2. To give basic configurations of router & switches				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**1. The TCP/IP and OSI Networking Models** 1.1 The TCP/IP Protocol Architecture 1.2 The TCP/IP Application Layer 1.3 The TCP/IP Transport Layer 1.4 The TCP/IP Internet Layer 1.5 The TCP/IP Network Access Layer 1.6 Data Encapsulation Terminology 1.7 Comparing OSI and TCP/IP 1.8 OSI Layers and Their Functions 1.9 OSI Layering Concepts and Benefits 1.10 OSI Encapsulation Terminology		10	3

2	**2. Fundamentals of LANs** 2.1 An Overview of Modern Ethernet LANs 2.2 A Brief History OF Ethernet 2.3 Ethernet UTP Cabling 2.4 UTP Cables and RJ-45 Connectors 2.5 Transmitting Data Using Twisted Pairs 2.6 UTP Cables Pinouts for 10BASE-T and 100BASE-TX 2.7 1000BASE-T Cabling 2.8 Improving Performance by Using Switches Instead of Hubs 2.9 Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.	10	5
3	**3. Fundamentals of WANs** 3.1 WAN Connections from the Customer Viewpoint, 3.2 WAN Cabling Standards, 3.3 Clock Rates, Synchronization, DCE, and DTE, 3.4 Building a WAN Link in a Lab, 3.5 Link Speeds Offered by Telco's, 3.6 HDLC, 3.7 Point-to-Point Protocol, 3.8 Point-to-Point WAN Summary, 3.9 The Scaling Benefits of Packet Switching,	15	5
4	**4. Fundamentals of IP Addressing and Routing** 4.1 Overview of Network Layer Functions, 4.2 PC1's Logic: Sending Data to a Nearby Router, 4.3 R1 and R2's Logic: Routing Data across the Network, 4.4 R3's Logic: Delivering Data to the End Destination, 4.5 Network Layer Interaction with the Data Link Layer, 4.6 IP Packets and the IP Header, 4.7 Network Layer (Layer3) Addressing, 4.8 Routing Protocols, 4.9 IP Addressing, 4.10 IP Routing,	15	5
5	**5. LAN Switching** 5.1 LAN Switching Concepts, 5.2 Historical Progression: Hubs, Bridges, and Switches, 5.3 Switching Logic, 5.4 LAN Switching Summary, 5.5 Collision Domains and Broadcast Domains, 5.6 Broadcast Domains, 5.7 The Impact of Collision and Broadcast Domains on LAN Design , 5.8 Virtual LANs (VLAN)	15	7
6	**6. Operating LAN Switches** 6.1 Foundation Topics	15	7

	6.2 Accessing the Switch CLI, 6.3 Catalyst Switches, 6.4 Switch Status from LEDs, 6.5 Accessing the IOS CLI, 6.6 CLI Access from the Console, 6.7 Accessing the CLI with Telnet and SSH, 6.8 Password Security for CLI Access, 6.9 User and Enable (Privileged) Modes, 6.10 CLI Help Features,		
7	**7. Routing protocol concepts** 7.1 Connected and Static Routes 7.2 Connected Routes, 7.3 Static Routes , 7.4 Extended ping Command, 7.5 Default Routes, 7.6 RIP-2 Basic Concepts, 7.7 Comparing and Contrasting IP Routing Protocols, 7.8 Interior and Exterior Routing Protocols,	20	8
References:			
1. CCENT/CCNA ICND1 (Official Exam Certification Guide, Second Edition)By – Wendell Odom.			

SEMESTER III TRACK IV : NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	T4-IT32	Windows Server Configurations	30	70
Objective:1. To give the complete knowledge of windows server configuration 2. Prepare the students for certification like MCITP (Microsoft Certified IT Professional) etc.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**

1	**Install and configure servers**
	• Install servers
	  • Plan for a server installation, plan for server roles, plan for a server upgrade, install Server Core, optimize resource utilisation by using Features on Demand, migrate roles from previous versions of Windows Server
	• Configure servers
	  • Configure Server Core, delegate administration, add and remove features in offline images, deploy roles on remote servers, convert Server Core to/from full GUI, configure services, configure NIC
			15	6

	teaming, install and configure Windows PowerShell Desired State Configuration (DSC) • Configure local storage • Design storage spaces, configure basic and dynamic disks, configure master boot record (MBR) and GUID partition table (GPT) disks, manage volumes, create and mount virtual hard disks (VHDs), configure storage pools and disk pools, create storage pools by using disk enclosures		

2	**Configure server roles and features**
	• Configure file and share access
	  • Create and configure shares, configure share permissions, configure offline files, configure NTFS permissions, configure access-based enumeration (ABE), configure Volume Shadow Copy Service (VSS), configure NTFS quotas, create and configure Work Folders
	• Configure print and document services
	  • Configure the Easy Print print driver, configure Enterprise Print Management, configure drivers, configure printer pooling, configure print priorities, configure printer permissions
	• Configure servers for remote management
	  • Configure WinRM, configure down-level server management, configure servers for day-to-day management tasks, configure multi-server management, configure Server Core, configure Windows Firewall, manage non-domain joined servers
		15	6

3	**Configure Hyper-V**
	• Create and configure virtual machine settings
	  • Configure dynamic memory, configure smart paging, configure Resource Metering, configure guest integration services, create and configure Generation 1 and 2 virtual machines, configure and use enhanced session mode, configure RemoteFX
	• Create and configure virtual machine storage
	  • Create VHDs and VHDX, configure differencing drives, modify VHDs, configure pass-through disks, manage checkpoints, implement a virtual Fibre Channel adapter, configure storage Quality of Service
		15	6

	• Create and configure virtual networks • Configure Hyper-V virtual switches, optimise network performance, configure MAC addresses; configure network isolation, configure synthetic and legacy virtual network adapters, configure NIC teaming in virtual machines		

4	**Deploy and configure core network services**
	• Configure IPv4 and IPv6 addressing
	  • Configure IP address options, configure IPv4 or IPv6 subnetting, configure supernetting, configure interoperability between IPv4 and IPv6, configure Intra-site Automatic Tunnel Addressing Protocol (ISATAP), configure Teredo
	• Deploy and configure Dynamic Host Configuration Protocol (DHCP) service
	  • Create and configure scopes, configure a DHCP reservation, configure DHCP options, configure client and server for PXE boot, configure DHCP relay agent, authorise DHCP server
	• Deploy and configure DNS service
	  • Configure Active Directory integration of primary zones, configure forwarders, configure Root Hints, manage DNS cache, create A and PTR resource records
		15	6

5	**Install and administer Active Directory**
	• Install domain controllers
	  • Add or remove a domain controller from a domain, upgrade a domain controller, install Active Directory Domain Services (AD DS) on a Server Core installation, install a domain controller from Install from Media (IFM), resolve DNS SRV record registration issues, configure a global catalogue server, deploy Active Directory infrastructure as a service (IaaS) in Microsoft Azure
	• Create and manage Active Directory users and computers
	  • Automate the creation of Active Directory accounts; create, copy, configure and delete users and computers; configure templates; perform bulk Active Directory operations; configure user rights; offline domain join; manage inactive and disabled accounts
	• Create and manage Active Directory groups and
		20	8

	organisational units (OUs) • Configure group nesting; convert groups, including security, distribution, universal, domain local and domain global; manage group membership using Group Policy; enumerate group membership; delegate the creation and management of Active Directory objects; manage default Active Directory containers; create, copy, configure and delete groups and OUs		
6	**Create and manage Group Policy** • Create Group Policy objects (GPOs) • Configure a Central Store, manage starter GPOs, configure GPO links, configure multiple local Group Policies • Configure security policies • Configure User Rights Assignment, configure Security Options settings. Configure Security templates, configure Audit Policy, configure Local Users and Groups, configure User Account Control (UAC) • Configure application restriction policies • Configure rule enforcement, configure AppLocker rules, configure Software Restriction Policies • Configure Windows Firewall • Configure rules for multiple profiles using Group Policy; configure connection security rules; configure Windows Firewall to allow or deny applications, scopes, ports, and users; configure authenticated firewall exceptions; import and export settings	20	8

References:

1. Mastering Windows Server 2012 R2 by Mark Minasi, Kevin Greene, Christian Booth
2. Mcsa Windows Server 2012 Complete Study Guide

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SEMESTER III
TRACK IV : NETWORKING

Sr. No.	Subject Code	Subject Title	Internal	External
6	T4-IT33	IT Infrastructure Monitoring	30	70

Objective: To aware basics of the IT infrastructure with the help of tools to be used. As well as to offer the knowledge of project and operations management.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Architecture** Introduction to computer architecture - Instructions and addressing - Main Memory concepts – Types of memory -Cache memory organization - Secondary storage – virtual memory – paging- I/O devices – I/O programming – polling – interrupts – DMA – Buses – Links – Interfacing – Context switching	5	3
2	**Nagios administration** - Installation - Capacity Planning - Installing the Nagios Software Nagios Server Nagios Plug-ins NagiosConfiguration Configuration Files Configuration Objects Defining host,Services,Templates, contact object, group objects, time periods, commands - Distributed monitoring, redundancy and failover – Integrating nagios - SNORT MRTG Cacti and other tools - Nagios administration General security guidelines Web console security Monitoring hosts and services Tactical monitoring Remote monitoring NRPE SSH - SNMP Macros – event handlers – notifications – External	25	10

	commands – host and services dependencies – Notification escalations -reporting		
3	**Open NMS administration** - Introduction to NMS tools - OpenNMS Installation, configuration, auto discovery, types of files, Add, modify, delete, nodes, report generations, report customizations multi-tenancy.	20	7
4	**Storage administration** - Introduction to Storage - Data storage Internal Storage SCSI ,SATA,IDE, iSCSI, FCP External storage DAS, NAS,SAN, CD, DVD ,Tape drive), Hard disk(Concepts of RAID) - Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, - Disaster Recovery, Hierarchical space management, Database & Application protection Bare machine recovery, Data retention.	25	10
5	**Project and Operations management** Role of project manager - Project Estimation – customer requirements – effort statements - feasibility project charter – project proposal - project request– Quality policy – statement of work – change control plan – communications plan – mile stone list – issue management plan - concept of service level agreement – types of SLA - components of SLA – SLA metrics – Metrics – Determination, measurement and interpretation- project plan – project schedule – quality plan – Responsibility matrix - Project TRACKing – Components of a report – Reporting - Early Warning Signals – Escalation – Need to escalate – Escalation follow-ups	25	10

References:

1. **Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Sjaak Laan**

SEMESTER III

SEMESTER III
TRACK IV : NETWORKING

Sr. No.	Subject Code	Subject Title	Internal	External
7	T4-IT34	Linux Administration I	30	70

Objective: To aware the installation, basic configuration and file system.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Installation and configuration** The Linux File system Basics Working with ext3 File system Other File system Available to Core Linux Creating a File system Mounting File systems Relocating a File system	16	4
2	**Managing Users** User Accounts Managing Groups Managing Users Managing Passwords Getting System Administrator Privileges to Regular Users The User Login Process Disk Quotas	16	7
3	**Backing Up, Restoring, and Recovery** Choosing a Backup Strategy Choosing a Backup Hardware and Media Using Backup Software Copying Files Undeleting Files System Rescue	16	5
4	**Printing with Linux** Overview of Linux Printing Configuring and Managing Print Services Creating and Configuring Local Printers Creating Network Printers Console Print Control Using the Common UNIX Printing System (CUPS) GUI	16	5
5	**Network Connectivity** Networking with TCP/IP Network Organization Hardware Devices for Networking Using Network Configuration Tools Dynamic Host Configuration Protocol Using the Network File System Putting Samba to work	16	10

6	**Managing DNS** Configuring DNS Essential DNS concept Overview of DNS Tools Configuring Name servers with BIND providing DNS for Real Domain	16	10

References:

1. Red Hat Linux and Fedora Unleashed – By Bill Ball and Hoyt Duff.
2. Enterprise Linux & Fedora Edition: The Complete Reference-By Richard L. Petersen
3. Linux Administration Handbook By – Evi Nemeth Prentice Hall
4. Linux Network Administrator's Guide By- Olaf Kirch & Terry Dawson

SEMESTER III **TRACK IV : NETWORKING**				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	T4-IT31L	Network Administration Lab – I *	50	-

Objective : To aware the students with all fundamentals of network administration with practical exposure.

Practical are expected on the following

1. Overview of IP Address
2. Design Ethernet Cables : Cross Cable, Straight Cable, Rollover Cable
   Demonstrate of Slicing of Fiber Cables ,Connectors
3. Demonstrate to connect two computer without connecting devices
4. Demonstrate to connect two computer with connecting devices
5. Demonstrate to establish client-server connection with using of windows server
7. Overview of Router
8. Demonstrate the use of router to make a connection
9. Introduction to Network Address Translation
10. Overview of different interfaces in router
11. Implement IP Subnetting in IPV4
12. Implement IP routing using RIP
13. Implement IP routing using IGRP
14. Implement IP routing using EIGRP
15. Implement IP routing using OSPF
16. Configuration of VLAN
17. Configuration of VTP
18. Managing traffic with Standard IP Access List
19. Managing traffic with Extended IP Access List
20. Overview of MPLS

SEMESTER III TRACK IV : NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9.	T4-IT32L	Server Configuration Lab (Windows and Linux)*	50	-

Objective : To aware the students for creating and configuring complete windows as well as Linux server.

Server Configuration

Windows – Windows Server

1. Manage local, roaming, and mandatory user profiles.
2. Implement user, group and computer accounts in an Active Directory environment.
3. Configure access to shared folders.
4. Install and configure Terminal Services for remote administration.
5. Install and configure Terminal Services to serve applications to thin clients.
6. Configure file system permissions.
7. Create policies to control user desktop settings and security.
8. Manage application of policies.
9. Deploy software using policies.
10. Configure and manage a web server.
11. Configure web-site authentication.
12. Perform system recovery for a server.
13. Manage backup procedures.
14. Recover from server hardware failure.
15. Configure DNS Server service
16. Configure RAID (redundant array of independent disks).
17. Manage network attached storage remotely.
18. Implement virtualization software.
19. Perform system recovery within a virtual computing environment.
20. Manage audit settings and audit logs.
21. Configure DHCP.
22. Verify DHCP reservation configuration.
23. Install Operating System images.
24. Configure a network policy server.

Linux Server

Students shall be able to:

1. Install a major Linux distribution to specifications.
2. Install and configure Linux services such as Apache, MySQL, etc
3. Partition according to pre-installation plans.
4. Configure file systems.
5. Manage packages after installing the operating systems.
6. Select appropriate networking configuration and protocols.
7. Select appropriate parameters for Linux installation.
8. Configure peripherals as necessary.
9. Manage storage devices for proper user security access.
10. Mount and un-mount varied file systems.

