



HSNC UNIVERSITY, MUMBAI

Board of Studies In the Subject of Information Technology

Faculty of Science & Technology

Board of Studies in the Subject of

Information Technology

1.) Name of Chairperson/Co-Chairperson/Coordinator: -

a) **Dr. Rakhi O. Gupta: Chairperson** (Assistant Professor and Head, Department of IT, K.C College, Churchgate)

rakhi.gupta@kccollege.edu.in 9619914191.

2.) Two to five teachers each having minimum five years teaching experience amongst the full-time teachers of the Departments, in the relevant subject.

a) **Ms. Pragati V Thawani : Co- Chairperson** (Assistant Professor, Department of IT, K.C College, Churchgate) pragati.thawani@kccollege.edu.in 9960782000

b) **Ms. Sandhya S Bhavsar:** (Assistant Professor, Department of IT, K. C. College, Churchgate) sandhya.bhasvar@kccollege.edu.in 8446677483

c) **Ms. Neha Patel** (Assistant Professor, Department of IT, K. C. College, Churchgate) neha.patel@kccollege.edu.in 9820609142

d) **Ms. Nashrah Gowalker:** (Assistant Professor, Department of IT, K. C. College, Churchgate) nashrah.gowalker@kccollege.edu.in 9664774108

3.) One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body; nominated by Parent Body; -

a.) **Dr. Rasika S. Mallya** (Associate Professor, Navinchandra Mehta Institute of Technology & Development, Mumbai.) rasikamallya@gmail.com 9819682436.

4.) Four external experts from Industry / Research / eminent scholar in the field relevant to the subject nominated by the Parent Body;

a.) **Dr. Hiren Dand** (Head of Department (IT), Mulund College of Commerce) Hiren.dand@mccmulund.ac.in 9821140717.

b.) **Mr. Asif K. Rampurawala** (Vice Principal, Vidyalankar School of Information Technology) asif.rampurawala@vsit.edu.in 9820765273.

c.) **Mr. Kaushal Shah** (Senior Manager Reliance Power Ltd.) Kaushalshah78@gmail.com 9869069203.

d.) **Mr. Prabhav Daga** (Proprietor & Partner Curaksha, Gianda Trading Solutions, LLP.) prabhav@curaksha.com 9820809884.

e.) **Ms. Kirti Bhatt** (Lecturer/ Industry Expert) kirti.bhatt@kccollege.edu.in 9869856998

5.) Top rankers of the Final Year Graduate and Final Year Post Graduate examination of previous year of the concerned subject as invitee members for discussions on framing or revision of syllabus of that subject or group of subjects for one year.

a) Ms. Suwati Singh - P.G Student K.C College, 8451926698, Suwatisingh10@gmail.com.

b) Ms. Sonali Tiwari – Software Developer IIFL (India Infoline Finance Ltd.) 8080452813 sonali.tiwari0845@gmail.com



Dr. Rakhi O. Gupta
BOS Chairperson – Information Technology

Part –I

Outline of Choice Based Credit System as outlined by University Grants Commission:

R. ****: The Definitions Of The Key Terms Used In The Choice Based Credit System And Grading System Introduced From The Academic Year 2020-2021 Are As Under:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/ Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.
 - 2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Choice Base Credit System:** CBCS allows students to choose inter- disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.
4. **Honors Program:** To enhance employability and entrepreneurship abilities among the learners, through aligning Inter Disciplinary / Intra Disciplinary courses with Degree Program. Honors Program will have 40 additional credits to be undertaken by the learner across three years essentially in Inter / Intra Disciplinary course.

A learner who joins Regular Undergraduate Program will have to opt for Honours

Program in the first year of the Program. However, the credits for honours, though divided across three years can be completed within three years to become eligible for award of honours Degree.

5. **Program:** A Program is a set of course that are linked together in an academically meaningful way and generally ends with the award of a Degree Certificate depending on the level of knowledge attained and the total duration of study, B.Sc. Programs.
6. **Course:** A 'course' is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a course must necessarily have academic coherence, i.e. there must be a common thread linking the various components of a course. A number of linked courses considered together are in practice, a 'program'.
7. **Bridge Course:** Bridge course is visualized as Pre semester preparation by the learner before commencement of regular lectures. For each semester the topics, whose knowledge is considered as essential for effective and seamless learning of topics of the Semester, will be specified. The Bridge Course can be conducted in online mode. The Online content can be created for the Bridge Course Topics.
8. **Module and Unit:** A course which is generally an independent entity having its own separate identity, is also often referred to as a 'Module' in today's parlance, especially when we refer to a 'modular curricular structure'. A module may be studied in conjunction with other learning modules or studied independently. A topic within a course is treated as a Unit. Each course should have exactly 3 Units.
9. **Self-Learning: 20% of the topics will be marked for Self-Learning.** Topics for Self-Learning are to be learned independently by the student, in a time-bound manner, using online and offline resources including online lectures, videos, library, discussion forums, fieldwork, internships etc.

Evaluative sessions (physical/online), equivalent to the credit allocation of the Self Learning topics, shall be conducted, preferably, every week for each course. Learners are to be evaluated real time during evaluative sessions. The purpose of evaluative sessions is to assess the level of the students' learning achieved in the topics earmarked for Self-Learning.

The teacher's role in these evaluative sessions will be that of a Moderator and Mentor, who will guide and navigate the discussions in the sessions, and offer concluding remarks, with proper reasoning on the aspects which may have been missed by the students, in the course of the Self-Learning process.

The modes to evaluate self-learning can be a combination of the various methods such as written reports, handouts with gaps and MCQs, objective tests, case studies and Peer learning. Groups can be formed to present self-learning topics to peer groups, followed by Question and Answer sessions and open discussion. The marking

scheme for Self-Learning will be defined under Examination and Teaching.

The topics stipulated for self-learning can be increased or reduced as per the recommendations of the Board of Studies and Academic Council from time to time. All decisions regarding evaluation need to be taken and communicated to the stakeholders preferably before the commencement of a semester. Some exceptions may be made in exigencies, like the current situation arising from the lockdown, but such ad hoc decisions are to be kept to the minimum possible.

- 10. Credit Point:** Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single course always pay attention to how many hours it would take for a learner to complete a single course successfully. A single course should have, by and large a course may be assigned anywhere between 2 to 8 credit points wherein 1 credit is construed as corresponding to approximately 15 learning hours.
- 11. Credit Completion and Credit Accumulation:** Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single course. Thus, a learner who successfully completes a 4 CP (Credit Point) course may be considered to have collected or acquired 4 credits. Learner level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more courses. Thus, the learner 'accumulates' course wise credits.
- 12. Credit Bank:** A Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the course/s for which Credit has been given, the course-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history.
- 13. Credit Transfer:** (performance transfer) When a learner successfully completes a program, he/she is allowed to transfer his/her past performance to another academic program having some common courses and Performance transfer is said to have taken place.
- 14. Course Exemption:** Occasionally, when two academic programs offered by a single university or by more than one university, may have some common or equivalent course-content, the learner who has already completed one of these academic programs is allowed to skip these 'equivalent' courses while registering for the new program. The Learner is 'exempted' from 'relearning' the common or equivalent content area and from re-appearing for the concerned examinations. It is thus taken for granted that the learner has already collected in the past the credits corresponding to the exempted courses.

Part-II

O*** The fees for transfer of credits or performance will be based on number of credits that a learner has to complete for award of the degree.**

The Scheme of Teaching and Examination:

The performance of the learners shall be evaluated in two components: Internal Assessment with 40% marks by way of continuous evaluation and by Semester End Examination with 60% marks by conducting the theory examination.

INTERNAL ASSESSMENT: - It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the credit based system by way of participation of learners in various academic and correlated activities in the given semester of the program.

A). Internal Assessment–40%

40 marks

1. For Theory Courses

Sr. No.	Particulars	Marks
1	One class test/online examination to be conducted in the given semester	15 Marks
2	One assignment based on curriculum (to be assessed by the teacher Concerned	10 Marks
3	Self-Learning Evaluation	10 Marks
4	Active participation in routine class instructional deliveries	05 Marks

2. For Courses with Practicals

For IT Department, Final Practical Examination of 50 marks is conducted.

Sr. No	Evaluation type	Marks
1	Two Best Practical /Assignments/Presentation /Preparation of models/ Exhibits/Case Study Or One Assignment/ project with class presentation to be assessed by teacher concerned	20 20
2	Journal	05
3	Viva	05

Practical Examination:

Practical exam would be conducted over a period of 4 days; 50 M for each practical paper.

Project exam would be conducted over a period of 2 days; 50 M for Sem – V & 150-M – for Sem-VI.

Each student to perform 2 practicals for Sem V for four subjects and Project Dissertation.

Each student to perform 2 practicals for Sem VI for four subjects and Project Demonstration and Viva-Voce.
For Sem VI, Viva would be conducted during the practical - Sem V; Sem VI

Distribution of marks for the experiments carried out during the examination:

Sem V & VI (50M/ paper): Practical 1: 20M; Practical 2: 20M; Viva: 05 M; Journal 05M.

The project report could be around 80-100 pages with appropriate referencing and formatting.

Marks distribution for the project would be as follows:

25 M - Planning & Methodology, 25 M Presentation Skills, 25 M Documentation and Content Creation,
25 M viva and Interactions; 25 M Project Functionality, 25 M Project Quality/Technology Adopted.