11. Create and modify files and directories.
12. Execute content and directory searches.
13. Create linked files.
14. Modify file and directory permissions and ownership.
15. Identify and modify default permissions for files and directories.
16. Access and write data to recordable media.
17. Manage Linux services/processes for efficient use of resources.
18. Manage run-levels and system initialization.
19. Control processes by identifying, executing, killing and managing.
20. Repair packages and scripts.
21. Monitor and troubleshoot network activity.
22. Manage print jobs and print queues.
23. Perform remote management.
24. Manage basic shell scripts by creating, modifying and using.
25. Manage user and group accounts by creating, modifying and deleting.
26. Manage and access mail queues.
27. Schedule jobs to execute in the future using daemons.
28. Configure client network services and settings.
29. Configure basic server network services.
30. Implement basic routing and sub-netting.
31. Configure the system and perform basic make file changes to support compiling applications
    and drivers.
32. Configure files that are used to mount drives or partitions.
33. Implement DNS.
34. Configure a Network Interface Card.
35. Configure Linux printing.
36. Apply basic printer permissions.
37. Configure log files.
38. Configure the X Window system.
39. Set up environment variables.
40. Manage server/workstation security parameters to maintain operating system and data integrity.
41. Configure security environment files.
42. Given security requirements, implement appropriate encryption configuration.
43. Use appropriate access level for login.
44. Set process and special permissions.
45. Given security requirements, implement basic IP tables/chains.
46. Implement security auditing for files and authentication.
47. Set up user-level security.
48. Configure removable system hardware.
49. Configure RAID (Redundant Array of Independent Disks)

COMMON SUBJECTS FOR SEMESTER IV				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
1	ITC41	Optimization Techniques	30	70

Objective :
To introduce linear programming, dynamic programming and related *optimization theories to solve real life / simulated problems*

Sr. No	**Topic details**		**No. of Sessions**
1	**Linear Programming** 1.1 Various definitions, statements of basic theorems and properties, Advantages and Limitations, 1.2 Application areas of Linear programming 1.3 Linear Programming – The Graphical method – Graphical Solution methods of Linear Programming problem 1.4 Two Phase Simplex Method and problems, 1.5 Dual Simplex Method and problems, 1.6 Big –M method and problems. 1.7 Transportation Problem and optimum solution by MODI method, 1.8 Assignment Problem and its solutions by Hungarian Method	25	10
2	**Sequential model and related Problems** Processing n jobs through 1 machine and 2 machines	15	6
3	**Queuing Theory** 3.1 Characteristics of Queuing Models 3.2 Transient and Steady states of the System 3.3 Model – I [(M/M/1) : (FCFS / ∞ /∞)] 3.4 Model II – Generalization of Model 3.5 [(M/M/1) : (FCFS / ∞ / ∞)] (Birth- Death Process) 3.6 Miscellaneous Problems	17	7
4	**Replacement Theory** 4.1 Replacement of items that deteriorates with time , when money value is consider & Problems 4.2 Replacement of items that fails suddenly 4.3 Individuals and Group Replacement-Miscellaneous Problems	10	4
5	**INVENTORY THEORY** 5.1 Inventory Model Building 5.2 Single item deterministic Model 5.3 Inventory Control Models without strategies 5.4 Inventory Control Models with shortages	13	5
6	**PERT & CPM** 6.1 Basic differences between PERT and CPM. 6.2 Arrow Networks, time estimates, Earliest expected time Latest – allowable occurrences time Forward Pass Computation Backward Pass Computation	20	8

	6.3 Representation in Tabular Form 6.4 Critical Path 6.5 Probability of meeting scheduled date of completion, 6.6 Calculation on CPM network. 6.7 Various floats for activities 6.8 Critical path updating projects. 6.9 Operation time cost trade off Curve project 6.10 Time cost – trade off Curve- 6.11 Selection of schedule based on Cost Analysis, Crashing the network		

Reference Books
1.Operations Research by Kanti Swaroop, P. K. Gupta and Man Mohan 2.Operations Research by Pannerselvam 3.Operations Research by H. A. Taha

COMMON SUBJECTS FOR SEMESTER IV				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
2	ITC42	Research Methodology & Statistical Tools*	70	-
Objective: Research is a tool which helps the manager to identify, understand and solve management problems. Research improves the decision making ability of the manager. The objective of the subject is to create scientific attitude towards solving a management problem and impart knowledge about tools available for carrying out research with the evidence of statistical techniques.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
Section – I - Research Methodology				
1	**Foundation of Research** 1.1 Introduction, Meaning and Objective 1.2 Motivation in research 1.3 Research Types 1.4 Research Approaches 1.5 Significance of Research		10	5
2	**Research Process** 2.1 Data and information 2.2 Literature – Meaning and importance 2.3 Literature searching and information gathering – need, importance and various sources for literature searching and information gathering 2.4 Research process 2.5 Criteria of a good research		20	5
3	**Research Design** 3.1 Concept and importance in research 3.2 Features of a good research design 3.3 Technical writing, referencing – Types, need and importance in computer science research. 3.4 Referencing styles 3.5 Writing a research proposal		15	8

	3.6 Techniques to be used in research planning and implementation – Gantt Charts, PERT, CPM **(Critical path analysis in research projects)**		
4	**Ethics in research** 4.1 Review of legal, ethical, social and professional (LSEP) issues including data protection and standards. 4.2 Ethical issues concerning research participants, researcher and sponsoring organization.	5	2
Section – I I – Statistical Tools			
5	**Basic Statistics** 5.1 Data, information and system model. 5.2 Frequency Distribution 5.3 Cumulative Frequency Distribution 5.4 Graphical Representation of data 5.5 Measure of Central Tendency and dispersion 5.6 Missing frequencies	25	8
6	**Linear Correlation and Linear Regressing Analysis** 6.1 Correlation – Meaning, Types and significance in research 6.2 Types of correlation 6.3 Karl Pearson's coefficient of correlation 6.4 Regression – Meaning and significance 6.5 Lines of regression.	15	6
7	**Hypothesis Testing** 7.1 Qualities of a good Hypothesis –Framing Null Hypothesis & Alternative Hypothesis. 7.2 Concept of Hypothesis Testing – Logic & Importance 7.3 Testing of Hypothesis, Large Sample Tests, Small Sample Tests (t- Test, F-Test and Chi-Square Test)	10	6
Note: Use of SPSS, MATLAB-Statistical Tool Box, etc. for additional knowledge is recommended.			

Reference Books

1. Christian W. Dawson: Projects in Computing and Information Systems (A Student's Guide). Addison Wesley, 2005.

   Justin Zobel: Writing for Computer Science. Springer, 2004
2. Research Methodology Methods And Techniques C.R. Kothari, New Age International Pub,2nd Ed
3. Research Methodology Concepts And Cases Deepak Chawla, Neena Sondhi, Vikas Pub.
4. Business Research Methods By By William G.Zikmund, Thomson South-Western, CENGAGE Learning.
5. Statistical Methods – S.P.Gupta, Sultan Chand, NewDelhi
6. Statistical and Quantative Methods – Mr. Ranjit Chitale

COMMON SUBJECTS FOR SEMESTER IV				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
3	SSC41	Soft Skill – Interview*	30	-

Objective :
Preparing resumes & CV-Covering letter (effective usage of MSWord)
Self introduction during interviews
Interviews – Types of Interviews, preparing for interviews (Opening, body-answer Q, close-ask Q), Types of questions, facing interviews, reviewing performance
Participating in mock interviews

Reference Books:

1. Interview Skills –Presenting Yourself With Confidence by Sajitha Jayaprakash, Himalaya Publishing House.
2. Enhancing Employability @ SOFT SKILLS by Shalini Verma, Pearson

SEMESTER IV TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T1-IT41	Advance Java	30	70

Objectives:
Students will be able to do socket programming, develop server side applications with database handling using servlets, JSP, JDBC and Hibernet and Springs framework.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Networking with Java** • Networking basics - Sockets, port - Proxy servers • java.net – networking classes and interfaces • Implementing TCP/IP based Server and Client • Datagrams – Datagram packet, Datagram server and client • URL connections • Multithreaded Chat Server • Multithreaded socket Programming	**12**	5
2	**JDBC** • Java database connectivity, JDBC Architecture, JDBC API, • Types of JDBC drivers • Steps to create JDBC Application • Writing first JDBC applications • Types of statement objects (Statement, PreparedStatement & CallableStatement) • Types of resultset, ResultSetMetadata • Inserting and updating records • JDBC and AWT • Connection pooling	13	5

3	**RMI** • Introduction & Architecture of RMI • Stubs & skeleton • Java RMI classes and interfaces • Writing simple RMI application • Parameter passing in remote methods (marshalling and unmarshalling)	5	2
4	**Java Beans** • Java Beans Introduction, design pattern • Beans persistence & introspection • Writing simple bean	5	2
5	**Servlets** • Introduction • Servlet vs CGI, Servlet API Overview • Servlet Life Cycle • Coding: Writing & running simple servlet • Generic servlet, HTTPServlet, ServletConfig, Servletcontext • Writing servlet to handle Get & Post methods, reading use request data • Session tracking in servlets, • Servlets & JDBC • Writing threadsafe servlet Note: Apache Tomcat server is used at server side.	20	6
6	**JSP** • Why JSP? • JSP Directives • Writing simple JSP page, Scripting Elements • Default Objects in JSP, JSP Actions • Managing Sessions using JSP • JSP with beans, JSP & Databases • Error Handling in JSP • Introduction to custom tag • JSP with JDBC Note: Apache Tomcat server is used at server side.	20	10
7	**Spring-Hibernate Fraemwork** • Overview of the Spring Framework • Inversion of Control / Dependency Injection Concepts • Aspect Oriented Programming - concept • Spring MVC Architecture • Bean Factory and Application Context, Attaching and Populating beans, Injecting data through setters and constructors • Listening on events, Publishing events, Spring MVC Layering • Dispatcher Servlet, Writing a Controller, DAO, Models, Services, Spring Configuration File • Error handling Strategy	25	10

	• JDBC with Spring – Working with the HSQLDB Database • Hibernate with Spring, Benefits of using Spring with Hibernate, Working with Hibernate objects, • Hibernate configuration in Spring • Hibernate Sessions, Hibernate Query Language, Executing Queries • DAO Persistence ORM, Hibernate Mapping • Integrating Spring MVC with Hibernate in web application		

Reference Books

1. Java Complete Reference Patric Naughton, Herbert Schildt, TMH,7th Ed.
2. Beginning Java Networking Chad Darby, John Griffin & others
3. Complete Reference- J2EE Jim Keogh, TMH.
4. Inside Servlets Dustine R. Callway, Pearson pub.
5. Developing Java Servlets James Goodwill, Techmedia Pub.
6. Professional JSP Wrox press
7. Complete reference JSP, TMH.
8. Java Server Programming Vol-I Wrox press.
9. JDBC, Servlet and JSP, Black Book, Santosh Kumar K. Dremtech publication
10. Spring and Hibernate, Santosh Kumar K. Mc.Graw Hill Education
11. Spring Persistence with Hibernate, Ahmad Seddighi
12. Java unleashed,; Micheal Morrison

SEMESTER IV
TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
5	T1-IT42	Python Programming	30	70

Objectives: To develop problem solving skills and their implementation through Python
To understand and implement concepts of object oriented methodology using Python.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Python** 1.1 Getting Started**:** Introduction to Python- an interpreted high level language, interactive mode and script mode. **Variables, Expressions and Statements** **1.2** Variables and Types-mutable and Immutable variable and Keywords. **1.3** Operators and Operands in Python. (Arithmetic, relational and logical operators), **1.4** Operator precedence , Expressions and Statements (Assignment statement); **1.5** Taking input (using raw_input() and input()) and displaying output - print statement **1.6** Comments in Python.	5	2
2	**Conditional and Looping Construct** **2.1** if - else statement and nested if – else while, for, use of range function in for, Nested loops	**15**	6

	2.2 break, continue, pass statement 2.3 Use of compound expression in conditional constructs **Functions** 2.4 Built-In Function, invoking built in functions 2.5 Module(Importing entire module or selected objects using from statement) 2.6 Functions from math, random, time & date module. 2.7 Composition 2.8 User Define Function : Defining , invoking functions, passing parameters *(default parameter values, keyword arguments)* **2.10** Scope of variables, void functions and functions returning values		
3	**Strings** 3.1 Creating, initializing and accessing the elements; 3.2 String operators: +, *, in, not in, range, slice [n:m] 3.3 String built in functions & methods: len, capitalize, find, isalnum, isalpha, isdigit, lower, islower, isupper, upper, lstrip, rstrip, isspace, istitle, partition, replace, join, split, count, decode, encode, swapcase 3.4 Strings constants defined in string module Regular Expression and Pattern Matching	10	4
4	**Lists** 4.1 Concept of mutable lists, creating, initializing and accessing the elements of list **4.2** List operations (Concatenation, Repetation, Membership, list slices), List comprehensions **4.3** List functions & methods: len, insert, append, extend, sort, remove, reverse, pop **Tuples** **4.4** Immutable concept, creating, initializing and accessing the elements in a tuple; **4.5** Tuple functions: cmp(), len(), max(), min(), tuple() **Sets** **4.6** Concept of Sets , creating, initializing and accessing the elements of 4.7 Sets operation(Membership, union, intersection, difference, and symmetric difference **Dictionaries** **4.8** Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, **4.9** Traversing, appending, updating and deleting elements 4.10 Dictionary functions & Methods: cmp, len, clear(), get(), has_key(), items(), keys(), update(), values(	25	10
5	**Modules** 5.1 More on Modules: Executing modules as scripts, The	5	2

	Module Search Path, "Compiled" Python files Standard Modules 5.2 The dir( ) Function 5.3 Packages Importing * From a Package, Intra-package References, Packages in Multiple Directories		
6	**I/O and File Handling** 6.1 Output Formatting 6.2 Reading and Writing Files(text and binary mode)	10	4
7	**Errors and Exceptions** **7.1** Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions **7.2** User-defined Exceptions, Defining Clean-up Actions(try - finally), Predefined Clean-up Actions	10	4
8	**Introduction to Object Oriented concepts in Python** **8.1** Object Oriented concepts **8.2** Objects, Python Scopes and Namespaces **8.3** Classes, Class Objects, Instance Objects, Method Objects, Class and Instance Variables **8.4** Inheritance	20	8
Reference Books			
1. https://docs.python.org **2. Learning Python By Mark Lutz,O'Reilly Publication** **3. Programming with python, A users Book, Michael Dawson, Cengage Learning** **4. Python Essential Reference, David Beazley, Third Edition** **5. Python Bible**			

SEMESTER IV **TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT**				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T1-IT43	Advance DBMS	30	70
Objectives: At the end of the course students should be able to: gain an awareness of the basic issues in objected oriented data models, applications, familiarize with the data-warehousing and data-mining techniques and other advanced topics.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**Introduction to Advance Database Management System – Concepts & Architectures** Centralized Client-Server Server system Transaction servers Data servers Cloud based servers Web based system Web architecture (2 tier , 3 tier, N-tier Architecture) Web services – SOAP		10	4

2	**Parallel Databases** Introduction I/O parallelism Inter-query and Intra-query parallelism, Inter-operational and Intra-operational parallelism Design of parallel systems Parallelism on Multicore processors	15	6
3	**Distributed Databases** Introduction, Homogeneous and Heterogeneous Databases Distributed data storage, Distributed transactions Commit protocols Concurrency control Availability Cloud based databases, Directory systems	15	6
4	**Specialty Databases & Applications** Object based Databases – OR & OO - Overview of Object- Oriented concepts & characteristics - Database design for OODBMS – Objects, OIDs and reference types - Database design for ORDBMS - Comparing RDBMS, OODBMS & ORDBMS Temporal databases Spatial data & Geographic database Multimedia data Mobility & Personal databases	20	8
5	**Data Warehousing** Introduction to Data warehousing Architecture, Warehouse schemas, Dimensional data modeling- star, snowflake schemas, Fact Constellation OLAP and data cubes: Operations on cubes Data preprocessing –need for preprocessing, data cleaning, data integration & transformation, data reduction	15	6
6	**Knowledge Base Systems & Data Mining** Data mining as a part Knowledge Discovery process Introduction to machine learning & data mining Association rules Market-basket Model, support & confidence Apriori Algorithm Sampling Algorithm Frequent-pattern Tree Algorithm Partition Algorithm Other types of Association rules Classification Decision tree induction Bayesian classifiers Clustering – k-means Algorithm	15	6

	Regression Neural Networks Genetic Algorithms Text mining Data-visualization Applications of Data Mining		
7.	**Information retrieval** Overview, Relevance ranking using terms and hyperlinks, synonyms, homonyms, ontology's, Indexing of documents, measuring retrieval effectiveness, web search engines, Information retrieval and structured data. Information Retrieval, Study and Comparison of Synonyms, Homonyms, ontology's. Implementation issues of Relevance ranking Algorithm.	10	4

Reference Books

1. Database system concepts', 6th Edition –Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International)
2. Data Mining: Concepts and systems – Jiawei Han, Micheline Kamber, (MorganKaufmannpublishers)
3. Database systems : "Design implementation and management"- Rob Coronel, 4thEdition, (Thomson Learning Press)
4.Database Management Systems – Raghu Ramkrishnan, Johannes Gehrke Second Edition, (McGraw Hill International)
5. Database Management System – Alexis Leaon, Mathews Leon, (leon press)
6. Fundamentals of Database Systems – Remez Elmasri , Shamkant Navathe,Pearson,5th Ed
7. Database Systems – a Practical approach to design , implementation & Management –Thomes M. Colnnolly, Carolyn E. Begg, Pearson 4th Ed.