Students would undertake a project for 8-9 months during the Sem-V for 50 M and Implementation in Sem-VI for 150 Marks.
The project should include either of the following:

1. Research Project or
2. One / more major technique/s required in the field of interest or
3. Industry Project OR

Duration – 2 Hours**Theory Question Paper Pattern**

The semester end examination (external component) of 60 % for each course will be as follows:

i) Theory Component Duration – 2 Hours**ii) Theory Question Paper Pattern: -**

1. There shall be five questions each of 12 marks. On each unit there will be one question. The first question will be based on entire syllabus.
2. All questions shall be compulsory with internal choice within the questions. (Each question will be of 24 marks with options.)
3. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depend on the weightage of the topic.

The marks will be given for all examination and they will be converted into grade (quality) points. The semester-end, final grade sheets and transcripts will have only credits, grades, grade points, SGPA and CGPA.

3. Project and Assignment:

- Project or Assignment, which can in the following forms
 - Case Studies
 - Videos

- Blogs
- Research paper (Presented in Seminar/Conference) Field Visit Report
- Presentations related to the subject (Moot Court, Youth Parliament, etc.)
- Internships (Exposition of theory into practice)
- Open Book Test
- Any other innovative methods adopted with the prior approval of Director Board of Examination and Evaluation.

4. Self-Learning Evaluation

- **20% OF THE TOPICS OF CURRICULUM ARE LEARNED BY THE STUDENT THROUGH SELF LEARNING USING ONLINE / OFFLINE ACADEMIC RESOURCE SPECIFIED IN THE CURRICULUM.**
- **HENCE 20% OF THE LECTURES SHALL BE ALLOCATED FOR EVALUATION OF STUDENTS ON SELF LEARNING TOPICS**
- The identified topics in the syllabus shall be learnt independently by the students in a time bound manner preferably from online resources. Evaluative sessions shall be conducted by the teachers and will carry 10 Marks.

CLUB the self-learning topics into 3-4 GROUPS OF TOPICS ONLY FOR EVALUATION.

- **PRESCRIBE TIME DURATION (IN DAYS) FOR COMPLETION OF EACH GROUP OF TOPIC AND EARMARK SELF LEARNING EVALUATION LECTURES IN THE TIMETABLE. HENCE EACH GROUP OF TOPIC CAN BE ASSIGNED 3 REGULAR LECTURES FOR THIS EVALUATION FOR ENTIRE CLASS**

3 Sub Topics

Each evaluative session shall carry 3 Marks (3 x 3 Units = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

4 Sub Topics

Each evaluative session shall carry 2.5 Marks (2.5 x 4 Units = 10 Marks)

- **EVALUATION OF SELF LEARNING TOPICS CAN COMMENCE IN REGULAR LECTURES ASSIGNED FOR SELF LEARNING EVALUATION IN THE TIMETABLE**

3 Evaluative sessions

Each evaluative session shall carry 3 Marks (3 x 3 = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

4 Evaluative sessions

Each evaluative session shall carry 2.5 Marks (2.5 x 4 = 10

Marks). Methods for Evaluation of Self-learning topics:

- Seminars/presentation (PPT or poster), followed by Q&A – Objective questions /Quiz / Framing of MCQ Questions.
- Debates
 - Group discussion
- You-Tube videos (Marks shall be based on the quality and viewership)
- Improvisation of videos
- Viva Voce
- Any other innovative method

TEACHERS CAN FRAME OTHER METHODS OF EVALUATION ALSO PROVIDED THAT THE METHOD, DULY APPROVED BY THE COLLEGE EXAMINATION COMMITTEE, IS NOTIFIED TO THE STUDENTS AT LEAST 7 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION AND IS FORWARDED FOR INFORMATION AND NECESSARY ACTION AT LEAST 3 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION

SEMESTER END EXAMINATION: - It is defined as the examination of the learners on the basis of performance in the semester end theory / written examinations.

B. Semester End Examination-60%

60

Marks

- 1) Duration – These examinations shall be of 2 Hours duration.
- 2) There shall be five questions each of 12 marks. On each unit there will be one question. The first question will be based on entire syllabus.
- 3) All questions shall be compulsory with internal choice within the questions. (Each question will be of 24 marks with options.)
- 4) Question may be subdivided into sub-questions a, b, c... and the allocation of marks depend on the weightage of the topic.

THE MARKS OF THE INTERNAL ASSESSMENT SHOULD NOT BE DISCLOSED TO THE STUDENTS UNTIL THE RESULTS OF THE CORRESPONDING SEMESTER IS DECLARED.



HSNC University Mumbai

(2022-2023)

Ordinances and Regulations

With Respect to

Choice Based Credit System (CBCS)

For the Program Under

The Faculty of Science and Technology

For the Course

Information Technology

Curriculum – Third Year Undergraduate Program

Semester-V and Semester -VI

2022-2023

1. Course Objectives:

Semester V

US-TIT-501

Software Project Management (TIT 501)

The objective of this course is to develop the students' understanding of the issues involved in managing Information Systems projects. The course imparts practical knowledge of the skills and techniques used to manage information systems projects. Project managers need many skills above and beyond the technical skills required to implement information systems. Management of time, scope and cost are vital, as are the “soft” skills of managing the team and communicating with the stakeholders.

US-TIT-502

Embedded System with IoT (TIT502)

To learn how to design digital systems, from specification and simulation to construction and debugging. To learn techniques and tools for programmable logic design and to understand the limitations and difficulties in modern digital design, including wiring constraints, high-speed, etc. and able to design, construct, test, and debug a moderate-scale digital circuit.

US-TIT-503

Enterprise Networking (Elective-I) (TIT503)

Students will be able to describe the basic (design, implementation and management) concepts related to data communications and networking. Topics included but not limited to network topology, protocols, transmission media, switching techniques, access control and addressing for wired and wireless networks, network security and network management principles.

US-TIT-504

Virtual Reality (Elective-I) (TIT 504)

This course is designed to introduce students to the field of virtual reality (VR) and provide students with hands-on experience developing applications for modern virtual and augmented reality systems. In the course, students learn about the historical development of virtual reality technology and virtual reality as a research field, gain mastery of fundamental principles, algorithms, and design patterns in computer graphics, discover the perceptual science behind mixed reality technologies, and explore libraries and tools for creating VR experiences such as WebGL and Unity.

US-TIT-505

Introduction to Artificial Intelligence (Elective-II) (TIT505)

The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a ‘hands-on’ approach for understanding, as well as a challenging avenue for exploration and creativity.

US-TIT-506

Linux Administration (Elective-II) (TIT506)

To understand and make effective use of Linux utilities and shell scripting language to solve problems and implement in C some standard Linux utilities like mv, cp,ls etc. To develop the skills the necessary for systems programming including file system programming, process and signal management and interposes communication. Also develop the basic skills required to write

network programs using sockets.

US-TIT-507

Enterprise Java (Elective-III) (TIT507)

To learn why Java is useful for the design of desktop and web applications. How to implement object-oriented designs with Java. Identify Java language components and how they work together in applications. Design and program stand-alone Java applications. How to design a graphical user interface (GUI) with Java Swing. Understand how to use Java APIs for program development. To understand how to design GUI components with the Java Swing API.

US-TIT-508

NoSQL DB (Elective-III) (TIT508)

To learn and develop MongoDB based applications. This course is designed for DBAs who wants to learn about NoSQL Database design with MongoDB.

Semester VI

US-TIT-601

Project (TIT601)

The objective of this course is to provide understanding of Selection of Project, Initiative, Problem Solving, Analytical Ability, Technical, Functional Experience & Exposure, Communication and Interpersonal Skills.

US-TIT-602

Cryptography & Network Security (TIT602)

To know about various encryption techniques and to understand the concept of Public key cryptography. Study about message authentication and hash functions. Also to impart knowledge on Network security using algorithm and technology.

US-TIT-603

Data mining & Business Intelligence (Elective-I) (TIT603)

To develop skills of using recent data mining software for solving practical problems. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems. Develop and apply critical thinking, problem-solving, and decision-making skills.

US-TIT-604

Cyber Laws, Compliance & Frameworks (Elective-I) (TIT604)

To explain laws relevant to computer forensics, to seize digital evidence from pc systems and recover data to be used as evidence. To analyze data and reconstruct events and explain how data may be concealed or hidden

US-TIT-605

Mobile & Cloud Computing (Elective-II) (TIT605)

To make the student understand the concept of mobile computing paradigm, its novel applications and limitations. To understand the typical mobile networking infrastructure through a popular GSM protocol.

US-TIT-606

Virtualization Concepts & Applications (Elective-II) (TIT606)

This course introduces the basic ideas of computing, networking, communications, security, and virtualization, and will provide students with an understanding of applications in transferring data easily, protects from system failures, reduces the cost of operations, and provides security to data.

US-TIT-607

DevOps (Development &Operations) (Elective-III) (TIT607)

To understand DevOps practices which aims to simplify Software Development Life Cycle .To be aware of different Version Control tools like GIT, CVS or Mercurial .To Integrate and deploy tools like Jenkins and Maven, which is used to build, test and deploy applications in DevOps environment . To be familiarized with selenium tool, which is used for continuous testing of applications deployed. To use Docker to Build, ship and manage applications using containerization. To understand the concept of Infrastructure as a code and install and configure Ansible tool.

US-TIT-608

Entrepreneurship Development &Management (Elective-III) (TIT608)

Students are able to distinguish Entrepreneur and Entrepreneurship starting and feasibility study. Realize the skills required to be an entrepreneur. Acquaint the students with challenges of starting new ventures. Identify the right sources of fund for starting a new business. Be familiarized with concept of E-business Models and Understanding of various E-business Strategies.

1. Process adopted for curriculum designing:

The Department conducted multiple meetings with academic partners, industry partners and BOS Members. After discussion with them personally, via mail, via messages, the changes in the syllabus were introduced. The course design focusses on immediate employability of the student after graduation.

2. Salient features, how it has been made more relevant:

After discussion and interaction with industry and academic experts, many innovative changes are introduced in the syllabus. Innovative and advanced teaching on Software Project Management, Embedded System with Internet of Things, Enterprise Networking, Introduction to Artificial Intelligence, Linux System Administration, NOSQL DB, Data mining & Business Intelligence, Cyber Laws, Compliance & Frameworks. New subjects like Virtual Reality, Cryptography & Information Security, Mobile & Cloud Computing, Virtualization Concepts & Applications, DevOps and Entrepreneurship Development & Management are introduced.

Community-based program (Social Responsibility), Career Skill Development, Soft Skills and Hands - on Training approach has been adopted.

3. Learning Outcomes:

The revised syllabus is expected to provide students with a strong foundation in Technology, Mathematical and Scientific fundamentals required to develop problem solving ability. It is expected to train students in comprehending, analyzing, designing, and creating novel products that provide solution frameworks to the real-world problems.

It will inculcate in students, the ability to gain multidisciplinary knowledge, modern tools usage and skills necessary for designing, developing and deploying software and hardware based applications. Our graduates should be able to set up various entrepreneurship ventures which in turn will facilitate employability.

At the end of six semesters in UG program, learners will acquire hands - on expertise in subjects like - Programming languages, Hardware concepts, Operating System, Networking, Database Management System, Software Engineering and SQA, Project Management, Security, Data Analytics, IoT, Virtual Reality, Cyber Law, Virtualization Concepts, Mobile & Cloud Computing, Artificial Intelligence and Machine Learning, Entrepreneurship and Business Management.

Understanding and knowledge of basic concepts of IT with systems and applications

such as algorithms, data structures, data handling, data communication and computation. Development of ability to identify, formulate and design solutions to computational challenges. Students will be empowered with superior expertise set of cutting edge innovation so that they are placed with prestigious IT companies like TCS , Infosys , Capgemini , Wipro , Datamatics , Curaksha , LTI , Pi Techniques , Atos Syntel , Tatvic Analytics and many more.

4. Input from stakeholders:

There are modifications suggested in syllabus by industry personnel, alumni, and students. Subjects which have greater market applicability like Core Java, Database Management System, Web Programming and Applied Mathematics have been upgraded with latest technologies. New subjects like Android Programming, Data Analytics using R programming and Digital Marketing are incorporated, Virtual Reality, Cryptography & Information Security, Mobile & Cloud Computing, Virtualization Concepts & Applications, DevOps and Entrepreneurship Development & Management are introduced.

Students are introduced to Statistics and Marketing concepts for technical analysis with the help of upgraded programming skills.

Part 1- Preamble

The revised and restructured curriculum for the Three-year integrated course is systematically designed considering the current industry needs in terms of skills sets demanded under new technological environment. It also endeavors to align the programme structure and course curriculum with student aspirations and corporate expectations. The proposed curriculum is more contextual, industry affable and suitable to cater the needs of society and nation in present day context. The B.Sc. Information Technology programme was started in 2001 with an aim to make the students employable and impart industry oriented training. The main objectives of the course are:

- To think analytically, creatively and critically in developing robust, extensible and highly maintainable technological solutions to simple and complex problems.
- To apply their knowledge and skills to be employed and excel in IT professional careers and/or to continue their education in IT and/or related post graduate programmes.
- To be capable of managing complex IT projects with consideration of the human, financial and environmental factors.
- To work effectively as a part of a team to achieve a common stated goal.
- To adhere to the highest standards of ethics, including relevant industry and organizational codes of conduct.
- To communicate effectively with a range of audiences both technical and non-technical.
- To develop an aptitude to engage in continuing professional development.

The new syllabus is aimed to achieve the objectives. The syllabus spanning three years covers the industry relevant courses. The students will be ready for the jobs available in different fields like:

Software Development (Programming)

Website Development

Mobile app development

Embedded System with Internet of Things

Network Security

Software Testing

Networking

Database Administration

System Administration

Cyber Law Consultant

Virtualization

Devops (Development & Operation)

Entrepreneurship Development & Management

Green IT and many other.

We sincerely believe that any student taking this programme will get very strong foundation and exposure to basics, advanced and emerging trends of the subject. We wholeheartedly thank all experts who shared their valuable feedbacks and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them.

Part 2- The Scheme of Teaching and Examination is as under:
Semester –V
Summary

Choice Based Credit System			
Sr. No.	Course Type	Course Title	Subject Code
1.	Skill Enhancement Course	Software Project Management	US-TIT-501
2.	Skill Enhancement Course	Embedded System with Internet of Things	US-TIT-502
3.	Discipline Specific Elective (Any One)	Enterprise Networking	US-TIT-503
		Virtual Reality	US-TIT-504
4.	Discipline Specific Elective (Any One)	Introduction to Artificial Intelligence	US-TIT-505
		Linux System Administration	US-TIT-506
5.	Discipline Specific Elective (Any One)	Enterprise Java	US-TIT-507
		NOSQL DB	US-TIT-508
6.	Skill Enhancement Course Practical	Project Dissertation	US-TIT-5P1
7.	Skill Enhancement Course Practical	Embedded System with Internet of Things Practical	US-TIT-5P2
8.	Discipline Specific Elective Practical (Any One)*	Enterprise Networking Practical	US-TIT-5P3
		Virtual Reality	US-TIT-5P4
9.	Discipline Specific Elective Practical (Any One)*	Introduction to Artificial Intelligence Practical	US-TIT-5P5
		Linux System Administration Practical	US-TIT-5P6
10.	Discipline Specific Elective Practical (Any One)*	Enterprise Java Practical	US-TIT-5P7
		NOSQL DB Practical	US-TIT-5P8

Third Year Semester -V Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week (Period of 45min)					Credit	Internals				Total Marks
			U n i t s	S. L. %	L	T	P		S. L. E	CT+ AT= 15+5	PA	SEE	
1.	US-TIT-501	Software Project Management	4	20 % *	5	0	0	2	10	20	10	60	100
2.	US-TIT-502	Embedded System with Internet of Things	4	20 % *	5	0	0	2	10	20	10	60	100
3.	US-TIT-503	Enterprise Networking (Elective-I)	4	20 % *	5	0	0	2	10	20	10	60	100
4.	US-TIT-504	Virtual Reality (Elective-I)	4	20 % *	5	0	0	2	10	20	10	60	100
5.	US-TIT-505	Introduction to Artificial Intelligence (Elective-II)	4	20 % *	5	0	0	2	10	20	10	60	100
6.	US-TIT-506	Linux System Administration (Elective-II)	4	20 % *	5	0	0	2	10	20	10	60	100
7.	US-TIT-507	Enterprise Java (Elective-III)	4	20 % *	5	0	0	2	10	20	10	60	100
8.	US-TIT-508	NOSQL DB (Elective-III)	4	20 % *	5	0	0	2	10	20	10	60	100
9.	US-TIT-5P1	Practicals Based US-TIT- 501	-	-	0	-	3	2				50 (40 +10)	50
10.	US-TIT-5P2	Practicals Based US-TIT- 502	-	-	0	-	3	2				50 (40 +10)	50

11.	US-TIT-5P3	Practicals Based US-TIT- 503	-	-	0	-	3	2				50 (40 +1 0)	50
12.	US-TIT-5P4	Practicals Based US-TIT- 504	-	-	0	-	3	2				50 (40 +1 0)	50
13.	US-TIT-5P5	Practicals Based US-TIT-505	-	-	0	-	3	2				50 (40 +10) 0)	50
14.	US-TIT-5P6	Practicals Based US-SIT-506	-	-	0	-	3	2				50 (40 +10)	50
15.	US-TIT-5P7	Practicals Based US-SIT-507	-	-	0	-	3	2				50 (40 +10)	50
16.	US-TIT-5P8	Practicals Based US-SIT-508	-	-	0	-	3	2				50 (40 +10)	50
Total Periods/ Credit			(25+45) per week / 20					20					750

***One to two lectures to be taken for CONTINUOUS self -learning evaluation**

Third Year Semester V– Units – Topics- Teaching Hours

Sr. N	Subject Code & Title	Subject Unit Title		Lecture s (48 min)	Total Lectures	Cr edit	Total Marks
1.	US-TIT-501 Software Project Management	1	Project Management Foundation, The Business Case, Initiating Projects	15	60 L	2	100 (60+40)
		2	Project Planning and Scheduling, Activity Planning, Risk Management	15			
		3	Resource Allocation, Monitoring and Control, Managing Contracts and People in Software Environments	15			
		4	Project Leadership and Ethics, Project Management and Project Management Tools Software Configuration Management, Project Closeout	15			
2.	US-TIT-502 Embedded System with IoT	1	Introduction to Embedded System	15	60 L	2	100 (60+40)
		2	Designing Embedded System	15			
		3	Introduction to the Internet of Things:	15			
		4	A Tutorial Introduction to IoT Design and Prototyping with Examples	15			
3.	US-TIT-503 Enterprise Networking (Elective-I)	1	General Network Design	15	60 L	2	100 (60+40)
		2	Network Design Models	15			
		3	WAN Technologies and the Enterprise Edge	15			
		4	Network Management Technologies RMON, RMON2 NetFlow Compared to RMON and SNMP, CDP LLDP Syslog	15			
4.	US-TIT-504 Virtual Reality (Elective-I)	1	Concepts of Virtual Reality	15	60 L	2	100 (60+40)
		2	Introduction to Maya	15			
		3	Introduction to unity	15			
		4	Creating Assembly for Virtual reality For PC VR	15			
5.	US-TIT-505 Introduction to Artificial Intelligence (Elective-II)	1	Introduction to Artificial Intelligence:	15	60 L	2	100 (60+40)
		2	Machine Learning Paradigms	15			
		3	Uncertainties And Inconsistencies with Probabilistic Reasoning	15			
		4	Applying Machine Learning	15			
6.	US-TIT-506 Linux System Administrator			15	60 L	2	
		1	Introduction to Linux				
		2	Requirements for a Linux System Administrator	15			
		3	Mail ,RAID and LVM, Load-Balanced Clusters	15			