SEMESTER IV
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
7	T1-IT44	Cloud Computing	30	70

Objective : This module gives students the skills and knowledge to understand how Cloud Computing Architecture can enable transformation, business development and agility in an organization.

-Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Cloud Computing** Cloud Computing definition, characteristics Pros and Cons of Cloud Computing, Cloud service Models(SAAS,PAAS,IAAS) Organizational Cloud Types(Private, Public, Hybrid) Benefits and limitations of Cloud Comparison of SAAS, PAAS, IAAS Cloud computing vs. Cluster computing vs. Grid computing	**15**	**6**

	Cloud Computing and SOA		
2	**Virtualization** Virtualization Basics Objectives Benefits of Virtualization Understanding Hypervisors Virtual Machine Types VMware	**14**	**5**
3	**Infrastructure as a Service (IaaS)** 3.1 Introduction to IaaS, IaaS definition, Introduction to virtualization 3.2 Different approaches to virtualization, Hypervisors 3.3 Machine Image, Virtual Machine(VM) 3.4 Resource Virtualization-Server,Storage,Network 3.5 Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing 3.6 Examples-Amazon EC2,Renting, EC2 Compute Unit, Platform and Storage, pricing, customers	**15**	**8**
4	**Platform as a Service (PaaS)** 4.1 Evolution of computing paradigms and related components (distributed computing, utility computing, Cloud computing, grid computing, etc.) 4.2 Introduction to PaaS-What is PaaS, Service Oriented Architecture (SOA) 4.3 Examples-Google App Engine 4.4 Microsoft Azure, 4.5 SalesForce.com's platform	**15**	**7**
5	Software as a Service(SaaS) 5.1 Introduction to SaaS,Web services,Web 2.0 5.2 Web OS,Case Study on SaaS	**15**	**4**
6	**Cloud Security** Cloud Security Fundamentals Vulnerability Assessment Tool For Cloud Privacy and Security in Cloud Cloud Security Architecture Identity Management and Access control Cloud Computing security challenges	**14**	**6**
7	**Issues in Cloud Computing** Issues in Inter cloud computing Quality of services in cloud Computing Data Migration in Cloud Streaming in Cloud	**12**	**4**

Reference Books
1. Google Apps by Scott Granneman,Pearson 2. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY) 3. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill, 4. Cloud Computing Bible by Barrie Sosinsky, Wiley India 5. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication **6.** Borko Furht, "Handbook of Cloud Computing", Springer **7.** Venkata Josyula,"Cloud computing – Automated virtualized data center", CISCO Press **8.** Greg Schulr,"Cloud and virtual data storage networking", CRC Press

SEMESTER IV TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	T1-IT41L	Advance Java Lab *	50	-
Objective: This lab work will provide hands on practice to student to enhance their Java Programming Skills. Assignments on Java concepts such as abstract Windows Toolkit, Java Input Output, Networking, JDBC, RMI ,Java Beans can be included.				

SEMESTER IV TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	T1-IT42L	Python Programming Lab*	50	-
Objective : This lab work will provide hands on practice to student to enhance their Python Programming Skills. Assignments on python concepts functions, strings, Lists, directories, modules, input output, exception handling, object oriented concepts can be included.				

Note : Python 2.7.X version can be used for practical sessions

SEMESTER IV TRACK II : INFRASTRUCTURE AND SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T2-IT41	Identity and Access Management	30	70

Objectives:
This objective of this course is intended to understand how IDA solutions are implemented in Windows Server 2008. This course provides a technology overview of IDA and PKI solutions, and details the implementation of each of the roles in Windows Server 2008 that implement the IDA solution. The motive is to make the students IT professionals, and developers who are responsible for integrating applications and platforms with enterprise directory and security services.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Exploring Identity and Access Solutions:** • The Business Case for Identity and Access Control • Active Directory Server Roles in IDA Management • Overview of Identity Lifecycle Manager 2007	10	4
2	**Deploying and Managing Active Directory Certificate Services** • Overview of PKI • Deploying a CA Hierarchy • Installing AD CS • Managing CAs	10	5
3	**Deploying and Managing Certificates** • Configuring Certificate Templates • Deploying Certificates by Using AD CS • Deploying Certificates by Using Auto enrollment • Revoking Certificates • Configuring Certificate Recovery	15	5
4	**Configuring Active Directory Lightweight Directory Services** • Installing and Configuring AD LDS • Configuring AD LDS Instances • Configuring AD LDS Replication • Configuring AD LDS Integration with AD DS	15	5
5	**Configuring Active Directory Federation Services** • Overview of AD FS • AD FS Deployment Scenarios • Deploying AD FS • Implementing AD FS Claims	15	6

6	**Configuring Active Directory Rights Management Services** • Overview of AD RMS • Installing and Configuring AD RMS Server Components • Administering AD RMS • Implementing AD RMS Trust Policies	15	6
7	**Maintaining Access Management Solutions** • Supporting AD CS • Maintaining AD LDS • Maintaining AD FS • Maintaining AD RMS	10	5
8	**Troubleshooting Identity and Access Solutions** • Troubleshooting AD CS • Troubleshooting AD LDS • Resolving AD FS Issues • Solving AD RMS Issues	10	4

Reference Books

1. AWS Identity and Access management(IAM)user guide kindle edition by Amazon web services.
2. Identity and Access Management :Business performance through connected intelligence by Ertem Osmanoglu.
3. Digital Identity and access management :technologies and frameworks by Rajsharman ,Sanjukta Das Smith,Manish Gupta.
4. Configuring and trouble shooting identity and access solutions with Windows server 2008 Acive directory, Publisher Microsoft.

SEMESTER I V TRACK II : INFRASTRUCTURE AND SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	T2-IT42	IT Advisory Services	30	70

Objectives: IT Advisory Services is one of the budding business models. Consultancy is a mindset that can be developed by any professional who aspires to become an IT Advisor. With proper education, this mindset can be inculcated into the minds of young professionals. The objective of this course is to provide students with the knowledge, skills and motivation required to encourage professional success and provides platform and solutions to face the global challenges that one might foresee in a venture.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	FUNDAMENTALS OF IT ADVISORY SERVICES- Meaning and definition, Overview, Four-tier system-professional services, staffing firm, independent consultants/contractors, information technology security consultant, Choice of correct form of business organization, Need, Scope and Objectives, Pre-requisites of an Advisory Services Organization, Major obstacles	15	8
2	IT CONSULTING SKILLS- Advisory skills, Technical skills, Business skills, Communication skills, Management skills, Language skills, Business and management language skills, Technical language skills	15	8
3	WHO IS A CONSULTANT Ways of work, common types, place of work, qualifications, Pre-requisites of contracts, Feasibility, Technical, Financial and operational, Types of consulting	10	4
4	GLOBAL TENDERING & OPERATIONAL ASPECTS Concept, Meaning, Legal framework, financial aspects, Transactional and currency issues, Licensing and quality aspects, Patents, trade-marks and copy right issues, Limitations	15	8
5	Optimization & utilization of resources, Maximizing profits, Minimizing Costs and achieving competitive advantage, Strategic issues to effect mergers and acquisitions (	15	4
6	CASE STUDIES Real life case-lets to be discussed in the classroom, Success and failure of consulting organizations as well as those companies who did not hire consultants to be elaborated and discussed.	15	8

References			
1. Information Technology Project Management, by Kathy Schwalbe ,Cengage publication 2. https://en.wikipedia.org/wiki/Information_technology_consulting 3. https://en.wikipedia.org/wiki/Consultant 4. "Consultant | Define Consultant at Dictionary.com". Dictionary.reference.com. 2004-03-09. Retrieved 2014-07-20. 5. The professional knowledge economy: the management and integration services in business organizations by Pieter P. Tordoir.			

SEMESTER IV TRACK II : INFRASTRUCTURE AND SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T2-IT43	**Infrastructure Security And Audit**	30	70
Objectives: To maximize the performance, maintain IT service continuity, reduce security risks and ensure scalability and compliance while effectively managing the IT infrastructure.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**INTRODUCTION TO IT INFRASTRUCTURE** Definition , What is infrastructure The infrastructure model IT systems model Application building blocks Application Integration building blocks Infrastructure building blocks Systems management building blocks, ITIL		10	4
2	**Trends in IT infrastructures, Cloud Computing** The cloud model, Deployment models Service models Infrastructure as a Service (IaaS) Green IT , Use greener equipment, PCs Datacenters, Enhance the efficiency of the datacenter Use less resources, Bring Your Own Device (BYOD) Big data		10	5

3	**Understand security concerns and concepts of the following types of devices:** • Firewalls; Routers; Switches; Wireless; Modems • RAS (Remote Access Server); Telecom / PBX (Private Branch Exchange) • VPN (Virtual Private Network); IDS (Intrusion Detection System) • Network Monitoring / Diagnostics; Workstations; Servers; Mobile Devices	10	5
4	**Understand the security concerns for the following types of media:** • Coaxial Cable; UTP / STP; Fiber Optic Cable • Removable Media (Tape; CD-R; Hard Drive; Diskette; Flashcard; Smartcard)	10	4
5	**Security Topologies:** • Security Zones (DMZ; Intranet; Extranet); VLANs (Virtual Local Area Network) • NAT (Network Address Translation)	13	4
6	**Intrusion Detection System:** • Network Based (Active Detection; Passive Detection) • Host Based (Active Detection; Passive Detection) • Honey Pots; Incident Response Note: Concepts, implementation and configuration of each kind of intrusion detection system	12	4
7	**Security Baselines** • OS / NOS Hardening (File System; Updates: Hotfixes, Service Packs, Patches) • Network Hardening (Firmware Updates; Configuration: Enabling and Disabling Services and Protocols, Access Control Lists) • Application Hardening (Updates; Web Servers; E-mail Servers; FTP Servers; DNS Servers; NNTP Servers; File / Print Servers; DHCP Servers; Data Repositories: Directory Services, Databases)	15	6
8	**Planning and reporting** BCP and DRP, security organization structure. Evidence collection, evaluation and Reporting methodologies	10	4
9	**Auditing for Security** Security Audits what are they? Need for Security audits in organizations Auditors responsibility in Security audits Types of Audits & approaches to Audits Technology based Audits – vulnerability scanning and penetration testing Resistance to Audits Key success factors for Security Audits	10	4

Reference Books

1. Critical Infrastructure Security: Assessment, Prevention, Detection, Response Hardcover – Import, 31 May 2011 by Francesco Flammini
2. IT Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition Hardcover – Import, 24 Feb 2013 by Sjaak Laan
3. IT Infrastructure Management Paperback – 2012 by Anita Sengar
4. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Gobole
5. Information systems control and Audit by Ron Weber, Pearson Pub.
6. Information security Management Hand book- 5th Edition-HAROLD F. TIPTON
7. Computer security by Alfred Basta, Wolf Halton
8. Electronic Signature law by L Padmavathi
9. Network Security by Ankit Fadia
10. Security Plus study guide by Michael Cross, Norrris Johnson
11. Information Security policies made easy version
12. : Charles Cresson Woo
13. Internetworking Technology Handbook by CISCO System
14. Computer Networks and Internets with Internet Applications by Douglas E. Comer

Reference websites:

- **www.security-internal-audit.com**
- **www.ngssecure.com/services**

SEMESTER IV TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	T2-IT44	Enterprise and Solution Architecture	30	70

Objective:

i) To give enterprise and solution architects a broad framework that covers the range of architecture work that precedes and steers system development, and to focus attention on areas where the architect is responsible for effective design and risk management.

ii) To provide architects with generally applicable knowledge and training. General here means independent of any specific architecture framework (Gartner, TOGAF, etc).

This enables Training Providers to teach general knowledge and skills, rather than framework-specific terms, concepts, structures and processes.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**ARCHITECTURE AND ARCHITECTS** 1.1 Architecture granularity 1.2 Architecture Domains 1.3 Hierarchical or Layered Architecture 1.4 Architect Roles, Goals and Skills 1.5 Architecture Precursors	12.5	5

2	**ARCHITECTURE FRAMEWORKS** 2.1 Architecture process frameworks 2.2 Architecture Descriptions 2.3 Architecture Models 2.4 Architecture description frameworks	12.5	5
3	**BUSINESS ARCHITECTURE** 3.1 Business Architecture Structure and Behavior 3.2 Business Process Decomposition and Automation 3.3 Design for Business Security	12.5	5
4	**DATA ARCHITECTURE** 4.2 Knowledge and/or Content Management 4.3 Data Architecture Structure 4.4 Data Qualities and Integration 4.5 Design for Data Security	12.5	5
5	**SOFTWARE ARCHITECTURE** 5.1 Component Structures and Patterns 5.2 Component Interfaces 5.3 Component Interoperation Styles 5.4 Component Communication Styles 5.5 Publish and Subscribe Distribution	12.5	5
6	**APPLICATIONS ARCHITECTURE** 6.1 Applications Architecture Structure and Behavior 6.2 Design for Applications Security 6.3 Application Platform	12.5	5
7	**INFRASTRUCTURE ARCHITECTURE** 7.1 Computers, Connecting Computers to Networks 7.2 Topologies, Networks and Protocols 7.3 Infrastructure Architecture Structure and Behaviour 7.4 Design for Infrastructure Security	12.5	5
8	**ARCHITECTURE MANAGEMENT** 8.1 Architecture implementation 8.2 Architecture change management 8.3 Architecture governance 8.4 Architecture in operations	12.5	5

Reference Books

1. Enterprise Architecture A to Z: Frameworks, Business Process Modeling, SOA, and Infrastructure Technology Hardcover by Daniel Minoli, Auerbach Publications
2. Patterns of Enterprise Application Architecture (Addison Wesley Signature Series) Hardcover by Martin Fowler, Addison Wesley; 1 edition
3. Beyond Software Architecture: Creating and Sustaining Winning Solutions (Addison Wesley Signature Series) Paperback by Luke Hohmann, Addison Wesley; 1 edition

SEMESTER IV TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	T2-IT41L	Identity and Access Management Lab *	50	-

Objective:
To give hand on experience on IDA Solutions

1. Explore How Active Directory Server Roles Provide IDA Management Solutions
2. Installing the AD CS Server Role
3. Issuing and Installing a Subordinate Certificate
4. Publishing the CRL
5. Configuring AD CS Certificate Templates
6. Configuring AD CS Web Enrollment
7. Configuring Certificate Auto enrollment
8. Configuring AD CS Certificate Revocation
9. Managing Key Archival and Recovery
10. Configuring an AD LDS Instance and an Application Partition
11. Configuring AD LDS Access Control
12. Configuring AD LDS Replication
13. Configuring AD DS and AD LDS Synchronization
14. Installing the AD FS Server Role
15. Configuring Certificate Requirements
16. Installing the AD FS Web Agent
17. Configuring the Web Server Application on the 6426B-NWTDC01 Virtual Computer
18. Configuring the Forest Trust and the Federated Trust Policies
19. Configuring the Federation Service Within the Internal Network
20. Configuring the Federation Service Within the Extranet
21. Testing the AD FS Implementation
22. Installing the AD RMS Server Role
23. Managing AD RMS Rights Policy Templates
24. Configuring Trust Policies
25. Testing AD RMS Functionality
26. Configuring CA Event Auditing
27. Implementing Role-Based Administration in AD CS
28. Backing Up a CA
29. Reconfiguring AD RMS Cluster Settings
30. Generating AD RMS Reports
31. Configuring AD RMS Logging
32. Identifying Tools and Troubleshooting Techniques of IDA Solutions

SEMESTER IV TRACK II: INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	T2-IT42L	Mini Project on IT Advisory Services and Enterprise Solutions Architecture *	50	-
Objective: Case study on choosing right type of consulting/advisory organization. Case study on success or failure of implementation based on consulting organization service. Case studies on choice of correct infrastructure model and such other related cases.				