	(Elective-II)	4	Local Network Services	15			100 (60+40)
7.	US-TIT-507 Enterprise Java (Elective-III)	1	Java Database Connectivity	15	60 L	2	100 (60+40)
		2	Invoking java code with JSP	15			
		3	EJB fundamentals	15			
		4	Spring-Hibernate Framework	15			
8.	US-TIT-508 NoSQL DB (Elective-III)	1	Definition of NOSQL	15	60 L	2	100 (60+40)
		2	Data Types, Data Modelling	15			
		3	Using Sort, Limit, and Skip Functions	15			
		4	Working with GridFS	15			
9.	US-TIT-5P1	1	Practicals based on US-TIT-501 Software Project Management		36 L x3 batches = 108 lectures	2	50
10.	US-TIT-5P2	2	Practicals based on US-TIT-502 Embedded System with IoT		36 L x3 batches = 108 lectures	2	50
11.	US-TIT-5P3	3	Practicals based on US-TIT-503 Enterprise Networking		36 L x3 batches = 108 lectures	2	50
12.	US-TIT-5P4 (Elective-I)	4	Practicals based on US-TIT-504 Virtual Reality		36 L x3 batches = 108 lectures	2	50
13.	US-TIT-5P5 (Elective-II)	5	Practicals based on US-TIT-505 Introduction to Artificial Intelligence		36 L x3 batches = 108 lectures	2	50
14.	US-TIT-5P6 (Elective-II)	6	Practicals based on US-TIT-506 Linux System Administrator		36 L x3 batches = 108 lectures	2	50
15.		7			36 L x3	2	

	US-TIT-5P7 (Elective-III)		Practicals based on US-TIT-507 Enterprise Java		batches = 108 lectures		50
16.	US-TIT-5P8 (Elective-III)	8	Practicals based on US-TIT-508 NoSQL DB		36L X3 bat ches=10 8 Lectures	2	50
			TOTAL			20	750

- **Lecture Duration – 48 Minutes**
- **One Credit =15 Hours**

L: Lecture: Tutorials P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination, PA-Project Assessment, AT-Attendance

Part 3: Detailed Scheme Theory

Curriculum Topics along with Self-Learning topics -To be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT.

Course Code: US-TIT-501 Software Project Management

Unit	Details	Lectures
I	<p>Project Management Foundation: Introduction, What is a Project? Why is Software Project Management Important?, Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives.</p> <p>The Business Case: Project Vs Operations, Necessity of project management, What is Management? Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices, Triple constraints, Negotiations and resolving conflicts. Project management in various organization structures. Project Success and Failure, PM knowledge areas as per Project Management Institute (PMI).</p> <p>Initiating Projects: How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.</p>	15
II	<p>Project Planning and Scheduling: Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyze Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps 9 and 10: Execute Plan/Lower Levels of Planning.</p> <p>Activity Planning: Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks. Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb. Introduction to Project Management Information System (PMIS).</p>	15

	Risk Management: Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm's Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts.	
III	<p>Resource Allocation: Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence.</p> <p>Monitoring and Control: Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM).</p> <p>Managing Contracts and People in Software Environments: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. Understanding Behavior, Organizational Behavior: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress, Stress Management, Health and Safety, Some Ethical and Professional Concerns.</p>	15
IV	<p>Project Leadership and Ethics: Introduction to project leadership, ethics in projects. Multicultural and virtual projects. Operational Security in Project Management.</p> <p>Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, and Version Control.</p> <p>Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.</p> <p>Project Closeout: Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report.</p>	15

Reference Books

- Project Management: A managerial approach, Jack Meredith & Samuel Mantel wiley India, 7th Edition, 2009.
- Software Project Management- Bob Hughes, Mike Cotterell, Rajib Mall, TMH, 6th Edition, 2018.
- Project management Tools & Technologies – An overview Shailesh Mehta, SPD, 1st Edition, 2017.
- Software Project Management Walker Royce Pearson, 1st Edition, 2005.

Self-Learning topics (Unit wise)

Sub- unit	Topic
2.2	Work Breakdown structure (WBS), Product Breakdown structure (PBS), Hybrid Breakdown structure (HBS), Networking and Scheduling techniques. PERT, CPM, GANTT chart
3.2	Monte Carlo Simulation, Critical Chain Concepts.
4.1	Operational Security in Project Management

Online Resource

<u>NPTEL :: Management - NOC:Project Management</u>
<u>NPTEL :: Computer Science and Engineering - NOC:Software Project Management</u>
<u>https://digitalguardian.com/blog/what-operational-security-five-step-process-best-practices-and-more</u>

Course Name: Project Dissertation Course Code: USTIT5P1

The details are given in Appendix – I

Course Code: US-TIT-502 Embedded System with Internet of Things

Unit	Details	Lectures
I	<p>1.1 Introduction to Embedded System: Embedded System Vs General Computing System, Classification of Embedded system, Applications of Embedded system, Characteristics of Embedded Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design</p> <p>1.2 Embedded System Architecture: CISC and RISC instruction Set Architecture, Basic Embedded Processor/ Microcontroller Architecture, Memory System Architecture, I/O Subsystem, Co-processor and Hardware Accelerators, EDLC</p> <p>1.3 Peripherals: Control and Status Registers, A/D and D/A Converters, Timers and counters, Interrupt Controllers, Interfacing components, Embedded Operating System, Real-Time Characteristics, Selection Process.</p> <p>1.4 Case studies: Washing Machine, Microwave Oven CISC-8051, RISC- DSP , Displays- Light emitting diode ,7-Segment LED Display ,Dot Matrix LED Display, Liquid Crystal Display ,Electroluminescent Display Technology</p> <p>Keyboard-4x4 Matrix Keypad</p>	15
II	<p>2.1 Designing Embedded System: Design process in Embedded System, Formalization of System Design, Skills required for an Embedded System Designer, Design Examples</p> <p>2.2 Programming Embedded Systems: Structure of embedded program, infinite loop, C for Programming embedded systems, Basic Compilation Techniques, Use of High-Level Languages, Analysis and Optimization of Execution Time and Energy and Power and Program Size, Program Validation and Testing</p> <p>2.3 Trends in Embedded Industry: Processor Trends in Embedded System, Embedded OS trends, Development Language Trends,</p> <p>2.4 Software Programming in Assembly Language.</p>	15
III	<p>3.1 Introduction to the Internet of Things: Core Concepts: Smart Objects and Smart Environments, Machine-to-Machine Communications, Who Works on the Internet of Things?, Internet of Things Framework, Networks and Connectivity, Sensors, Actuators, Addressing Schemes Based on IPv6</p> <p>3.2 Environment, People, and Time as Factors in the Internet of Things Technical Revolution: Technical Revolutions, Environment, Time, People, Cybersecurity, Reasoning from Data, Adaptable Self-Organizing Systems.</p> <p>3.3 An Overview of Enabling Technologies for the Internet of Things: Overview of IoT Architecture, Enabling Technologies- Perception Layer Technologies, Network Layer Technologies, Middleware Technologies, Application Layer Technologies, Business Layer Technologies, IoT Platforms and Operating Systems</p> <p>3.4 Case studies: IoT in Soap Dispensers, Retail Uses RFID to Enable Cold Chain Monitoring</p>	15
IV	4.1 A Tutorial Introduction to IoT Design and Prototyping with	15

	<p>Examples: Main Features of IoT Hardware Development Platforms, Key Features of Arduino Hardware Development Platforms, Major Features of the Raspberry Pi Hardware Platforms, Design and Prototyping of IoT Applications, An Arduino Project for IoT Application, A Raspberry Pi Project for IoT Application.</p> <p>4.2 Cloud and Fog Computing in the Internet of Things: IoT System Requirements, Cloud Computing in IoT, Examples of Cloud-Based IoT, Key Challenges of Cloud-Based IoT, Fog Computing in IoT, Examples of Fog-Based IoT, Key Challenges of Fog-Based IoT.</p> <p>4.3 Security Mechanisms and Technologies for Constrained IoT Devices: Security in IoT Protocols and Technologies, Security Issues and Solutions.</p> <p>4.4 Case studies: Smart Home, Smart Industry, Internet of Things in Smart Ambulance and Emergency Medicine, Implementing the Internet of Things for Renewable Energy</p>	
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Reference Books

1. Embedded System Design: A Unified Hardware/Software Approach Frank Vahid and Tony Givargis
2. Wayne Wolf, “Computers as components: Principles of embedded computing systems design”; Second edition, published by Morgan Kaufmann series(2008)
3. Mastering the Raspberry Pi, Warren Gay, Apress
4. Embedded Systems, Rajkamal, TataMcGraw-Hill
5. Programming Embedded Systems in C and C++, First Edition January, Michael Barr, O’ Reilly
6. Introduction to embedded systems, Shibu K V Tata McGraw-Hill.
6. Internet of Things A to Z , Technologies and Applications, IEEE Press, WILEY

Self-Learning Topic (Unit Wise)

Sub Unit	Topic
1.4	Case studies: Washing Machine, Microwave Oven CISC-8051, RISC- DSP , Displays- Light emitting diode ,7-Segment LED Display ,Dot Matrix LED Display, Liquid Crystal Display ,Electroluminescent Display Technology Keyboard-4x4 Matrix Keypad
2.4	Software Programming in Assembly Language.
3.4	Case studies: IoT in Soap Dispensers, Retail Uses RFID to Enable Cold Chain Monitoring
4.4	Case studies: Smart Home, Smart Industry, Internet of Things in Smart Ambulance and Emergency Medicine, Implementing the Internet of Things for Renewable Energy

Online Resources

Course: Embedded Systems Design

Week 1: Introduction to Embedded System, ASICs and ASIPs

Week 2: Designing Single Purpose Processors and Optimization

Reference:

<https://nptel.ac.in/courses/106/105/106105159/>

Course Code: US-TIT-503 Enterprise Networking (Elective I)

Unit	Details	Lectures
I	<p>General Network Design: Network Design Methodology, Architectures for the Enterprise, Borderless Networks Architecture, Collaboration and Video Architecture, Data Center and Virtualization Architecture, Design Lifecycle: Plan, Build, Manage Plan Phase BuildPhase Manage Phase Prepare, Plan, Design, Implement, Operate, and Optimize Phases Prepare Phase Plan Phase Design Phase Implement Phase Operate Phase Optimize Phase Summary of PPDIOO Phases Project Deliverables Design Methodology Identifying CustomerDesign Requirements Characterizing the Existing Network Steps in Gathering Information Network Audit Tools Network Checklist Designing the Network Topology and Solutions Top-Down Approach Pilot and Prototype Tests Design Document.</p> <p>Network Design Models: Hierarchical Network Models Benefits of the Hierarchical Model, Hierarchical Network Design, Core Layer, Distribution Layer, Access Layer, Hierarchical Model Examples, Hub-and-Spoke, Design Collapsed Core, Design Enterprise Architecture Model, Enterprise Campus Module, Enterprise Edge Area, E-Commerce Module, Internet Connectivity Module, VPN/Remote Access, Enterprise WAN, Service Provider Edge Module, Remote Modules, Enterprise Branch Module, Enterprise Data Center Module, Enterprise Teleworker Module, High Availability Network Services, Workstation-to-Router Redundancy and LAN, High Availability Protocols, ARP Explicit Configuration, RDP, RIP, HSRP, VRRP, GLBP, Server Redundancy, Route Redundancy, Load Balancing, Increasing Availability, Link Media Redundancy.</p> <p>Enterprise LAN Design: LAN Media, Ethernet Design Rules, 100Mbps Fast Ethernet Design Rules, Gigabit Ethernet Design Rules, 1000BASE-LX Long-Wavelength Gigabit Ethernet, 1000BASE-SX Short-Wavelength Gigabit Ethernet, 1000BASE-CX Gigabit Ethernet over Coaxial Cable, 1000BASE-T Gigabit Ethernet over UTP 86, 10 Gigabit Ethernet Design Rules, 10GE Media Types, EtherChannel, , Campus LAN Design and Best Practices Best Practices for Hierarchical Layers, AccessLayer Best Practices, Distribution Layer Best Practices, Core Layer Best Practices, STP Design Considerations, STP Toolkit, PortFast, UplinkFast, BackboneFast, Loop Guard, Root Guard, BPDU Guard, BPDU Filter, VLAN and Trunk Considerations, Unidirectional Link Detection (UDLD) Protocol, Large-Building LANs, Enterprise Campus LANs, Edge Distribution, Medium-Size LANs, Small and Remote Site LANs, Server Farm Module, Server Connectivity Options, Enterprise Data Center Infrastructure, Campus LAN QoSConsiderations, Multicast Traffic Considerations, CGMP, IGMP Snooping.</p>	15

II	<p>Data Center Design: Enterprise DC Architecture, Data Center Foundation Components, Data Center Topology Components, Data Center Network Programmability, SDN, Controllers, APIs, ACI, Challenges in the DC, Data Center Facility Aspects, Data CenterSpace, Data Center Power, Data Center Cooling, Data Center Heat, Data Center Cabling, Enterprise DC Infrastructure, Data Center Storage, Data Center Reference Architecture, Defining the DC AccessLayer, Defining the DC Aggregation Layer, Defining the DC Core Layer, Security in the DC, Fabric Extenders, Virtualization Overview,Challenges, Defining Virtualization and Benefits, Virtualization Risks, Types of Virtualization, Virtualization Technologies, VSS, VRF, vPC, Device Contexts, Server Virtualization, Server Scaling, Virtual Switching, Network Virtualization Design Considerations, Access Control, Path Isolation, Services Edge, Data Center Interconnect, DCI Use Cases, DCI Transport Options, DCI L2 Considerations, Load Balancing in the DC, Application Load Balancing, Network Load Balancing.</p> <p>Wireless LAN Design: ISM and UNII Frequencies, Summary of WLAN Standards, Service Set Identifier, WLAN Layer 2 Access Method, WLAN Security, Unauthorized Access, WLAN Security Design Approach, IEEE 802.1X-2001 Port-Based Authentication, Dynamic WEP Keys and LEAP, Controlling WLAN Access to Servers, WLAN Authentication, Authentication Options, WLAN Controller Components, WLC Interface Types, AP Controller Equipment Scaling, Roaming and Mobility Groups, Intracontroller Roaming, Layer 2 Intercontroller Roaming, Layer 3 Intercontroller Roaming, Mobility Groups, WLAN Design, Controller Redundancy Design: Deterministic vs. Dynamic, N+1 WLC Redundancy, N+N WLC Redundancy, N+N+1 WLC Redundancy, Radio Management and Radio Groups, RF Groups, RF Site Survey, Using EoIP Tunnels for Guest Services, Wireless Mesh for Outdoor Wireless, Mesh Design Recommendations, Campus Design Considerations, Power overEthernet (PoE), Wireless and Quality of Service (QoS), Branch Design Considerations, Local MAC, REAP, Hybrid REAP, Branch Office Controller Options.</p>	15
III	<p>WAN Technologies and the Enterprise Edge: WAN and Enterprise Edge Overview, Definition of WAN, WAN Edge Module, Enterprise Edge Modules, WAN Transport Technologies, ISDN, ISDN BRI Service, ISDN PRI Service, Digital Subscriber Line, Cable, Wireless, Metro Ethernet, SONET/SDH, Multiprotocol Label Switching (MPLS), Dark Fiber, Dense Wavelength-Division Multiplexing, Ordering WAN Technology and Contracts, WAN and Edge Design Methodologies, Response Time, Throughput, Reliability, Bandwidth Considerations, WAN Link Categories, Optimizing Bandwidth Using QoS, Queuing, Traffic Shaping and Policing, Classification, Congestion Management, Priority Queuing, Custom Queuing, Weighted Fair Queuing, Class-Based Weighted Fair Queuing, Low-Latency Queuing, Traffic Shaping and Policing, Link Efficiency, Window Size, DMZ Connectivity, Segmenting DMZs, DMZ Services, Internet Connectivity,</p>	15

	<p>Centralized Internet (Branch) vs. Direct Internet (Branch), High Availability for the Internet Edge,</p> <p>WAN Design</p> <p>Traditional WAN Technologies Hub-and-Spoke Topology Full-Mesh Topology Partial-Mesh Topology Point-to-Point Topology Remote Site Connectivity Enterprise VPN vs. Service Provider VPN Enterprise Managed VPN: IPsec IPsec Direct Encapsulation Generic Routing Encapsulation IPsec DMVPN IPsec Virtual Tunnel Interface Design GETVPN Service Provider–Managed Offerings ,Metro Ethernet Service Provider VPNs: L2 vs. L3 ,Virtual Private Wire Services VPWS L2 VPN Considerations ,Virtual Private LAN Services VPLS L2 VPN Considerations ,MPLS, MPLS Layer 3 Design Overview MPLS L3 VPN Considerations ,VPN Benefits WAN Backup Design WAN Backup over the Internet Enterprise WAN Architecture Cisco Enterprise MAN/WAN Enterprise WAN/MAN Architecture Comparison ,Enterprise WAN Components Comparing Hardware and Software Enterprise Branch Architecture Branch Design Branch Connectivity Redundancy for Branches Single WAN Carrier vs. Dual WAN Carriers Single MPLS Carrier Site ,Dual MPLS Carriers HybridWAN: L3 VPN with IPsec VPN ,Internet for Branches Flat Layer 2vs. Collapsed Core ,Enterprise Branch Profiles Small Branch Design Medium Branch Design Large Branch Design Enterprise Teleworker Design, ISRs for Teleworkers. Internet Protocol Version 6 Design, IPv6 Header IPv6 Address Representation IPv4-Compatible IPv6 Addresses IPv6 Prefix Representation IPv6 Address Scope Types and Address Allocations IPv6 Address Allocations IPv6 Unicast Address Global Unicast Addresses Link-Local Addresses , Unique Local IPv6 Address Global Aggregatable IPv6 Address , IPv4-Compatible IPv6 Address IPv6 Anycast Addresses , IPv6 Multicast Addresses IPv6 Mechanisms ICMPv6 , IPv6 Neighbor Discovery Protocol IPv6 Name Resolution , Path MTU Discovery IPv6 Address-Assignment Strategies , Manual Configuration SLAAC of Link-Local Address , SLAAC of Globally Unique IPv6 Address DHCPv6 , DHCPv6 Lite IPv6 Security IPv6 Routing Protocols RIPng OSPFv3 , BGP4 Multiprotocol Extensions (MP-BGP) for IPv6 , IPv6 Addressing Design , Planning for Addressing with IPv6 , Route Summarization with IPv6 IPv6 Private Addressing IPv6 for the Enterprise IPv6 Address Allocation , Partly Linked IPv4 Address into IPv6, Whole IPv4 Address Linked into IPv6 IPv6 Addresses Allocated Per Location and/or Type , IPv4-to-IPv6 Transition Mechanisms and Deployment Models , Dual-Stack Mechanism IPv6 over IPv4 Tunnels , Protocol Translation Mechanisms IPv6 Deployment Models , Dual-Stack Model Hybrid Model Service Block Model ,IPv6 Deployment Model Comparison IPv6 Comparison with IPv4 ,OSPF, BGP, Route Manipulation, and IP Multicast,OSPFv2 OSPFv2 Metric OSPFv2 Adjacencies and Hello Timers , OSPFv2 Areas OSPF Area Design Considerations OSPFRouter Types OSPF DRs LSA Types Autonomous</p>	
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	System External Path Types OSPF Stub Area Types Stub Areas Totally Stubby Areas	
IV	<p>NSSAs Virtual Links OSPFv2 Router Authentication , OSPFv2 Summary OSPFv3 OSPFv3 Changes from OSPFv2, OSPFv3 Areas and Router Types OSPFv3 LSAs OSPFv3 Summary</p> <p>BGP BGP Neighbors eBGPiBGP Route Reflectors Confederations BGP Administrative Distance, BGP Attributes, Weight, and the BGP Decision Process</p> <p>BGP Path Attributes Next-Hop Attribute Local Preference Attribute Origin Attribute Autonomous System Path Attribute</p> <p>MED Attribute Community Attribute Atomic Aggregate and Aggregator Attributes Weight BGP Decision Process, BGP Summary, Route Manipulation PBR Route Summarization</p> <p>Route Redistribution Default Metric OSPF Redistribution Route Filtering Transit Traffic Routing Protocols on the Hierarchical Network Infrastructure</p> <p>IP Multicast Review, Multicast Addresses Layer 3 to Layer 2 Mapping IGMP, IGMPv1 IGMPv2 IGMPv3 CGMP IGMP Snooping, Sparse Versus Dense Multicast Multicast Source and Shared Trees PIM PIM-SM PIM DR Auto-RP PIMv2 Bootstrap Router, DVMRP IPv6 Multicast Addresses</p> <p>Types of Firewalls Next-Gen Firewalls NAT Placement , Firewall Guidelines Firewall ACLs , Identity and Access Control Deployments Detecting and Mitigating Threats IPS/IDS Fundamentals IPS/IDS Guidelines , Threat Detection and Mitigation Technologies , Threat-Detection and Threat-Mitigation Solutions , FirePOWER IPS Security Management Applications , Security Platform Solutions Security Management Network</p> <p>Integrating Security into Network Devices IOS Security, ISR G2 Security Hardware Options Securing the Enterprise, Implementing Security in the Campus Implementing Security in the Data Center Implementing Security in the Enterprise Edge</p> <p>Other Network Management Technologies RMON, RMON2 NetFlow Compared to RMON and SNMP, CDP LLDP Syslog</p>	15