SEMESTER IV TRACK III: INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4.	T3-IT41	E -Commerce & Knowledge Management	30	70

Objectives:
To understand the concepts & role of e-commerce and Knowledge Management in organizations. To get introduced to the key themes of techniques & technology to realize more value from knowledge assets.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to e-commerce**: Meaning, nature and scope; channels of e-commerce, Business applications of e-commerce, Traditional commerce vs. E-commerce, Business model of e-commerce: B2B, B2C, C2C,B2G and other models of e-commerce. The internet technology background, categories of network, switching techniques, Internet service provider, virtual private network	12	**5**
2	**Mobile commerce:** Introduction to M-Commerce ,History & Key Benefits & limitations, Critical Success factors, Wireless Application protocol(WAP),Mobile banking.	8	**3**
3	**Electronic payment system**: Type of payment systems- e-cash and currency servers, e- cheques, credit card, smart card, electronic purses and debit cards, operational, credit and legal risks of e-payments, risk management options for e-payment system, order fulfillment for e-commerce.	15	**7**
4	**Security issues in e-commerce**: Security risk of e-commerce, type and sources of threats; protecting the electronic commerce assets and intellectual property; firewalls; client server network security; data and message security; digital identification and electronic signature; encryption approach to e commerce security.	15	**5**
5	**Introduction to Knowledge Management (KM)** History of Knowledge Management, Types of Knowledge, The Knowledge Management Processes, Knowledge Management Systems, Organizational impact on knowledge management, Factors influencing Knowledge Management.	20	**8**
6	**Knowledge Management Technologies and systems** Knowledge Application Systems, Knowledge Capture Systems, Knowledge sharing systems and Knowledge Discovery Systems.	15	**6**
7	**Knowledge Management Tools** Knowledge capture and creation tools, Knowledge Sharing and Dissemination Tools, Knowledge Acquisition and application tools. Practical implications of KM tools and techniques.	15	**6**

	The KM team: KM roles and Responsibilities within organizations, Future challenges for KM.		

Reference Books

1. E-Commerce concept-model-strategies, C.S.V. Murthy, Himayalaya Publication House
2. Electronic commerce, Elias M. Awad., PHI
3. Knowledge Management, Donald Hislop, Oxford University Press, 2nd edition
4. E-Commerce concepts and applications, Nidhi Dhawan,International book house Pvt Ltd.
5. Knowledge management, Systems and Processes, IRMA Becerra- Fernandez, Rajiv Sabherwal, PHI edition.
6. Knowledge Management, Elias M. Awad and Hassan Ghaziri, Pearson, fourth impression
7. Knowledge Management in Theory and Practice,Kimiz Dalkir,Elsevier
8. Frontiers of Electronic commerce, Kalkota and Whinston, Pearson
9. E-commerce, Joseph, PHI second edition

SEMESTER IV
TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL

Sr. No.	Subject Code	Subject Title	Internal	External
5.	T3-IT42	Cyber laws and Intellectual Property Rights	30	70

Objectives:
To understand the Cyber Crime, it's types and the IT Act and Cyber laws in India.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to Cyber crimes** 1.1 Definition, cybercrime and information security, 1.2 Classes of cybercrime and categories, Cyber offences, Cybercrimes with mobile and wireless devices.	20	**8**
2	**Jurisdiction in the cyber world across the world** 2.1 Cybercrime law in Asia, 2.2 Cybercrime & federal laws, legal principles on jurisdiction and jurisdictional disputes W.R.T. the internet in united states of America, 2.3 Cybercrime legislation in African region, 2.4 Foreign judgments in India	15	**6**
3	**Indian IT act** 3.1 Information Technology Act, 2000(Complete including digital signature, certifying authorities and E-governance), 3.2 Positive aspects, weak areas 3.3 Amendments to the Information Technology Act, 2008 3.4 Challenges to Indian law and cybercrime scenario in India 3.5 Protection of cyber consumers in India	**30**	**12**

4	**Emerging Electronic System** 4.1 E – commerce; E – governance; Concept of Electronic Signature; Credit Cards; Secure Electronic Transactions	7.5	**3**
5	**Intellectual property Rights** 5.1 Intellectual Property law basics 5.2 Types of Intellectual Property 5.3 Agencies responsible for Intellectual Property registration 5.4 International organizations, Agencies and Treaties 5.5 Increasing importance of Intellectual Property Law	10	**4**
6	**Copyright issues in Cyberspace** 6.1 Relevant provisions under Copyright Act, 1957 regulating copyright issues in Cyberspace; Online Software Piracy – legal issues involved; Analysis of sufficiency of provisions of Copyright Act to deals with Online Software Piracy. 6.2 **Trademark issues in Cyberspace –** Domain Name; Cyber squatting as a form of Domain Name dispute; Case law.	7.5	**3**
7	**Case studies** : 7.1 Highlight the cybercrimes, cyber laws and Intellectual property Rights with the help of minimum 5 cases with reference to Indian IT act for better understanding.	10	**4**

Reference Books

1. Herman T. Tavani. Ethics & Technology, Ethical Issues in an Age of Information and Communication Technology,3rd Edition, John Wiley & Sons, Inc., 2011
2. Cyber Laws – Singh Yatindra
3. Cyber Crime – Bansal S K
4. Cyber law , E-commerce & M-Commerce – Ahmand Tabrez
5. Handbook of Cyber and E-commerce laws – Bakshi P M & Suri R K
6. The Indian Cyber Law, Second Edition 2001, Vishwanathan Suresh T., Bharat Law House.
7. Law Relating to Information Technology (Cyber Laws), 1st edition 2001- Asia Law House, Prasad T.V.R. Satya
8. A Guide to Information Technology" (Cyber Laws & E-commerce) Edition 2001:- Capital Law House. Syed Shakil Ahmed and Reheja Rajiv
9. Reed Chris, "Computer Law", Third Edition 1996 (First Indian Reprint 2000):- Universal Law Publishing Co. Pvt. Ltd.

10. Law Relating to Computers Internet & E-commerce (A guide to Cyber Laws & the Information Technology Act, 2000 with Rules & Notification), 2nd Edition, Reprint : 2002:- Universal Book Traders, Kamath Nandan
11. Intellectual Property (Trade Marks & the Emerging concepts of Cyber property rights (HB)", 3rd Edition. (HB), 2002, Universal Book Traders, P. Narayanan,

SEMESTER IV TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6.	T3-BM43	Customer Relationship Management & Supply Chain Management	30	70

Objectives:
To make students understand the role of IT or how IT is an enabler for SCM and CRM.
To understand supply chain strategy framework and supply chain strategies
To comprehend the functionalities of CRM in service sector

Sr. No	**Subject Topic details**	*% Weightage*	**No. of Sessions**
1	**Introduction to CRM** 1.1What is CRM? Why we need CRM? Definition of CRM 1.2 Architecture of CRM 1.3 Technology considerations of CRM 1.4 Technology Components of CRM 1.5 Customer Life Cycle, Customer Lifetime Value computation 1.6 Implications of Globalization on Customer Relationship Management	15	6
2	**Introduction to e-CRM** 2.1 Definition of e-CRM, Its Need, features 2.2 Framework of e-CRM 2.3 Six e's of e-CRM 2.4 CRM Vs e- CRM 2.5 Architecture of e-CRM 2.6 Implementing a Technology Based CRM Solution: (eg; The ICICI Experience)	**15**	**6**
3	**Introduction to Supply Chain** 3.1 what is supply chain, generic types of Supply chain, Major drivers of Supply chain 3.2 What is SCM? Why SCM? 3.3 Supply Chain Strategies Value in Supply Chain- quality, delivery, flexibility 3.4 Core competencies in Supply Chain	20	8
4	4.1 Source management in Supply Chain- insourcing, outsourcing, partner selection, sourcing strategies, procurement strategies 4.2 Managing Inventory in Supply chain- definition of inventories, selective inventory control, vendor managed inventory systems, inventory performance measures- financial, operational & inventory	20	8

	turnover ratio (ITR) 4.3 Transportation Decisions in a Supply Chain – Transportation Strategy, transportation selection, mode of transportation, Transportation management system (TMS)		
5	e- Supply Chain Management 5. 1 Information technology in Supply Chain – Typical IT solutions- EDI, Intranet, Extranet, Data Warehousing, E- commerce, E – procurement, Bar coding technology, GPS, RFID 5.2 Information Systems in Supply Chain Case Study – A live case of use of IT	15	6
6	Case Studies for SCM & CRM (eg. For SCM Mumbai Tiffinwala, For CRM Software like Sales Force)	15	6
Reference Books			
1. Supply Chain & Logistic Management by Bowersox, Closs & Cooper , TMGH, 2nd Edition 2. CRM at the speed of light by Paul Greenberg, YMH 2nd Edition. 3. Customer Relationship Management by Kristin Anderson and Carol Kerr, TMGH			

SEMESTER IV **TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL**				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7.	T3-IT44	Software Quality Assurance and Control	30	70
Objectives: To enable student to learn Software Quality Assurance and control, this course covers the principles of software development emphasizing processes and activities of quality assurance.				

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Software Quality Assurance Fundamentals** 1.1 Definition of Quality, QA, QC, SQA 1.2 SQA Planning & Standards 1.3 SQA Activities 1.4 Building blocks of SQA 1.5 Quality factors 1.6 Software Quality Metrics	**15**	**6**
2	**Software Reliability** 2.1 Reliability Measures 2.2 Reliability models	**7.5**	**3**

3	**Software Verification & Validation Activities** 3.1 Verification & Validation Concepts 3.2 Verification & Validation Planning 3.3 Software inspections 3.4 Automated static Analysis 3.5 Clean room Software Development 3.6 **Case Study** : Software Inspection Checklist preparation	**15**	**6**
4	**Software Quality Assurance Plan:** 4.1 Steps to develop and implement a Software Quality Assurance 4.2 Plan Quality Standards: ISO 9000 and Companion ISO Standards 4.3 CMM, CMMI, PCMM, Malcom Balridge **4.4** Six Sigma	**15**	**6**
5	**Software Quality Assurance Metrics** 5.1 Measurement Software Quality Metrics 5.2 Product Quality metrics 5.3 In-Process Quality Metrics 5.4 Metrics for Software Maintenance 5.5 Examples of Metric Programs	**15**	**6**
6	**Software Quality metrics methodology** 6.1 Establish quality requirements 6.2 Identify Software quality metrics 6.3 Implement the software quality metrics 6.4 Analyze software metrics results 6.5 Validate the software quality metrics 6.6 Software quality indicators 6.7 Fundamentals in Measurement theory	**17.5**	**7**
7	**Software Quality Infrastructure Components** 7.1 Procedures and Work Instructions 7.2 Supporting Quality Devices 7.3 Staff Training, Instructing and Certification 7.4 Preventive and Corrective Actions 7.5 Configuration Management 7.6 Documentation and Quality Records Controls	**15**	**6**

Reference Books

1. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, 2012. 2.
2. Roger S. Pressman, "Software Engineering-A Practitioner's Approach", McGraw Hill pub.2010.
3. Allen Gilles "Software quality: Theory and management", International Thomson, Computer press 1997.
4. Stephen H.Kan, "Metrics and models in software quality Engineering", Addison – Wesley 2003. Software Engineering R. Pressmen – TMH,7th Ed.
5. Software Engineering Sommerville, Pearson,8th Ed

1. www.effectivesoft.com
2. www.sei.cmu.edu
3. www.iist.org

SEMESTER IV TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8.	T3-IT43L	Mini Project based on CRM & SCM *	50	-
Objective : Students should develop mini project using the concepts of CRM and SCM				

SEMESTER IV TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	T3-IT44L	Software Quality Assurance & Control Lab*	50	-

1. MS - project

Its use in project scheduling

2. Project planning and installation of the Work environment

Objectives:

1: Perform the project planning activity according to the basic profile of ISO/IEC 29110, perform a desk check of the project plan;

2: Select tools and set up the working environment (e.g. a version control tool and an issue tracking tool);

Deliverables

1. Project plan:
• Profile of freedoms/constraints
• Identification of the criticality of the project
• Roles and responsibilities of team members
• Version control strategy
• Delivery instructions
2. Work environment [installed and tested]
3. Contracts among team members
4. Defect registration form (desk check of the project plan)

3. Analysis and documentation of requirements

Objective 1: Perform the software requirements analysis activity of ISO 29110;

Objective 2: Perform a walkthrough to verify the specifications

Deliverables

1. Functional and nonfunctional requirement specifications
2. Audit results
3. Validation results

5. Software user documentation
[preliminary]

4.S/W Configuration Management Tools
Source Code Control System (SCCS)

SEMESTER IV				
SEMESTER IV TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T4-IT41	Network Administration II	30	70
Objective: To offer advanced knowledge about the network administration along with the practical exposure on VLAN, IP Routing, OSPF, IGRP,EIGRP etc.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	**Virtual LANs** 1.1 Virtual LAN Concepts, 1.2 Trunking with ISL and 802.1Q, 1.3 IP Subnets and VLANs, 1.4 VLAN Trunking Protocol (VTP), 1.5 VLAN and VLAN Trucking Configuration and Verification, 1.6 VTP Configuration and Verification,		10	4
2	**Troubleshooting LAN Switching** 2.1 Generalized Troubleshooting Methodologies, 2.2 Analyzing and Predicting Normal network Operation, 2.3 Troubleshooting the LAN Switching Data Plane, 2.4 An Overview of the Normal LAN switch Forwarding Process , 2.5 PC1 Broadcast in VLAN 1, 2.6 Forwarding Path: Unicast from R1 to To PC1 151,		15	6
3	**IP Routing: Static and Connected Routes** 3.1 IP Routing 162, 3.2 IP Addressing and Sub netting, 3.3 IP Forwarding by matching the most specific Route, 3.4 DNS, DHCP, ARP, and ICMP, 3.5 Fragmentation and MTU 173, 3.6 Secondary IP Addressing ISL and 802 1 Q configuration on Routers, 3.7 Configuring State Routes, 3.8 The extended ping Command, 3.9 Static Default Routes, 3.10 Default Routes Using the IP route Command, 3.11 Default Routes Using the IP default - network command		15	6
4	**TROUBLESHOOTING IP ROUTING**		10	4

	4.1 The Ping and trace route Commands 4.2 Internet Control Message Protocol 4.3 Troubleshooting the Packet Forwarding Process 4.4 Host Troubleshooting Tips 4.5 Interface Status 4.6 Access List Troubleshooting Tips		
5	**ROUTING PROTOCOL THEORY** 5.1 Dynamic Routing Protocol Overview 5.2 Routing protocol Functions 5.3 Interior and Exterior Routing Protocols 5.4 Comparing IGPs 5.5 Distance Vector Routing Protocol Features 5.6 Link-State Routing Protocol Features	15	6
6	**OSPF** 6.1 OSPF Protocols and Operation 6.2 OSPF Neighbors 6.3 OSPF Topology Database Exchange 6.4 Building the IP Routing Table 6.5 OSPF Configuration	10	4
7	**EIGRP** 7.1 EIGRP Concepts and Operation 7.2 EIGRP Neighbors 7.3 Exchanging EIGRP Topology Information 7.4 EIGRP Convergence 7.5 EIGRP Configuring and Verification	15	6
8	**POINT-TO-POINT WANs** 8.1 PPP Concepts 8.2 The PPP Protocol Field 8.3 PPP Link Control Protocol 8.4 PPP Configuration	10	4
References:			
CCNA ICND2 (Second Edition) - By Wendell Odom.			