Reference Books:

1. Authorized Self-Study Guide, Designing for Cisco Internetwork Solutions (DESGN), Second Edition, Cisco Press-Diane Teare.
2. Designing and Supporting Computer Networks, CCNA Discovery Learning Guide (Cisco Systems Networking Academy Program) Paperback – 2008, Kenneth Stewart, Aubrey Adams, Allan Reid , Jim Lorenz
3. Top-Down Network Design (Networking Technology) 3rd Edition, Priscilla Oppenheimer, Cisco Press Book
4. Network Planning and Design Guide Paperback – 2000, Shaun Hummel

Sub Unit	Self-Learning (Unit wise) Topics
1.3	LAN Media, Ethernet Design Rules, 100Mbps Fast Ethernet Design Rules, Gigabit Ethernet Design Rules, 1000BASE-LX Long-Wavelength Gigabit Ethernet, 1000BASE-SX Short-Wavelength Gigabit Ethernet, 1000BASE-CX Gigabit Ethernet over Coaxial Cable, 1000BASE-T Gigabit Ethernet over UTP 86, 10 Gigabit Ethernet Design Rules, 10GE Media Types, EtherChannel
3.1	Dense Wavelength-Division Multiplexing
3.2	Traditional WAN Technologies Hub-and-Spoke Topology
3.2	Full-Mesh Topology Partial-Mesh Topology Point-to-Point Topology Internet Protocol Version 6 Design, IPv6 Header IPv6 Address Representation IPv4-Compatible IPv6 Addresses IPv6 Prefix Representation IPv6 Address Scope Types and Address Allocations IPv6 Address Allocations IPv6 Unicast Address Global Unicast Addresses Link-Local Addresses , Unique Local IPv6 Address Global Aggregatable IPv6 Address , IPv4-Compatible IPv6 Address
3.2	Comparison IPv6 Comparison with IPv4 ,OSPF,

	Online Recourse
	Computer Networks and Internet Protocol - Course (nptel.ac.in)
	Introduction to Computer Networks & Internet Protocols - Course (swayam2.ac.in)

Course Code: US-TIT-504 Virtual Reality (Elective I)

Unit	Content	Lectures
I	<p>1.1 Concepts of Virtual Reality: This module will make students understand the knowhow of Virtual Reality. It will also go through a complete understanding of the exact need for Virtual Reality.</p> <p>1.2 Concepts of UI/UX for Virtual Reality Using Photoshop: This module will help students to use the Photoshop tools to create viable UI for Virtual Reality.</p> <p>1.3 Creating 360 Photo Stitching: This module will teach student how to quickly create 360 Experience form Images.</p>	15
II	<p>2.1 Introduction to Maya: This module will cover introduction to 3d graphics where student will learn concepts of 3d graphics using Maya.</p> <p>2.2 Creating and Downloading Assets: This module will help student to understand Tweaking and cleaning when an asset is downloaded. This module will also cover tips and tricks, to created asset making process faster.</p> <p>2.3 Creating Virtual Reality Video Using Maya : This module will help student understands concepts Creating Virtual 360 Walkthroughs using a 3d Software Maya</p> <p>2.4 Introduction to Video Editing using Premier: In this module students will be taken through the process of editing Videos and Sound along with file formats compatible with Virtual Reality Hardware's.</p>	15
III	<p>3.1 Introduction to unity: This module will cover introduction to Unity as an engine .This module will help students understand which are the cross platform uses for unity .This module will also discuss case studies of few applications and games created using unity</p> <p>3.2 Introduction to C# in Unity: This Module will cover basic orientation of C# language, Students will be taken through series of assignments involving syntax's, variable, conditions, and loops, s, etc. Students will also learn how to implement OOPS in unity using C#.</p> <p>3.3 Creating Assembly for Virtual Reality: This module will focus on creating Interactivity for Virtual Reality using unity. In This module students will be thought how to Assemble a Working environment with pre given assets.</p>	15
IV	<p>4.1 Creating Assembly for Virtual reality For PC VR: This module will cover Introduction to Virtual Reality. Students will be exposed to the process, need and current industry standards to build a Virtual Reality Experience. This module students will also be thought how to assemble a Virtual reality experiences by given assets For PC.</p> <p>4.2 Creating Assembly for Virtual reality For Standalone Devices/Mobile VR: This module will cover Introduction to Virtual Reality. Students will be exposed to the process, need and current industry standards to build a Virtual Reality Experience. This module students will also be thought how to assemble a Virtual reality experiences by given assets for Standalone and Mobile.</p> <p>4.3 Animation with Adobe Animate and Illustrator</p>	15

Reference Books

- Virtual Reality Insider, Nite Sky All About Virtual Reality: Includes 5 Amazing VR Experiences by Jack Challoner.
 - Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile by Tony Parisi
 - UX/UI Design Dot Grid Paper by Terri Jones
 - The Complete Guide to VR & 360 Photography: Make, Enjoy, and Share & Play Virtual Reality Paperback –by Jonathan Tustain.
 - Maya for Games by Michael Ingrassia, Creating Games with Unity and Maya by Adam Watkins.
 - The 360° Video Handbook: A step-by-step guide to virtual reality (VR) by Michael Wohl Arnold
 - 5: First Lessons in Autodesk Maya 2018 by Donna Betancourt.
 - Virtual Reality Filmmaking: Techniques & Best Practices for VR by Celine Tricart
 - Adobe Premiere Pro CC Classroom in a Book 1st Edition, by Jago Maxim.
1. Game Development with Unity by Michelle Menard, Unity 3D Game Development by Ryan Henson Creighton.
 2. Game Programming: Developing with Unity in C# for Beginners by Ortus Publishing, Let Us C# by Yashavant P.Kanetkar.
 3. Mobile Game Development with Unity by Jon Manning, Paris Buttfield addison, Working environment with Holistic Game Development with Unity by Penny de Byl.
 4. Unity Virtual Reality Projects by Jonathan Linowes, Building Virtual Reality with Unity And Steam VR by Murray Jeff W.
 5. Augmented Reality: Principles & Practice by Schmalstieg/Hollerer ,Complete Virtual Reality and Augmented Reality Development with Unity by Jesse, Glover, Jonathan, Linowes, Unity 2018 Augmented Realit Projects by Jesse Glover.

Self-Learning Topic

Sub Unit	Topic
1.3	Creating a 360 Image Collage
4.2	Installing Unity with required SDK,Creating environments foir VR,Assignments
4.3	Animation with Adobe Animate and Illustrator

Online Resources

<https://www.pdf3d.com/photography/>

<https://docs.unity3d.com/560/Documentation/Manual/InstallingUnity.html>

Course Code: US-TIT-505 Introduction to Artificial Intelligence (Elective II)

Unit	Details	Lectures
I	<p>1.1 Introduction to Artificial Intelligence: Brief History, ELIZA, Categorization of Intelligent Systems, Components of AI Program, Foundations of AI, Applications [Ref 1- ch1]</p> <p>1.2 Problem Solving: Introduction, Characteristics of Problem, Exhaustive Searches, Breadth-First search, Depth-First Search, Travelling Salesman Problem, Tower of Hanoi [Ref 1- ch2]</p> <p>1.3 Logic Concepts and Logic Programming: Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau Rules, Predicate Logic, Logic Programming, Resolution Methods. [Ref 1- ch4]</p> <p>1.4 Prolog Programming: Control Strategy of Prolog, Programming Techniques in Prolog, List Manipulation in Prolog, System Predicate Cut, Effect of Rule and Goal Orders[Ref 1- ch5]</p>	15
II	<p>2.1 Machine Learning Paradigms: Machine Learning Systems, Types of Learning, Support Vector Machines, Case-Based Reasoning and Learning [Ref 1- ch11]</p> <p>2.2 Artificial Neural Networks: The Neuron Model, Activation Functions, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Recurrent Networks [Ref 1- ch12]</p> <p>2.3 Fuzzy Sets and Uncertainties: Fuzzy set and Fuzzy Logic, Set and Fuzzy operators, Extended fuzzy operations, Fuzzy Relations, Fuzzy System and Design, Fuzzy Inference [Ref 2- ch 5]</p> <p>2.4: Adversarial attacks: What is an Adversarial Example?, What are adversarial whitebox and blackbox attacks?, The Threat of Adversarial Attacks in Machine Learning, How Adversarial Attacks on AI Systems Work, Popular Adversarial Attack Methods</p> <p>2.5 Fuzzy Cartesian Product, Fuzzy Composition, Linguistic Hedges, Syntax for IF and THEN rules, Graphical Techniques of Inference, Defuzzification methods, Application of Fuzzy Logic [Ref 2- ch 5]</p>	15
III	<p>3.1 Uncertainties And Inconsistencies with Probabilistic Reasoning: Uncertainty in AI, Probabilistic Reasoning, Joint Probability, Conditional Probability, Bayesian Networks [Ref 2- ch 8]</p> <p>3.2 Advancement Of Artificial Intelligence : Expert Systems, Advantages of an Expert System, Production System [Ref 2- ch 12]</p> <p>3.3 Natural Language Processing: Need for NLP, Natural Language Understanding, Natural Language Generation [Ref 2- ch 13]</p> <p>3.4 Case studies: Min-Max with tic tac toe game, Alpha-Beta pruning, Optimization, Hill Climbing</p>	15
IV	<p>4.1: Applying Machine Learning: Getting Started with a Strategy, Understanding Machine</p>	15

	<p>Learning Techniques, Applying Machine Learning to Business Needs [Ref 3- ch2]</p> <p>4.2 Looking Inside Machine Learning: The Impact of Machine, Learning on Applications, Data Preparation, The Machine Learning Cycle [Ref 3- ch3]</p> <p>4.3 Introduction to TensorFlow: Limitations of Traditional Programming, From Programming to Learning, What Is TensorFlow?, Using TensorFlow, Getting Started with Machine Learning, Seeing What the Network Learned [Ref 4- ch1]</p> <p>4.4 Resources: Medium Inside Machine Learning, CognitiveClass.ai, Coursera online learning, Udacity courses on machine learning, Galvanize, edX courses, MITOpenCourseware, Google Research Blog, Kaggle Wiki, KDnuggets, Data Science Central [Ref 3- ch 5], Using TensorFlow in Google Colab [Ref 4- ch1]</p>	
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Reference Books

1. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning
2. Artificial Intelligence and Soft Computing for Beginners, Anindita Das Bhattacharjee, SPD, 3rd Edition
3. Machine Learning For Dummies®, by Judith Hurwitz and Daniel Kirsch, IBM Limited Edition, Published by John Wiley & Sons, Inc
4. AI and Machine Learning for Coders, A Programmer's Guide to Artificial Intelligence, Laurence Moroney, O'REILLY.

Self-Learning Topic (Unit Wise)

Sub Unit	Topic
1.4	Prolog Programming: Control Strategy of Prolog, Programming Techniques in Prolog, List Manipulation in Prolog, System Predicate Cut , Effect of Rule and Goal Orders[Ref 1- ch5]
2.4	Fuzzy Cartesian Product, Fuzzy Composition, Linguistic Hedges, Syntax for IF and THEN rules, Graphical Techniques of Inference, Defuzzification methods , Application of Fuzzy Logic [Ref 2- ch 5]
3.4	Case studies: Min-Max with tic tac toe game, Alpha-Beta pruning, Optimization, Hill Climbing
4.4	Medium Inside Machine Learning, CognitiveClass.ai, Coursera online learning, Udacity courses on machine learning, Galvanize, edX courses, MITOpenCourseware, Google Research Blog, Kaggle Wiki, KDnuggets, Data Science Central [Ref 3- ch 5], Using TensorFlow in Google Colab [Ref 4- ch1]

Online Resources

Course: ARTIFICIAL INTELLIGENCE : SEARCH
METHODS FOR PROBLEM SOLVING

Week 2 : State Space Search: Depth First Search, Breadth First Search, Depth First Iterative Deepening

Week 3 : Heuristic Search: Best First Search, Hill Climbing, Solution Space, TSP, Escaping Local

Optima, Stochastic

Local Search

Week 4 : Population Based Methods: Genetic Algorithms, SAT, TSP, emergent Systems, Ant Colony Optimization

Week 5 : Finding Optimal Paths: Branch & Bound, A*, Admissibility of A*, Informed Heuristic Functions

Reference:

<https://nptel.ac.in/courses/106/106/106106126/>

Course: Introduction to Machine Learning

Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

Reference:

<https://nptel.ac.in/courses/106/106/106106139/#>

Course Code: US-TIT-506 Linux System Administration (Elective II)

Unit	Details	Lectures
I	<p>1.1 Introduction to Linux: Linux Distributions, Operating Systems and Linux, History of Unix and Linux, Linux Overview, Open Source Software, Linux Software, [Ref 1- ch1]</p> <p>1.2 Office and Database Applications: Running Microsoft Office on Linux , OpenOffice.org , Document Viewers , Database Management Systems , Editors [Ref 1- ch11]</p> <p>1.3 Managing Software: The Red Hat Package Manager, Managing Software Using RPM, Yum, The Debian Package Management System, Software Management in Ubuntu, Compile and Install GNU Software [Ref 3- ch 4]</p> <p>1.4 Scripting: bash Beginnings, Expressions, Arithmetic, If, Troubleshooting a Simple Script, Loops, cron Jobs [Ref 2- ch 10]</p> <p>1.5 The Linux Shell and File Structure: The Command Line, History, Filename Expansion, Standard Input/output and Redirection, Pipes, Jobs, Ending Processes, Linux Files, The File Structure, Listing, Displaying, and Printing Files, Managing Directories, File and Directory Operations [Ref 1- ch2]</p>	15
II	<p>2.1 Requirements for a Linux System Administrator : Who Needs You?, Help Wanted, Analyzing Skill Sets, What System Managers Should Know About Linux, [Ref 2- ch1]</p> <p>2.2 Setting Up a Linux Multifunction Server: Server Requirements, Installing Debian, Logging in Remotely, Configuring the Network, Changing the Default Debian Packages, Setting Up Quotas, Providing Domain Name Services, Adding a Relational Database: MySQL, Configuring Mail Securely with Postfix, POP3, and IMAP, Putting Apache to Work, Adding FTP Services with ProFTPD, Summarizing Your Web Statistics with Webalizer, Synchronizing the System Clock [Ref 2- ch2]</p> <p>2.3 The Domain Name System: DNS Basics, Advantages of Localized DNS Administration, Getting into the BIND, Components of BIND, Setting Up a DNS Server, Using a chroot Environment for Security, Configuring an Authoritative DNS Server, Editing the Configuration Files, BIND Tools [Ref 2- ch 3]</p> <p>2.4 Administering Apache: Static and Dynamic Files , A Simple LAMP Setup , Apache Configuration Files , CGI, Virtual Hosts, Logfiles [Ref 2- ch 6]</p>	15
III	<p>3.1 Mail : Key Mail Service Terms, Postfix, Send mail, and Other MTAs, Adding Authentication and Encryption, Configuring POP3 and IMAP Mail Delivery Agents, Email Client Configuration [Ref 2- ch 5]</p> <p>3.2 RAID and LVM: Logical Volume Manager (LVM), LVM Example for Multiple Hard Drives, LVM Snapshots, Configuring RAID Devices, Creating and Installing RAID Devices, Corresponding Hard Disk Partitions. [Ref 1- ch30]</p> <p>3.3 Load-Balanced Clusters:</p>	15

	Load-Balancing Software, IPVS on the Load Balancer, ldirectord, Configuring the Realservers (Apache Nodes), Configuring the Load Balancer, Testing the System, Adding HA to LB, Adding Other LB Services, Scaling Without LB and HA [Ref 2- ch7] 3.4 Backups: Evaluating Your Backup Needs , Command-Line Backup Tools [Ref 3- ch31] Restoring Backed up files, System Recovery(dd and rsync)	
IV	4.1 Local Network Services: Distributed Filesystems , Introduction to Samba , Configuring the Network , DHCP , Gateway Services , Print Services , User Management [Ref 2- ch8] 4.2 Virtualization: Why Virtualize? Virtualization Concepts, Virtualization Implementations, KVM, Setting Up KVM in Ubuntu/Debian, Containers [Ref 3- ch30] 4.3 Linux Firewall (Netfilter): How Netfilter Works, Installing Netfilter, Configuring Netfilter [Ref3 -ch13] 4.4 Network Security: TCP/IP and Network Security, Tracking Services, Binding to an Interface, Shutting Down Services, Monitoring Your System, Handling Attacks [Ref-3 ch-13] 4.5 Network Security Tools: nmap, Snort, Nessus, Wireshark/tcpdump	15