Semester				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	T4-IT42	Internet of Things	30	70
Objective: To study the paradigm of objects interacting with people, information systems, and with other objects via network communications.				
Sr. No	**Topic Details**		**% Weightage**	**No. of Sessions**
1	Introduction – Concepts behind the Internet of Things. 1.1 The IoT paradigm - Smart objects - Bits and atoms -		12	05

	Goal orientation - Convergence of technologies 1.2 Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, 1.3 Overview of IoT architecture (for Conceptual understanding only)		
2	IoT Applications for Value Creation 2.1 Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT 2.2 Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT 2.3 Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	13	05
3	Overview of IoT connectivity methods , technologies 3.1 Wireless 101 3.2 RF 101 3.3 ZigBee 3.4 RFID 3.5 Hardware, SoC, sensors, device drivers, IoT standards 3.6 Cloud computing for IoT 3.7 Bluetooth, Bluetooth Low Energy 3.8IEEE 802.15.4, IEEE 802.15.4e, 802.11ah 3.9Relay Access Point (AP) 3.10Grouping of stations 3.11 Target Wake Time (TWT) 3.12Real-time systems and embedded software 3.13Cloud computing and storage 3.14 Augmented Reality	25	10
4	Protocols 4.1NFC, RFID, Zigbee 4.2MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe 4.3Wired vs. Wireless communication 4.4GSM, CDMA, LTE, GPRS, 3G, LTE,small cells, SATCOM 4.5Sensors and sensor networks 4.6Wired connectivity 4.7IPv4/IPv6 4.8Ethernet/GigE	20	08
5	Evaluation of of The Internet of Things 5.1 Platforms 5.2 Mobile integration	20	08

	5.3 Deployment 5.4 Data Visualization 5.5 Convergence with Social Networks 5.6 Value chain and Business models 5.7User centric cloud based services 5.8 Analytical Hierarchy Process for technology selection 5.9 End-to-end security 5.10Integration with IT systems,Cost/benefit constraints End-to-end compatibility ,Application Architecture 5.11 Lifecycle solution management,Real-time response and delay		
6	Internet of Things Privacy, Security and Governance 6.1 Introduction, Overview of Governance 6.2 Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	10	04

REFERENCES :

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013, ISBN: 978-87-92982-96-4 (E-Book), ISBN: 978-87-92982-73-5 (Print

2. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1

3. Internet of Things (A Hands-on-Approach) by Vijay Madisetti, Arshdeep Bahga

4. Getting Started with the Internet of Things by Cuno Pfister

5. The Internet of Things by Samuel Greengard

SEMESTER IV TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T4-IT43	Linux Administration II	30	70

Objectives :
1. To understand internet connectivity and database service administration.
2. To aware with the secure file transfer protocols and e-mail handling as well as management of kernel and other application through linux.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Internet connectivity** 1.1 Common configuring information. 1.2 Laying the foundation: the local host Interface 1.3 Configuring dialup internet Access. 1.4 Configuring Digital Subscriber Line Access 1.5 Troubleshooting Connection Problems 1.6 Configuring a Dial –in PPP server	15	6
2	**Administering Database Services** 2.1 A brief Review of Database Basics 2.2 Installing & Configuring MySQL, PostgresSql 2.3 Database Clients	10	5
3	**Secure File Transfer Protocol** 3.1 FTP Client 3.2 FTP Server 3.3 Installing FTP Software 3.4 FTP User 3.5 Configuring the Very Secure FTP Server. 3.6 Configuring The WU-FTPd Server 3.7 Using Commands in the ftp hosts File to Allow or Deny FTP Server Connection 3.8 Server Administration	20	8
4	**Handling Electronic Mail** 4.1 How Email is Send & Received 4.2 The Mail Transport Agent 4.3 Choosing a Mail Client 4.4 Attachment – Sending Binary Files as Text 4.5 Basic Sendmail Configuration & Operation 4.6 Using Fetchmail to Retrieve Mail. 4.7 Choosing a Mail Delivery Agent 4.8 Mail Daemons	20	8
5	**Kernel & Module Management** 5.1 The Linux kernel 5.2 Managing Modules 5.3 When to Recompile modules 5.4 Kernel Versions 5.5 Obtaining the Kernel Sources 5.6 Patching the kernel 5.7 Compiling the kernel	20	8

6	**Multimedia Applications** 6.1 Burning CDs & DVDs in Fedora core Linux 6.2 Sound & Music 6.3 Viewing TV & Video 6.4 Using Cameras with Fedora core Linux 6.5 Using Scanners in fedora Core Linux	15	5

References:

1. Red Hat Linux & Fedora Unleashed- By Bill Ball & Hoyt Duff
2. Linux Administration Handbook- By Evi Nemeth, Garth Snyder, Trent R. Hein
3. The Complete Reference Linux Sixth Edition- By Richard Petersen
4. Red Hat Linux 7 Unleashed- By Bill Ball, David Pitts, et al.

SEMESTER IV TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	T4-IT44	Wireless Networks	30	70

Objective: To get the complete knowledge on wireless technology including all generations.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Wireless local area networks** Introduction to wireless LANs IEEE 802.11 WLANs Physical Layer MAC sublayer MAC Management Sublayer Wireless ATM HIPERLAN HIPERLAN-2, WiMax	20	8
2	**3G overview & 2.5G evolution** Migration path to UMTS UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview Radio and Network components, Network structure, Radio network, TD-CDMA, TD-SCDMA	20	8
3	**Ad-hoc & sensor networks** Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols,	20	8

	Wireless Sensor networks- Classification, MAC and Routing protocols		
4	**Interworking between Wlans and 3g wwans** Interworking objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Interworking Architectures for WLAN and GPRS, System Descripltion, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system	20	8
5	**4G & Beyond** 4G features and challenges, Technology path, IMS Architecture, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services, Multimedia, MVNO.	20	8

References:

1. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
2. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.
3. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
5. Dharma Prakash Agrawal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India Edition, 2nd Ed., 2007.
6. Gary. S. Rogers & John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2007.
7. Sumit Kasera and Nishit Narang, " 3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.

SEMESTER IV **TRACK IV :NETWORKING**				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8.	T4-IT41L	Virtualization Lab *	50	-
Objective : To give the complete knowledge of hardware and software virtualization				
1. Virtualization Basics and Technology Choices 2. Comparing Virtualization Technologies 3. Installation of VMware Server 4. Installation of VMware ESXi				

5. Installation of Citrix XenServer
6. Installation of Microsoft Virtual PC
7. Installation of Microsoft Hyper-V
8. Installation of VirtualBox
9. Configuring Dedicated Servers with Virtualization
10. Desktop Virtualization
11. Network and Storage Virtualization
12. Building the Virtual Infrastructure

SEMESTER IV TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9.	T4-IT44L	Wireless Network Lab *	50	-

Objective: To give the practical exposure on wireless networks along with live cases which helps to configure and understand real issues on the site. Set of practical are helpful to become wireless administrator and builds the platform to become certified professional.

1. Wireless Component and Media Identification
2. Install a WLAN Adapter Card
3. Wireless Mathematics
4. Topology Design with Cisco Network Designer (CND)
5. Configuring Basic AP Settings
6. Resetting the Bridge
7. Antenna Setup
8. Wireless Attacks and Countermeasures
9. WLAN Design
10 Site Survey Active Mode
11 Basic Troubleshooting on AP
12 Wireless Case Study of a School/Hospital/Hotel/Any organization

SEMESTER V

COMMON SUBJECTS FOR SEMESTER V

Sr. No.	Subject Code	Subject Title	Internal	External
1	ITC51	Software Project Management	-	70

Objective:
To learn process of software project management, cost estimation, use of project Management tools, configuration management, user roles and software teams.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Project Management Framework** Overview of project Management Project Organization Project management life cycle Planning a s/w project Role of - Project Manager , Team members , Client & Users in project management	12	5
2	**S/w Project Estimation** Work Break Down for Project Estimation & setting Milestones Different methods of estimation COCOMO model Delphi cost estimation Function point analysis. Project Management through Microsoft Project(Ms-Project)· Introduction Gantt Chart PERT Chart Usage of Microsoft Project for Estimation and Management Software Project Metrics (Size Oriented, Software Measurement, Function Oriented, Object Oriented Metrics) Project Scheduling, tracking & Progress reporting	25	11
3	**Risk Management** Identification of Risks Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Risk Closure	10	4
4	**Software Quality Management & Control** Quality Assurance & Standards ; The SEI Capability Maturity Model CMM; Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, Quality assurance & Validation plan (SQA Activities , reviews, walkthroughs, inspection, testing) Automation to improve Quality in testing Defect Management	20	7
5	**Configuration Management(CM)** Configuration management & Maintenance plan Change Management Version and Release Management Configuration Management Tools	13	5

6	**S/W Team Management** Team Structure & Staff development plan Characteristics of Performance management High performance Directive and collaborative styles Team Communication Group Behavior Managing customer expectations	12	5
7	**Project Management Tools** Project management tool like MS Project Assignment can be given based on the tool	**8**	3

Reference Books

1. Software engineering principles and practice, McGraw-Hill, Waman S. Javadekar
2. Effective software project management,Willy india edition, Robert K. Wysocki
3. Software quality, producing practical, consistent software, Mordechai Ben-Menachem
4. Software project management in practice, Pearson,Pankaj Jalote
5. Software testing and quality assurance , Theory and practice,Willy-India edition, Kshirsagar Naik
6. Software project management, A Concise Study, S. A. Kelakar.
   Software Engineering, Pressman

Reference website

http://www.pmi.org

SEMESTER V

COMMON SUBJECTS FOR SEMESTER V

Sr. No.	Subject Code	Subject Title	Internal
1	ITC51P	Project *	100

Guidelines:

Student supposes to collect all requirements, do the analysis of the requirements of project. Student should prepare the SRS of the project. Student should complete the project up to design phase of SDLC.

COMMON SUBJECTS FOR SEMESTER V

Sr. No.	Subject Code	Subject Title	Internal
3	SSC51	Soft Skill – Group Discussion *	30

Objective:

Team building , Team briefing, Role of Team leader, Conflict resolution, Methodology of Group discussions, Role Functions in Group Discussion, Improving group performance, Mock group discussions

Reference Books:

1. Successful Workplace Communication by Phil Baguley-Hodder Education
2. Organizational Behavior by Newstrom Keith Davis-Tata McGraw-Hill.

SEMESTER V

SEMESTER V
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
4	T1-IT51	ASP .Net using C#	30	70

Objective: To teach student application development technology currently available.

Guidelines for subject: Prefer .NET Framework 4.0 and Visual Studio 2010

Sr. No	Topic Details	% Weightage	No. of Sessions
1.	**Basics of C# and ASP .Net** 1.1 . C# basics (oops concepts, syntaxes, loops, typecasting etc.) 1.2 C# Basics –II (Sealed class,Abstract class,Partial class,Sealed Method Generics, Delegates, file/stream,collection) 1.3 Net Framework 1.4 Creating an ASP.NET Web Application Project 1.5 ASP .Net Architecture 1.6 Processing of an application in .Net 1.7 Namespace Fundamentals 1.8 Maintaining State Information	15	7
2.	**Creating a User Interface (Controls and Master Page)** 2.1 Using Controls 2.2 Validation Controls 2.3 Navigation between Pages 2.4 Master Pages & Themes 2.5 Simple Master Page Nested Master Page Configuring Master Page Creating Themes 2.6 Applying Themes, Applying Style sheet	12	6
3.	**Data Binding** 3.1 Bind data to UI 3.2 Transform and filter Data	7	3
4.	**Storing and Retrieving Data with ADO.NET** 4.1 Accessing Data with ADO.NET 4.2 Using Data Sets on Web Forms 4.3 Processing Transactions	11	6
5.	**Catching and Correcting Errors** 5.1 Using Exception Handling 5.2 Using Error Pages 5.3 Logging Exceptions	9	4
6.	**Web Services** 6.1 Creating Web Services 6.2 Discovering Web Services 6.3 Instantiating and Invoking Web Services	9	3
7.	**Testing , Building and Deploying Web Applications** 7.1 Creating Tests 7.2 Running Tests	9	4

	7.3 Debugging 7.4 Building a Web Application 7.5 Deploying a Web Application 7.6 Creating an Installation Program		
8.	**Building and Deploying Web Applications** 8.1 Building a Web Application 8.2 Deploying a Web Application 8.3 Creating an Installation Program	7	2
9.	**Maintaining Security** 9.1 Authenticating and Authorizing Users 9.2 Using Windows Authentication 9.3 Using Forms Authentication	7	2
10.	**Use of Ajax on the web forms** 10.1 Introduction to Ajax Controls 10.2 Using Ajax controls on web forms	7	2
11.	**Introduction to MVC** **10.1** Introduction to MVC Architecture 10.2 MVC- Model,Views,Controllers 10.3 Creating Simple MVC Application	7	3

Reference Books

1. Microsoft ASP.NET 4.0 Step by Step - George Shepherd, Microsoft Press
2. Mastering ASP.Net - BPB Publication
3. ASP.net – The Complete Reference- Tata McGraw Hill
4. ASP.NET Programming – Murach

SEMESTER V
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
5	T1-IT52	Service Oriented Architecture	30	70

OBJECTIVES:
- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To learn technology underlying the service design
- To learn advanced concepts such as service composition, orchestration and Choreography
- To know about various WS specification standards

Sr. No	Topic Details	% Weightage	No. of Sessions
1	Introducing SOA: Fundamental SOA - Common Misperceptions about SOA - Common tangible benefits of SOA - Common pitfalls of adopting SOA. -The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework-Services, Service descriptions, messaging with SOAP.	15	6
2	Web Services and Contemporary SOA: Message exchange	**25**	10

	patterns- Service activity-coordination-Atomic transactions-Business activities-Orchestration-Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging-Correlation- Policies- Metadata exchange- Security- Notification and eventing. SOA and Service-Orientation: Principles of Service - Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation.		
3	Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis-Benefits of a business-centric SOA- Deriving business services-Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.	20	8
4	Service-Oriented Design Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.	20	8
5	SOA Service Design: - Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics-WS Coordination.	20	8

Reference Books

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2006.
2. Frank. P. Coyle, "XML, Web Services And The Data Revolution", Pearson Education, 2002.
3. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services. An Architect's Guide", Pearson Education, 2005.
4. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
5. Dan woods and Thomas Mattern, "Enterprise SOA designing IT for Business Innovation", O'REILLY, First Edition, 2006.
6. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013.

SEMESTER V TRACK I : SOFTWARE AND APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T1-IT53	Big Data Analytics	30	70

Objectives:

1. To Understand the Big Data challenges & opportunities ,its applications
2. Gain conceptual understanding of NOSQL Database.
3. Understanding of concepts of map and reduce and functional programming
4. Gain conceptual understanding of Hadoop Distributed File System.

Sr. No	Topic Details	% Weightage	No. of Sessions
	Introduction		
1	**"Big Data" in the Enterprise** Big Data Concepts, Challenges. Opportunities from Big Data Enterprise Information Management :New Approach to Enterprise Information Management For Big Data, Capabilities needed for Big data **Big Data Implications for Industries** Big Data Analytics for Telecom/Banking/Retail/HealthCare/IT/Operations	**15**	**6**
2	**Emerging Database Landscape** Scale-Out Architecture, RDBMS Vs Non-Relational Database Database Workload & its Characteristics Implication Of Big data Scale on Data Processing	10	4
3	**Application Architectures For Big Data And Analytics** Big Data Warehouse & Analytics Big data Warehouse System requirements & Hybrid Architectures Enterprise Data Platform Ecosystem Big Data and Master Data Management	**15**	**6**
4	**Data Modeling Approaches for Big data And Analytics Solution** Understanding data integration Pattern Big Data Workload Design Approaches Map-Reduce patterns, Algorithms and Use Cases	**10**	**4**
5	**NOSQL** Introduction of NoSQL Database concepts: -: ACID Vs. BASE, Advantages, Where Applicable, Schema, Two Phase Commit, Sharding and Share Nothing Architecture, NoSQL Databases, Brewers CAP Theorem, Features and comparisons of few NOSQL Databses (Cassandra, Mongo, Cloudera, CouchDB, HBase)	10	4
6	**Hadoop Framework** Hadoop Architecture, History of Hadoop – Facebook, Dynamo, Yahoo, Google Components Of Hadoop Framework :HDFS, MAP Reduce Introduction to Pig, Hive, Mahout Installation of Single Node cluster- installation of Java,	10	6

	Hadoop Configuration		

7	**Big Data Analytics Methodology** Big data Analytics Methodology- Analyze & Evaluate Business Cases Develop Business Hypothesis-Analyse outcomes, Build & Prepare Data sets, Select & Build Analytical Model, Design For Big data Scale,Build The production ready System, Setting up the Big Data Analytics System, Gathering data, Measure & Monitor	20	6
8	**Extracting Value From Big Data** Real time Analytics & CAP Theorem In-Memory Data Grid for Real time Analysis Map Reduce & Real Time Processing Use Cases	10	4

Reference Books

1. Madhu Jagadeesh, SoumendraMohanty, HarshaSrivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", 1st Edition, Apress (2013)
2. Frank J. Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley Publishers (2012)
3. CristianMolaro, Surekha Parekh, Terry Purcell, "DB2 11: The Database for BigData&Analytics",MC Press, 2013

SEMESTER V
TRACK I: SOFTWARE AND APPLICATION DEVELOPMENT

Sr. No.	Subject Code	Subject Title	Internal	External
7	T1-IT54	Mobile Application Development	30	70

Objective : Student should able to develop the mobile application using Android

Sr. No	Topic Details	% Weightage	No. of Sessions
1	Android application development 1.1 Overview of Android 1.2 Devices running android 1.3 Why Develop for Android 1.4 Features of android 1.5 Architecture of Android, Libraries 1.6 Software development kit	10	4
2	Designing the user interface. 2.1 Introducing views , List of views and view groups 2.2 Introducing layouts, Creating new views, 2.3 Creating and using Menus	**10**	**4**
3	Starting with Application Coding	**25**	**6**

	3.1 Introducing Intents 3.2 Introducing Adapters 3.3 Using Internet Resources 3.4 Introducing Dialogs 3.5 Capturing Date and Time 3.6 Validating and Handling Input data		
4	Accessing Location Based Services Application 4.1 Selecting Location Provider 4.2 Finding your location. 4.3 Creating map based activities	**10**	**6**
5	Data Storage, retrieval and Sharing 5.1 File system in android 5.2 Internal and external storage 5.3 Saving and loading files 5.4 File Management tools	**5**	**4**
6	Introduction to SQLite 6.1 Creating SQLite database, 6.2 Editing Tasks with SQLite 6.3 Cursors and content values 6.4 Working with Android database	**20**	**9**
7	Peer to peer to communication 7.1 Accessing Telephony Hardware 7.2 Introducing Android Instant Messaging 7.3 GTalk Service : Using, binding & Making connection 7.4 Managing chat Sessions 7.5 Sending and receiving Data messages 7.6 Introducing SMS 7.7 Using, sending & receiving SMS Messages	**10**	**3**
8	Accessing Android Hardware 8.1 Audio, Video and Using the camera. 8.2 Introducing Sensor Manager 8.3 Android Telephony 8.4 Using Bluetooth 8.5 Manage network and Wi-Fi connections	**10**	**2**
9	Publishing Android Application to Market	**5**	**2**

Reference Books

1. Professional Android™ Application Development Wrox Publications, Reto Meier
2. Hello Android, Introducing Google's Mobile Development Platform, Ed Burnette, Pragmatic Programmers,ISBN: 978-1-93435-617-3
3. Sams teach yourself Android application development, Lauren Dercy and Shande Conder, Sams publishing

Reference Sites:

1. https://developer.android.com
2. http://www.tutorialspoint.com/android/

SEMESTER V			
TRACK I : SOFTWARE & APPLICATION DEVELOPMENT			
Sr. No.	**Subject Code**	**Subject Title**	**Internal**
1	T1-IT51L	Mini Project using ASP .Net*	50
Objectives: In this mini project, student should design dynamic website using asp.net using c#. Visual Studio 2010 is strongly Preferred.			

SEMESTER V TRACK I : SOFTWARE & APPLICATION DEVELOPMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9.	T1-IT54L	Mini Project Using Mobile Application Development *	50	-
Objective : This mini project work will provide hands on practice to student to enhance their Android Programming Skills. Android concepts such as Views and view groups, Layouts, Creating Menus Intents, Adapters, Dialogs, location based services, file handlings, CRUD operation on SQlite, Gtalk, Audio, Video can be included.				

SEMESTER V TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4.	T2-IT51	Quality Verification	30	70

Objectives:
To create awareness about the quality parameters of software .

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Information Systems** 1.Introduction, 1.1 Formal verification technique 1.2 Model checking technique 1.3 Continuous Process Verification 1.4 Continued Process Verification 1.5 Continuous Quality Verification (CQV) 1.6 Elements of Continuous Quality Verification	15	7
2	**Operational Aspects** 2.1 Licensing Verification, 2.2 Open Sources Software 2.3 Patents ,Trademarks, Copyrights 2.4 IPR issues	15	8
3	**Quality Standards** 3.1 LISA, 3.2 EISA, 3.3 CMM, 3.4 TQM, 3.5 ISO 9001, ISO 27001, 3.6 Six Sigma , 3.7 Coupling CMMI with Six Sigma	30	12
4	**Testing Maturity Model** 4.1 Software quality issues in Black Box Testing & White Box Testing 4.2 Testing Maturity Model 4.3 TMMi	20	7
5	**Case studies** Successful implementation of quality verification techniques , failure and causes of failure , need evaluation strategies for small and medium scale organization	20	6

Reference Books

1. Software Testing and Continuous Quality Improvement, Third Edition, by William E. Lewis , Auerbach Publications
2. Intellectual Property Rights in Software: A Practical Guide for Professionals and Business

Managers (BCS Practical Guides)- British Computer Society
3. Intellectual Property and Open Source by Van Lindberg O'Reilly publication
4. Computer Buses: Bus, Conventional PCI, Industry Standard Architecture, Extended Industry Standard Architecture, Micro Channel Architecture by Source Wikipedia (Author), LLC Books(Wiki Series)
5. The capability maturity model, by Mark c.paulk
6. Total Quality Management by Mukherjee - PHI Learning Private Limited-New Delhi
7. Total Quality Management (2 Color) by Dale H. Besterfield (Author), Pearson Education;
8. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Addison-Wesley, 2012. 2.
9. Roger S. Pressman, "Software Engineering-A Practitioner's Approach", McGraw Hill pub.2010.
10. Allen Gilles "Software quality: Theory and management", International Thomson, Computer press 1997.
11. Stephen H.Kan, "Metrics and models in software quality Engineering", Addison –Wesley 2003. Software Engineering R. Pressmen – TMH,7th Ed.
12. Software Engineering Sommerville, Pearson,8th Ed
13. http://www.tutorialspoint.com/software_testing_dictionary/test_maturity_model.htm
14. http://www.tmmi.org/pdf/e-book_tmmi.pdf
15. http://www.ecpmedia.com/publicdownloads_open/PCSLMStudyGuideDatasheet.pdf

SEMESTER V TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	T2-IT52	Infrastructure Auditing & Implementation	30	70

Objectives:

Infrastructure Auditing is the essence of successful business models. Appropriate methods used to analyze, compare and evaluate the usage of infrastructure by the professional is essential aspect of IT management. The objective of this course is to provide students with the knowledge, skills and motivation to face the global challenges that one might foresee in any venture.

The word *audit* usually makes security and IT staffs either groan or quake with fear. Failing an audit is everyone's worst nightmare because of the potential damage to the organization's reputation and its ability to transact business. Yet with the increasing importance of regulations and standards such as Sarbanes-Oxley, ISO 17799 and Visa's Cardholder Information Security Program (CISP), the number of audits is increasing. Also increasing is the time it takes to perform the audit and the cost to the organization. Companies are being told by regulators to control key IT information processes and to clearly demonstrate such control through rigorous systems and audits.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1.	FUNDAMENTALS OF INFRASTRUCTURE AUDIT- Meaning and definition, Overview, Choice of correct methods, Need, Scope and Objectives	20	8

2.	INTRODUCTION TO RISK ASSESSMENT- Entity area, strategies and policies, in operation, support, External Drivers, User Interaction, Consequences- Importance of demonstrating control over network and security staffs, Risk of operator access controls over device and server settings.	10	4
3.	CHECKLIST FOR IT AUDIT- Alignment with Business Strategy, Long Term IT Strategy, Short range IT Plans, Information System Security Policy, Implementation of Security Policy, Information System Audit Guidelines, Acquisition and implementation of packaged software	20	8
4.	REQUIREMENT IDENTIFICATION AND ANALYSIS- Configuration audits, Need for an audit trail, A real-time, live-network change review, Automatically verify compliance with both external best practices and internal standards.	10	4
5.	VENDOR SELECTION CRITERIA & PROCESS- TRACKing the vendor selection criteria	10	4
6	CONTRACTING- The issues of site licenses, usage of open sources softwares, Annual Maintenance Contracts	10	4
7	IMPLEMENTATION- Importance of regulations and standards such as Sarbanes-Oxley, ISO 17799 and Visa's Cardholder Information Security Program (CISP), On-demand historical reports, Governance & Cobit as a model for IT compliance.	10	4
8	BENEFITS OF INFRASTRUCTURE AUDIT, Strong change management process	10	4

Reference Books

Checklist for information security audit
How to effectively audit your IT infrastructure
Network infrastructure audit by meridian
Manual of IT Audit office of the comptroller and audit general of India
www.netwrix.com
www.rbi.org

SEMESTER V TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T2-IT53	IT Service Management	30	70

Objectives:

- To appreciate the organizational significance of managing the IT service encounter to achieve internal and external customer satisfaction.
- To understand new service development from both a product and process perspective.
- To gain an appreciation of the complexities associated with implementing change during IT services.
- To extend the knowledge scope from Technique to Management, and from Software Engineering to Service Science.

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**IT Service Management Overview** - scanning the research work in the fields of service science, management, and engineering. **IT Infrastructure, RFID wireless network, and Data Storage Management** - reviewing the concepts and histories of computer platforms and operating systems, network, data storage, and applications, as well as the selective IT service topics: RFID wireless network, and business continuity with IT services on storage management. **IT service strategy, methods, and case study**	**10**	**5**
2	**Configuration Management** Configuration Items and their relationships; planning control, levels, variants, models, versions and copies; naming conventions; baselines. Building, implementing and managing a configuration management database; using it to manage problems and changes. Configuration audits. The Definitive Software Library (DSL), Definitive Hardware Store (DHS) and Software Licence Management. Change & Configuration Management (C&CM) Plan. **Service Desk** The Service Desk Function and role. Interface between IT and users. Business Process Support. Local, central and virtual Service Desks. Reporting IT	15	6

	Service Quality, Structuring the Service Desk. Service Desk Education and Training. Use of knowledge bases. Outsourcing the Service Desk.		
3	**Incident Management** The Incident Management Process. First line incident support. Business Application Support. Designing the incident management process. Coding systems and use of scripts. Incident record content. Escalation. **Problem Management** Incidents, problems and known errors. Problem control and prevention; error control procedures. Coding systems for problem/error categorisation impact, urgency and priority. Proactive Problem Management , Problem solving techniques.	**15**	**6**
4	**Change Management** Organisation of the Change Management function; role of the Change Advisory Board. Procedures for handling requests for change; priority levels and handling urgent changes; change authorisation. Scheduling, testing, backout plans and implementation of changes.Interface with project management. Change & Configuration Management (C&CM) Plan,Change Models. **Release Management** Storage and protection of management-authorised software in both centralised and distributed systems. The Definitive Software Library. Release of software and/or hardware into the live environment. Distribution of software. Implementation (bringing into service) of software and/or hardware. Client-server and Internet issues	**15**	**6**
5	**Service Level Management** Planning, negotiating and managing Service Level Requirements and Agreements; structure and	15	6

	content of typical Service Level Agreements; key service items. The SLM process; monitoring, reporting & reviewing. Service Targets. Underpinning contracts and OLAs. Service Improvement Programs (SIPs) **Capacity Management** Business Capacity Management, Service Capacity Management, Resource Management. Modelling and simulation; building a capacity management database; demand management, application sizing, Capacity Planning.		
6	**IT Service Continuity Management** Loss of IT service. Risk analysis and management. IT recovery options: Creating an ITSCM plan; implementing and testing the plan. Links to Business Continuity Plans. Return to normal **Financial Management for IT Services** Budgeting, IT Accounting & Charging. Building Cost Models. The importance of money as a management metric. Investment appraisal. Charging policy & pricing methods.	12	5
7	**Availability Management** Planning and maintaining IT services. Recovery of failed systems. Ensuring that the availability and reliability of IT services to customers is in accordance with Service Level Agreements. Availability plans. Vital Business Functions (VBF). Methods & Techniques. Security.	12	5
8	**An introduction to IBM** – exhibiting the structure and culture of IBM from the perspectives of IT Service Management	6	2

Reference Books

1. *Service Management*, Fourth Edition, J.A. Fitzsimmons and M.J. Fitzsimmons, McGraw Hill.
2. *Services Marketing*, Valerie Zeithaml, Mary Jo Bitner, and Dwayne Gremler, McGraw-Hill.
3.*Introduction to Operations Research*, Hillier and Lieberman
4. *Service modeling, Principles and Applications.* Vilho Råisånen, Wiley
5. *Understanding Service Business*, S.E. Sampson, Wiley.
6. *Managing Services*, Alan Nankervis, Cambridge Press.
7. *Principles of Service Marketing and Management*, Christopher Lovelock and Lauren Wright, Prentice Hall.
8. *Blue Ocean Strategy*, W. Chan Kim and R. Mauborgne, Harvard Business School Press.
9. *Development as Freedom,* A. Sen, Anchor Books .

SEMESTER V				
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	T2-IT54	Digital and e-business Infrastructure and security mechanism	30	70
Objectives: Student should able to get knowledge of E-commerce and digital payments.				

Sr.No	Topic Details	% Weightage	No. of Sessions
1.	Introduction: E-commerce on the Internet, The importance of e-commerce security to the business enterprise. Web Technology and Web Security, Current threats facing organizations that conduct business online and how to mitigate these challenges, Vulnerability Trends	15	3
2.	Cryptography Basics, Cryptography review SSL,TLS and PKI, public key certificates and infrastructures, authentication and authorization certificates, Scripts, secure credential services and role-based authorization	10	2
3.	Securing Web Applications Web Browser Security Web Server Security mobile code security Biometrics and Digital Identification	20	5
4.	Digital Infrastructure Security Threats – Environmental, Accidental, Deliberate Security Life Cycle - Determining and designing the security infrastructure, Deploying and implementing security features and security policies, Continually managing the security solution common steps or processes to design network infrastructure security: security requirements planning, Establish and create secure boundaries security technologies for the network, server security technologies, application	25	8

	security technologies, user security technologies. auditing strategy, network monitoring strategy.		
5.	Digital Payments, security of agent-based systems, secure electronic transactions, electronic payment systems	15	4
6.	Coding Issues and Intellectual Property, intellectual property protection, Law and Regulation	15	3

Reference Books :

1. Zalewski, Michal, Tangled Web: A Guide to Securing Modern Web Applications. No Starch Press, 2012. (ISBN-10:1-59327-388-6
2. Grafinkle, Simson, Web Security, Privacy and Commerce, 2nd Edition, O'Reilly, 2002.
3. Gary Schneider, Electronic Commerce, Sixth Edition, Course Technologies, 2006, ISBN: 0-619-21704-9
4. Ford, W., Baum, M., Secure Electronic Commerce: Building the Infrastructure for Digital Signatures and Encryption, 2/E, Prentice Hall, 2001, ISBN: 0-13-027276-0

Web Resources :

1. Computer Security Resource Clearinghouse http://csrc.nist.gov
2. Microsoft Security Center http://www.microsoft.com/security/
3. Center for Education and research in Information Assurance and Security http://www.cerias.p~irdue.edu
4. http://www.tech-faq.com/designing-network-infrastructure-security.html

SEMESTER V			
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT			
Sr. No.	**Subject Code**	**Subject Title**	**Internal**
8	T2-IT52L	Mini Project on Infrastructure Audit*	50
Objectives: Explore and identity various facets of infrastructure required for effective implementation of software projects. Ensure understanding of security management issues and Case studies.			

SEMESTER V			
TRACK II :INFRASTRUCTURE & SECURITY MANAGEMENT			
Sr. No.	**Subject Code**	**Subject Title**	**Internal**
9	**T2-IT54L**	**Digital and e-business Infrastructure and security mechanism**	**50**

List of Experiments

Perform an experiment to grab a banner with telnet and perform the task using netcat utility.

Perform an experiment for port scanning with nmap, superscanUsing nmap

1. find open ports on a system
2. find the machines which are active
3. Find the version of remote os on other systems 4)find the version of s/w installed on other system
4. Performa an experiment to demonstrate how to sniff for router traffic by using the tool wireshark.
5. Install jcrypt tool (or any other equivalent) and demonstrate asymmetric, symmetric crypto algorithm, hash and digital/pki signatures
6. Demonstrate intrusion detection system (ids) using snort.
7. Generating password hashes with openssl
8. Setup a honey pot and monitor the honeypot on network.
9. Setup any network monitoring software and observe network e.g. OpManager/nagios
10. Setup browser security settings.
11. Create .htaccess file with security options to secure web application.
12. Deployment e-payment / netpay module in sandbox in any ecommerce application e.g. PayPal module in PrestaShop/ OSCommerce

SEMESTER V				
TRACK III :INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T3-IT51	Software Testing & Tools	30	70

Objectives:
To enable student to learn Software Testing Tools good practices with the help of various software testing techniques and tools and case studies.

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Software Testing Fundamentals** 1.1 Definition & Objectives 1.2 Types of software bugs 1.3 Bug life cycle 1.4 Testing lifecycle 1.5 Test Plan 1.6 Test Cases – Definition, Test Case Designing 1.7 Case Studies on Test Plan & Test Case	**15**	**6**
2	**Review of software development models** 2.1 (Waterfall Models, Spiral Model, W Model, V Model) 2.2 Agile Methodology and Its Impact on testing 2.3 Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)	**5**	**2**
3	**Approaches for testing** 3.1 Static Testing Structured Group Examinations Static Analysis 3.2 Control flow & Data flow 3.3 Determining Metrics	**7.5**	**3**
4	**Testing Tools** 4.1 Automation of Test Execution 4.2 Requirement TRACKer 4.3 High Level Review Types of test Tools Tools for test management and Control 4.4 Test Specification, Static Testing 4.5 Dynamic Testing 4.6 Non functional testing Selection and Introduction of Test Tools Tool Selection and Introduction 4.7 Cost Effectiveness of Tool Introduction	**17.5**	**7**
5	**Black Box & White Box Testing** 5.1 Functional Testing (Black Box) Equivalence partitioning, BVA, Cause- 5.2 Effect graphing, Syntax testing 5.3 Structural Testing (White Box) Coverage testing, Statement coverage, 5.4 Branch & decision coverage, Path coverage 5.5 Domain Testing 5.6 Non functional testing techniques: Localization,	**12.5**	**5**

	Internationalization Testing 5.7 Black box vs. White Box		
6	**Different types of Testing** 5.6 Unit Testing 5.7 Integration Testing 5.8 System Testing – Performance, Load, Stress, Security, Recoverability, compatibility testing 5.9 Regression Testing 5.10 Installation Testing 5.11 Usability Testing 5.12 Acceptance Testing- Alpha testing & Beta testing 5.13 Static vs. Dynamic testing 5.14 Testers workbench 5.15 Manual vs. Automatic testing	**15**	**6**
7	**Static & Dynamic Testing** 7.1 Static Testing Techniques 7.2 Review types: Informal Review, Technical or peer review, Walkthrough and Review Meeting 7.3 Review Reporting & Record keeping, Review guidelines 7.4 Data flow analysis 7.5 Control flow analysis 7.6 Cyclometric Analysis 7.7 **Case Study : Cyclometric Complexity**	**15**	**6**
8	**Testing specialized Systems and Applications** 8.1 Testing object oriented software 8.2 Testing Web based Applications 8.3 Computer Aided Software testing tools (CAST) (only type & their purpose should be covered)	**12.5**	**5**

Reference Books

1. Introducing Software Testing Louise Tamres
2. Effective Methods for software Testing William Perry, Wiley Pub,3rd Ed.
3. Software Testing in Real World Edward Kit, Pearson Pub.
4. Software Testing Techniques Boris Beizer, dreamTech pub,2nd Ed.
5. Software Testing By Ron Patton, TechMedia Pub.

Websites:

4. www.effectivesoft.com
5. www.sei.cmu.edu
6. www.softwarerisk.com
7. www.iist.org

SEMESTER V				
TRACK III :INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5.	T3-BM52	Entrepreneurship Development	30	70

Objectives:

Entrepreneurship is a mindset that can be developed by any professional who aspires to become a successful businessman . With proper education, this mindset can be inculcated into the minds of young professionals. The objective of this course is to provide students with the knowledge, skills and motivation required to encourage entrepreneurial success and lay down the conditions and solutions to the challenges that one might foresee in a venture.

Sr. No.	Topic Details	% Weightage	No. of Sessions
1.	**Entrepreneurship**: Definition, requirements to be an entrepreneur, Characteristics of entrepreneur, intrapreneur, entrepreneur vs. manager, growth of entrepreneurship in India, Women entrepreneurship, Social Entrepreneurship.	10	5
2.	**Management of Enterprises**: Objectives and functions of management, scientific management, general and strategic management; introduction to human resource management: planning, job analysis, training, recruitment and selection, etc.; marketing and organizational dimension of enterprises.	20	9
3.	**Entrepreneurial Motivation**: motivating factors, motivation theories- McClelland's Need Achievement Theory, Government's policy actions towards entrepreneurial motivation in the form of Subsidies and Training, Entrepreneurship development programmes.	15	6
4.	**Business Plan:** Identification and Selection of projects; Project report: contents and formulation, concept of project evaluation. Feasibility study report. Detailed Project Report.	15	5
5.	**Types of Enterprises**: Small scale, Medium scale and Large scale enterprises as per MSME Act 2006. Role of small enterprises in economic development, proprietorship, partnership, Limited Liability Partnership and Public Limited companies, Formation, Capital structure and Source of finance. Venture Capital, Angel Capital.	20	8
6.	**Institutional Support and Policies**: Institutional Support towards the development of entrepreneurship in India, technical consultancy organizations, government policies for small scale enterprises. Role of EDII, DIC, NIESBUD, NASSCOM	15	5

	and IFCI. Make in India, Skill India and New Startups.		
7.	Case Studies: Successful and Failed Entrepreneurs	5	2

Reference Book:

1. Dynamics of Entrepreneurship Development – Vasant Desai.
2. Entrepreneurship: New Venture Creation – David H. Holt
3. Entrepreneurship Development New Venture Creation – Satish Taneja, S.L.Gupta
4. Project management – K. Nagarajan.
5. Entrepreneurship: Strategies and Resources – Marc J. Dollinger

* Mentoring and Guidance is to be done by the concerned faculty

SEMESTER V
TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL

Sr. No.	Subject Code	Subject Title	Internal	External
6.	T3-IT53	Decision Support System	30	70

Objectives:
To learn DSS, DSS Tools, DSS implementation and impacts and Enterprise DSS.

Sr. No	Topic details	*% Weightage*	No. of Sessions
1	**Decision Support Systems-An Overview** 1.1 Decision Support Systems (DSS) Concept 1.2 DSS : Deterministic Systems 1.3 Artificial Intelligence 1.4 Knowledge Based Expert Systems 1.5 MIS and Role of DSS	12	5
2	**Data warehouse, Access, Analysis, Mining and Visualization for DSS** 2.1 Data warehousing , access ,analysis and visualization 2.2 Data collection problems and quality 2.3 Internet and commercial database service 2.4 Database Mgt System for DSS 2.5 Database organization structure for DSS 2.6 Data warehousing 2.7 OLAP 2.8 Data mining 2.9 Data Visualization 2.10 GIS and virtual reality 2.11 Business Intelligence	25	10
3	DSS Development 3.1 Introduction to DSS development 3.2 Traditional system development life cycle 3.3 Alternate development methodologies 3.4 Prototyping :DSS Methodology	13	5
4	**Tools for DSS development** 4.1 DSS Technology levels and tools	25	10

	4.2 DSS development platform 4.3 4.3 DSS development tools selection 4.4 Team – developed DSS 4.5 End user Developed DSS 4.6 Development of DSS : Putting system together 4.7 DSS future		
5	**Enterprise Decision Support System** 5.1 Enterprise system : Concept and definition, Evolution of executive and enterprise information system 5.3 Characteristics and capabilities of ESS 5.4 Comparing and integrating EIS and DSS 5.5 EIS , data access, data warehousing, OLAP , multidimensional analysis, presentation 5.6 Including soft information in enterprise systems 5.7 Organizational DSS 5.8Computerized systems – MRP , ERP , SCM 5.9 Frontline DSS 5.10 Future of DSS and EIS	13	5
6	**Implementation , integration and impacts** 6.1 Implementation : an overview 6.2 The major issues of implementation 6.3 Implementation strategies 6.4 System Integration: What and Why? 6.5 Generic models of MSS integration 6.6 Models of ES and DSS integration 6.7 Integration of EIS , DSS and ES 6.8 Intelligent DSS 6.9 Intelligent modeling 6.10 Examples of integrated systems	12	5

Reference Books

1. Decision Support Systems and Intelligent Systems by Efrain Turbon
2. Management Information Systems by W S Jawadekar
3. Data Mining Concepts by Han And Kamber
4. Data Mining by Margaret Dunham
5. Database Management System by Korth, Sudarshan

SEMESTER V TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7.	T3-IT54	Business Architecture	30	70
Objectives: The primary objective of this course is to give students a broad framework that covers the range of architecture work that precedes and steers System development, and to focus attention on the areas where the architect is responsible for effective design and Risk Management				

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction to the Architecture** 1.1 Solution(s) and Software. 1.2 Architecture domains 1.3 Hierarchical or layered architecture 1.4 Architect roles, goals and skills 1.5 Solution descriptions and plans 1.6 Standards and regularity requirements 1.7 Scope of The Architecture work	**15**	**6**
2	**Architecture process frameworks** 2.1 Method for enterprise architecture development (ADM) in the Open Group Architecture Framework (TOGAF) 2.2 Architecture descriptions 2.3 Architecture models 2.4 Model-Driven Architecture (MDA) 2.5 Unified Modelling Language (UML)and ArchiMate 2.6 Architecture description frameworks	**5**	**2**
3	**Business architecture structure and behaviour** 3.1 Business system model including process structures 3.2 Business function (or capability) structures 3.3 Business data models and business rules 3.4 Business process decomposition and automation 3.5 Workflow, use case and automated service 3.6 Design for business security	**7.5**	**3**
4	**Data Architecture** 4.1 Knowledge and/or content management 4.2 Data architecture structure (Recognise the functions of database) 4.3 Management system and concept of a federated transaction across a distributed database. 4.4 Data qualities and integration, dimensions of a data dissemination view 4.5 Master data management and implementation 4.6 Design for data security	**17.5**	**7**

5	**Software Architecture** 5.1 Component structures and patterns: client versus server, loosely-coupled versus tightly-coupled. 5.2 Model-view controller (MVC). 5.3 Component interfaces, Application Programming Interface (API) and Interface Description Language (IDL). 5.4 Asynchronous from Synchronous communication 5.5 Component interoperation styles 5.6 Component communication styles	**12.5**	**5**
6	**Applications Architecture** 6.1 Structural and behavioural models of applications architecture 6.2 Portfolio management. 6.3 Screen scrapers, ETL, application consolidation 6.4 Point-to-point, hub and spoke application integration 6.5 TOGAF concepts of Boundary less Information Flow 6.6 Integrated Information Infrastructure Reference Model (III-RM). 6.7 Design for applications security 6.8 Application platform	**15**	**6**
7	**Infrastructure Architecture and behaviour** 7.1 Technical Reference Model 7.2 Hardware configuration diagram, and the process of infrastructure architecture design 7.3 Recognise the concepts of virtualisation and server consolidation. 7.4 Design for infrastructure security 7.5 Techniques for infrastructure security used to protect client devices, web sites andservices 7.6 Firewalls and a De-Militarised Zone (DMZ).	**15**	**6**
8	**Architecture Management** 8.1 Architecture implementation: Software Development Life Cycle (SDLC) 8.2 Development and Agile Development 8.3 Architecture change management 8.4 Architecture governance 8.5 Architecture in operations	**12.5**	**5**

Reference Books

1. Business Architecture: A Practical Guide by Jonathan Whelan and Graham Meaden. Gower Pub Co,2012
2. Erich Gamma, Richard Helm, Ralph Johnson, & John Vlissides Design Patterns: Elements of Reusable Object-Oriented Software, Addison Wesley.
3. Martin Fowler, Patterns of Enterprise Application Architecture, Addison Wesley

4. Marc Lankhorst. Enterprise architecture at work. Modelling, Communication and Analysis. EE series. Springer, 2009
Websites
1. http://www.opengroup.org
2. 2.www.itgi.org

SEMESTER V TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8	T3-IT51L	CASE Tools Lab*	50	

Objective : To make student accustom with various automated tools used for Software Design and Development, Testing, Project Management etc.

1.Use of diagramming tools for system analysis

Preparing Data Flow Diagrams & Entity Relationship Diagrams

2.Use of Tools

To design User Interfaces

Report generation

(Using Oracle Developer)

3. Use of any Automated Testing Tools – Win Runner / Selenium

1. Record Context Sensitive
2. Record Analog
3. Database check point
4. Bit map Check Point
5. Synchronization point

SEMESTER V TRACK III : INFORMATION MANAGEMENT & QUALITY CONTROL				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9	T3-BM52L	Activities based on Entrepreneurship Development *	50	

Objectives:
1. To get motivation to become an entrepreneur.
2. To get the knowledge of how the business can run.
3. To know the procedure of financers to raise finance

Activities including:
1. Generate Business Plan
2. Preparation of Project report
3. Field Assignment

SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
4	T4-IT51	Network Routing Algorithms	30	70
Objective: To aware students with different types of network routing protocols and algorithms.				

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Introduction** ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Nonhierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.	20	8
2	**Internet Routing** Internet Protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.	20	8
3	**Routing In Optical Wdm Networks** Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.	20	8
4	**Mobile - Ip Networks** Macro-mobility Protocols, Micro-mobility protocol Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP,	20	8

	Handoff Wireless Access Internet Infrastructure (HAWAII).		
5	**Mobile Ad –Hoc Networks** Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).	20	8

References:

1. William Stallings, ' High speed networks and Internets Performance and Quality of Service', IInd Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, ' Routing in Communication network, Prentice –Hall International, Newyork, 1995.
3. S. Keshav, 'An engineering approach to computer networking' AddisonWesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, " A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.26
7. A.T Campbell et al., " Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
8. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi–2002.

SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
5	T4-IT52	Computer and Network Security	30	70
Objective. To understand the various security measures related to computer and network security.				

Sr. No	**Topic Details**	**% Weightage**	**No. of Sessions**
1	**Security Foundations** Benefits of good security practices Security Methodology Three Ds of security Steps to better security Business processes vs. technical controls	10	5
2	**Risk Analysis and defense models** Threat definition and risk analysis Defense models(Lollipop and Onion models of defense)	10	5
3	**Security Organization** Role and responsibilities Separation of duties	15	6

	Security operations management Security life cycle management Security Awareness		
4	**Data &Security Management Architecture** Principle of data security architecture Applications of data security architecture Administrative security Security and Activity monitoring Audit	15	6
5	**Network Architecture and Device security** - Secure Network Design (Acceptable Risk, Designing security into networks, Designing appropriate network,) - Switches and Router basics(switches, routers and routing protocols) - Network Hardening(Parches, switch security practices,ACL,ICMP,Anti-spoofing and source routing, Logging)	20	6
6	**Principles of Application Security** Web Application Security Regular Application Security Embedded Application Security Remote Administration Security Database Security Database Auditing and Monitoring	15	6
7	**Incidence Response, Forensic Analysis and Legal issues** Incident Response plans Forensic Network Regulations Information Security Regulations (Gramm-Leach Bliley safeguards, Sarbens-Oxley Act, HIPPA privacy and security rules)	15	6
References:			
1. Introduction to Network Security by Neal Krawetz, Cengage learning			
2. Network Security, The Complete Reference by Roberta Bragg, Mark-Rhodes-Ousley,Keith Strassberg, Tata McGrawHill			

SEMESTER V				
SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
6	T4-IT53	Cloud Architectures and Security	30	70
Objective: The course on cloud Architecture & Security introduces the basic concepts of security systems and cryptographic protocols, which are widely used in the design of cloud security. The issues related multi tenancy operation, virtualized infrastructure security and methods to improve virtualization security are also dealt with in this course				

Sr. No	Topic Details	% Weightage	No. of Sessions
1	**Cloud computing fundamentals** Cloud computing definition, Private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Cloud architecture Benefits and challenges of cloud computing, Role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture. Cloud security and disaster recovery; Next generation Cloud Applications. Advantages and disadvantages of cloud	10	4
2	**Security concepts** Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defense in depth, least privilege, how these concepts apply in the cloud, What these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.	20	8
3	**Multi-tenancy issues** Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues- e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).	20	8

4	**Virtualization system-specific attacks** Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.	20	8
5	**Technologies for virtualization based security enhancement** IBM security virtual server protection, virtualization-based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter.	15	6
6	**Legal and compliance issues** Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs.compliance for the customer.	15	6

References:

1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948],2009.
3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition [ISBN: 1439834539],2010.
1. Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" [ISBN: 0470589876],2010.
3. John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1edition [ISBN: 1439806802], 2009.
4. J.R. ("Vic") Winkler, "Securing the Cloud" Syngress [ISBN: 1597495921], 2011.
5. Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing" 2009.
6. Vmware "VMware Security Hardening Guide" White Paper, June 2011 .
7. Cloud Security Alliance 2010, "Top Threats to Cloud Computing" Microsoft013.
8. Timothy Grance; Wayne Jansen;NIST "Guidelines on Security and Privacy in Public Cloud Computing", 2011.
9. Evelyn Brown NIST "Guide to Security for Full Virtualization Technologies",2011.

SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
7	T4-IT54	Unified Communication	30	70
The Syllabus would be uploaded soon…				

SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
8.	T4-IT52L	Computer and Network Security – Lab *	50	
Objective : To highlight the issues with computer and network security by giving the hands on knowledge of various thing like monitoring and analyzing network traffic, installing and configuring different tools like wireshark, SNORT, NMAP, Port Scanners etc.				
1. Perform An Experiment To Grab A Banner With Telnet And Perform The Task Using Netcat Utility. 2. Perform An Experiment For Port Scanning With Nmap, Superscan Or Any Other Software. 3. Using Nmap 1)Find Open Ports On A System 2) Find The Machines Which Are Active 3)Find The Version Of Remote Os On Other Systems 4)Find The Version Of S/W Installed On Other System 4. Perform An Experiment On Active And Passive Finger 5. Printing Using Xprobe2 And Nmap. 6. Performa An Experiment To Demonstrate How To Sniff For Router Traffic By Using The Tool Wireshark. 7. Perform An Experiment How To Use Dumpsec. 8. Perform An Wireless Audit Of An Access Point / Router And Decrypt Wep And Wpa. 9. Perform An Experiment To Sniff Traffic Using Arp Poisoning 10. Install Jcrypt Tool (Or Any Other Equivalent) And Demonstrate Asymmetric, Symmetric Crypto Algorithm, Hash And Digital/Pki Signatures 11. Demonstrate Intrusion Detection System (Ids) Using Any Tool Eg . Snort Or Any Other S/W 12. Install Rootkits And Study Variety Of Options 13. Generating Password Hashes With Openssl 14. Setup A Honey Pot And Monitor The Honeypot On Network				

SEMESTER V TRACK IV :NETWORKING				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
9.	T4-IT53L	Cloud Building within Organization (Deployment of cloud and cloud based applications)*	50	-
Objective: Building cloud using open source technology and installing applications on such a cloud.				

SEMESTER VI				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
1.	ITC61	Open subject relevant for each TRACK*	70	-
2.	ITC61L	Lab on Open subject relevant for each TRACK*	30	-

SEMESTER VI				
Sr. No.	**Subject Code**	**Subject Title**	**Internal**	**External**
1.	ITC61P	Project	150	250

Internal Marks Evaluation Parameters

Project Evaluation Phases Recommended			
Phase	**Description**	**Marks Distribution**	
		Internal	**External**
1	SRS Document	50 Sem V	50 Sem VI
2	Design document	50 Sem V	50 Sem VI
3	Executable/User Interface	50 Sem VI	50 Sem VI
4	Test plan and Documentation	50 Sem VI	50 Sem VI
5	Project Viva/Presentation	50 Sem VI	50 Sem VI

General Instruction Regarding Preparation of Project Report
For MCA-III (Sem V & VI)

TYPING

1. The typing shall be standard 12 pts in double spaced using black ink only
2. Margins must be Left 2 inches Right 1.5 inches Top 2 inches Bottom 1.5 inches
3. Paper A4 size Bond Paper

COPIES

Two hard-bound copies
(Black Rexine with Golden Embossing as per format displayed herewith)
One original and one clean Xerox Copy.

FORMAT FOR TITLE PAGE AND FOR EMBOSSING

PROJECT REPORT

ON

"NAME OF THE SYSTEM"

FOR

NAME OF THE COMPANY

BY

NAME OF STUDENT

SAVITRIBAI PHULE PUNE UNIVERSITY

MASTERS OF COMPUTER APPLICATION

NAME OF THE INSTITUTE

2015-2018

The Guidelines regarding the documentation and scope of project are mentioned here below:

MCA-III SEM-V &VI (Desktop / Stand Alone Applications)

Project Report should be submitted in following format for Commercial Application Projects viz. Payroll, Sales, Purchase, Inventory, Book Shop, Examination system etc. Where C, C++, Python, Java, MS Access, Oracle, SQL Server, My SQL etc. are used.

1 Blank Pages at beginning
2 Title Page
3 Certificate from Company
4 Certificate from Institute
5 Declaration by Student
6 Certificate from project guide
7 Acknowledgement
8 Table of Contents

Chapter 1 : INTRODUCTION

1.1 Company Profile
1.2 Existing System and Need for System
1.3 Scope of Work
1.4 Operating Environment - Hardware and Software

Chapter 2 : PROPOSED SYSTEM
2.1 Proposed System
2.2 Objectives of System
2.3 User Requirements

Chapter 3 : ANALYSIS & DESIGN
3.1 Data Flow Diagram (DFD)
3.2 Functional Decomposition Diagram (FDD)
3.3 Entity Relationship Diagram (ERD)
3.4 Data Dictionary
3.5 Table Design
3.6 Code Design
3.7 Menu Tree
3.8 Menu Screens
3.9 Input Screens
3.10 Report Formats
3.11 Test Procedures and Implementation

Chapter 4 : USER MANUAL
4.1 User Manual
4.2 Operations Manual / Menu Explanation
4.3 Forms and Report Specifications

Drawbacks and Limitations
Proposed Enhancements
Conclusion Bibliography
ANNEXURES:

ANNEXURE 1 : INPUT FORMS WITH DATA

Project report should be submitted in following format for project using OOAD, Embedded System, WAP and other technologies and Web Deployed Systems where C, C++, J2EE, .NET, OOAD and JAVA, SDK's, API's are used.

MCA-III SEM-V &VI (Web Based / Mobile Applications)

1 Blank Pages at beginning
2 Title Page
3 Certificate from Company
4 Certificate from Institute
5 Declaration by Student
6 Certificate from project guide
7 Acknowledgement
8 Table of Contents

CHAPTER 1 : INTRODUCTION

1.1 Company Profile
1.2 Existing System and Need for System
1.3 Scope of Work
1.4 Operating Environment - Hardware and Software
1.5 Detail Description of Technology Used

CHAPTER 2 : PROPOSED SYSTEM

2.1 Proposed System
2.2 Objectives of System
2.3 User Requirements

CHAPTER 3 : ANALYSIS & DESIGN

3.1 Object Diagram
3.2 Class Diagram
3.3 Use Case Diagrams
3.4 Module Hierarchy Diagram
3.5 Component Diagram
3.6 Deployment Diagram (in case of Web Deployment)
3.7 Module Specifications
3.8 Interface Diagram (in case of WAP and Embedded Systems)
3.9 Web Site Map Diagram (in case of Web Site)
3.10 User Interface Design (Screens etc.)
3.11 Table specifications (in case back end is a database)
3.12 Test Procedures and Implementation

CHAPTER 4 : USER MANUAL

4.1 User Manual
4.2 Operations Manual / Menu Explanation
4.3 Program Specifications / Flow Charts

Drawbacks and Limitations
Proposed Enhancements

Conclusion
Bibliography
ANNEXURES:
ANNEXURE 1 : USER INTERFACE SCREENS
ANNEXURE 2 : OUTPUT REPORTS WITH DATA (if any)
ANNEXURE 3 : SAMPLE PROGRAM CODE (which will prove sufficient development is done by the student)
1 Blank Pages at the end.

Recommended Certifications

- **Business English – University of Cambridge**
  http://www.cambridgeesol.org/index.html
- **Certified Software Development Associate**
  (IEEE computer society certification)
  http://www.computer.org/portal/web/certification/csda
- **QAI global Institute (Certification by Roger Pressman)**
  Certified software Business Analyst
  Certified Associate Business Analyst
  http://www.qaiglobalservices.com/qaiglobalinstitute/BA_Prep/csba.asp
- **Relevant Oracle Certifications**
  http://education.oracle.com
- **Red-Hat**
  Red Hat Certified System Administrator (RHCSA)
  http://www.redhat.com/certification/rhct/
  Red Hat Certified Engineer (RHCE)
  http://www.redhat.com/training/certifications/rhce/
- **Microsoft certifications (MCSE)**
  http://www.microsoft.com/learning/en/us/certification/cert-overview.aspx
- **CCNA/CCNP Wireless Certification**
  http://www.cisco.com/web/learning/le3/le2/le0/le9/learning_certification_type_home.html
- **IBM-Rational Certifications**
  http://www-03.ibm.com/certify/certs/rl_index.shtml
- **IBM Business Analytics: Cognos and SPSS**
  http://www-03.ibm.com/certify/certs/ba_index.shtml
- **Java Certifications**
  Java Associate/Professional / Master / Certified expert
  http:/educatio.oracle.com
- **.Net Certifications**

http://www.microsoft.com/learning/en/us/certification/mcsd.aspx

- **Testing Certifications**
  Certified Associate in Software Testing (CAST)
  http://softwarecertifications.org/qai_cast.htm
  (certified Information System Auditor (may not be for the students -)
  http://www.isaca.org/Certification/CISA-Certified-Information-Systems-Auditor/Pages/default.aspx
  PMI Certifications
- **The Foundation Certificate in IT Service Management**

(ITIL V3 Foundation Certification) http://www.itilfoundation.org/
Other useful links for certification exams http://www.certificationguru.co.in/ www.softwarecertifications.org http://www.whizlabs.com/scjp/scjp.html

Reference Websites / Useful e-leaning sites for all subjects

1. Free lectures on computer science subjects from : IISc Bangalore, IIT Bombay, IIT Delhi, IIT Kanpur, IIT Kharagpur, IIT Madras, MIT Computer, Portland Community College, Stanford, The University of New South Wales, UC Berkeley ,University of Washington, Harvard
   http://freevideolectures.com/

2. Other e-learning sites:
   http://nptel.iitm.ac.in
   www.youtube.com

Useful Websites	
Topics	**Useful Websites**
Fundamentals of Computer	www.intel.com www.intel.in
C Programming	http://www.lysator.liu.se/c/bwk-tutor.html (Brian W. Kernighan)
Software Engineering	http://www.research.ibm.com/softeng/
Object Oriented Programming with C++	www.cplusplustutor.com
Database Management System	www.oracle.com
Essentials of Operating system	http://windows.microsoft.com http://www.linux.org/ http://www.redhat.com/
Enterprise Resource Planning	http://www.sap.com/
Web Supporting Technologies	www.w3schools.com www.devguru.com
Data Communication And Computer Networks	http://www.cisco.com/web/learning/le21/learning_events_home.html
Advanced Database management System	www.oracle.com www.nosqldatabases.com http://www.ibm.com/in/en/
Object Oriented Analysis And Design	http://www-01.ibm.com/software/in/rational/
Research Methodology and Tools*	http://www-01.ibm.com/software/in/analytics/spss/
Java Programming	http://www.java.com http://www.oracle.com
Information Security And Audit	http://www.isaca.org
Software Testing And Quality Assurance	http://www.learnqtp.com
Software project Management	http://www.pmi.org.in/

Asp.net with c#	http://www.php.net/ http://www.javascriptkit.com www.w3schools.com http://www.rspa.com http://struts.apache.org/ www.springsource.com/
Advanced Internet Technology	www.w3schools.com

Internal [30] Marks Breakup	
Unit Test Marks	5
Prelim Marks	5
Assignment	5
Presentations/Case-Study/Group Activity	10
Attendance	5
Total Marks	**30**

Practical[50] Marks Breakup	
Practical Hands on	40
Viva-voce	5
Assignments	5
Total Marks	**50**