Reference Books

1. Linux: The Complete Reference , Sixth edition, Richard Petersen, Mc Graw Hill
2. Linux System Administration, Tom Adelstein and Bill Lubanovic, O'REILLY.
3. Linux Administration, A Beginner's Guide, Seventh Edition, WALE SOYINKA, Mc Graw Hill

Self-Learning Topic (Unit Wise)

Sub Unit	Topic
1.5	The Linux Shell and File Structure: The Command Line, History, Filename Expansion, Standard Input/Output and Redirection, Pipes, Jobs, Ending Processes, Linux Files, The File Structure, Listing, Displaying, and Printing Files, Managing Directories, File and Directory Operations [Ref 1- ch5]
2.4	Administering Apache: Static and Dynamic Files , A Simple LAMP Setup , Apache Configuration Files , CGI, Virtual Hosts, Logfiles
3.4	Backups: Evaluating Your Backup Needs , Command-Line Backup Tools
4.5	Network Security Tools: nmap, Snort, Nessus, Wireshark/tcpdump

Online Resources
Course: Linux Operating System Third Tutorial: Installing Software Eighth Tutorial: File Attributes Ninth Tutorial: Redirection Pipes Twelfth Tutorial: Basics of System Administration Reference: https://onlinecourses.swayam2.ac.in/aic20_sp24/preview

Course Code: US-TIT-507 Enterprise Java (Elective -III)

Unit	Content	Lectures
I	<p>Java Database Connectivity: JDBC Concepts, JDBC API, Driver Manager, Connection, Statement, Prepared Statement, Callable Statement and Result Set classes with relevant methods, Types of Result Sets. Handling queries, inserts, deletes and updates to database. Displaying the query results. Stored Procedures.</p> <p>Servlet: Introduction to Servlet , The Servlet Life Cycle, Using generic servlet and Http Servlet, Handling Client Request: Form Data, Handling Client Request: HTTP Request Headers. Generating server Response: HTTP Status codes, Generating server Response: HTTP Response Headers, Handling Cookies, Session Tracking.</p> <p>Overview of JSP: JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, JSP Architecture and life cycle.</p>	15
II	<p>Invoking java code with JSP: scripting elements, creating Template Text, Invoking java code from JSP, Limiting java code in JSP, using jsp expressions, comparing servlets and jsp, writing scriptlets. For example Using Scriptlets to make parts of jsp conditional, using declarations, declaration example.</p> <p>Controlling the Structure of generated servlets: The JSP page directive, import attribute, session attribute, isElgnore attribute, buffer and autoflush attributes, info attribute, errorPage and isErrorPage attributes, isThreadSafe Attribute, extends attribute, language attribute, Including files and applets in jsp Pages, using java beans components in JSP documents</p> <p>Expression Language: MVC in JSP, JSTL, Custom Tags, Custom Tag Example, Attribute, Iteration</p>	15
III	<p>EJB fundamentals: Motivation for EJB, EJB Echo system, J2EE technologies, Enterprise beans and types, distributed objects and middleware, developing EJB components, remote local and home interface, bean class and deployment descriptor.</p> <p>Introducing session beans: Session bean's life time, statefull and stateless session beans, lifecycle of session beans with examples.</p> <p>3.3. Java Server Face: Features of JSF, JSF request processing life cycle, JSF Element, JSF Expression Language, JSF standard Component, JSF Facelet Tag, JSF Convertor, JSF Validation Tag, JSF Database Access, JSF PrimeFace.</p>	15
IV	<p>Spring-Hibernate Fraemwork : Overview of the Spring Framework , Inversion of Control / Dependency, Injection Concepts, Aspect Oriented Programming – concept</p> <p>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</p> <p>Example with Spring and Hibernate: Dispatcher Servlet, Writing a Controller, DAO, Models, Services, Spring Configuration File , Error handling Strategy</p>	15

Reference Books:

1. “Advanced Java 2 Platform HOW TO PROGRAM” by H. M.Deitel, P. J. Deitel, S. E. Santry, Prentice Hall, 2001
2. “Beginning Java™ EE 6 Platform with GlassFish 3 from Novice to Professional” by Antonio Goncalves – Apress publication, 2009
3. “Beginning Spring” by Mert Caliskan, Kenan Sevindik, Wrox Publication, 2015

Self-Learning topic (Unit wise)

Sub Unit	Topics
1.3	Introduction on JSP, Advantage and Benefit of JSP, Need of JSP
2.3	MVC in JSP, Introduction in JSTL
3.1	Introduction on EJB, Architecture on EJB

Online Resource

Sr.No	Website Address
1	https://docs.oracle.com/javaee/5/tutorial/doc/bnagx.html
2	https://docs.oracle.com/javaee/7/tutorial/
3	https://spring.io/guides

Course Code: US-TIT-508 NOSQL DB (Elective -III)

Unit	Content	No of Lecture
I	1.1 Definition of NOSQL , History of NOSQL and different NOSQL Products, Exploring Mongo DB java, Exploring Mongo DB Ruby/Python, Interfacing and Interacting with NOSQL, Interfacing and Interacting with NOSQL. 1.2 Review of the Relational Model , Acid Properties, Distributed Database: Sharding and Replication, Consistency, The Cap Theorem, No Sql Data model. 1.3 NoSql database classification -key value stores, column family stores, document stores, XML Database, Graph Database, Introduction to MongoDB installation.	15
II	2.1 Data Types, Data Modelling : Designing the database, Drilling down on collection, using documents, creating the _id field, Building indexes, Impacting performance with Indexer. 2.2 Working with Data : Navigation Your Database, Inserting Data into Collection, Querying for Data, Using the Dot Notion.	15
III	3.1 Using Sort, Limit, and Skip Functions Working with Capped Collections, Retrieving a Single Document, Using Aggregate Command, Working with Conditional Operator, Leveraging Regular Expression, Update Data, Update Information Automatically. 3.2 Understanding the NOSQL architecture , Understanding the, NOSQL architecture, Understanding the, NOSQL architecture, Performing CRUD, operations, Querying NOSQL stores, Modifying Data Stores and Managing Evolution, Modifying Data Stores and Managing Evolution, Indexing and Ordering Data Sets	15
IV	4.1 Working with GridFS , Getting Started with the Command Line Tools, Using the _id Key, Working with Filename, Determining a File Length, Working with Chunk size, Tracking the Upload Date, Hashing your File, Using search command, Deleting, Retrieving File from MongoDB.	15

Reference Books:

1. NoSQL For Dummies by Adam Fowler A Wiley brand
2. David Hows, "The definitive guide to MongoDB", 2nd edition, Apress Publication, 2009, 8132230485.
3. Shakuntala Gupta Edward, "Practical Mongo DB", Second edition, Apress Publications, 2016, ISBN 1484206487
4. Daniel Perkins, "Mongo DB, Third Edition, CreateSpace Independent Publishing Platform, 2016, ISBN 152396300.
5. Steve Hoberman, "Data Modelling for Mongo DB", First Edition, Technics Publication, 2014, ISBN 9781935504702

Self-Learning Topic (Unit wise)

Sub Unit	Topics
1.3	NoSql database classification-key value stores, column family stores, document stores, XML Database, Graph Database, Introduction to MongoDB installation.
2.1	Data Types, Data Modelling: Designing the database, Drilling down on collection
3.1	Working with Conditional Operator, Leveraging Regular Expression, Update Data, and Update Information Automatically.

Online Resource

Sr.No	Website Address
1.	https://www.nosqldbm.ru
2.	https://www.mongodb.com

Part - 4 Detailed Scheme Practicals

Course Code: US-TIT-5P2 Embedded System with Internet of Things Practical

Sr No.	Practical
Unit (1 to 5)	Content
1.	Basic programs using LEDs <ol style="list-style-type: none">1. Blink Single LED2. Toggle two LEDs3. Generate different LED patterns4. Turn the LED ON/OFF using Push button
2.	Programs based on 7-segment LED. <ol style="list-style-type: none">1. Display digits 0 to 9.2. Display numbers 00 to 99.3. Display Hours and Minutes.
3.	Stepper motor/ Servo motor programs <ol style="list-style-type: none">1. Rotate motor in clockwise direction2. Rotate motor in anti-clockwise direction
4.	Programs based on LCD display and Keypad <ol style="list-style-type: none">1. Display Roll number and Name2. Display digits entered through Keypad
5.	Write a program to simulate oscilloscope using Raspberry Pi.
6.	Visitor monitoring system using Pi Camera.
7.	User Authentication using RFID cards or tags.
8.	Biometric attendance system using Fingerprint module.
9.	Tracking location using GPS module.
10.	Home Automation using Telegram.

Course Code: US-TIT-5P3 Enterprise Network (Elective I)

Sr No.	Practical
Unit (1 to 5)	Content
1	Configuring OSPF – I
a	Single-Area OSPF Link Costs and Interface Priorities
b	Multi-Area OSPF with Stub Areas and Authentication
2	Configuring OSPF – II
a	OSPF Virtual Links and Area Summarization
b	OSPF over Frame Relay
3	Redistribution and Administrative Distances
a	Redistribution Between RIP and OSPF
b	Manipulating Administrative Distances
4	BGP
a	Configuring BGP with Default Routing
b	Using the AS_PATH Attribute
c	BGP Route Reflectors and Route Filters
5	IPv6
a	Configuring OSPF for IPv6
b	Configuring 6to4 Tunnels
6	VLANs and EtherChannel
a	Static VLANs, VLAN Trunking, and VTP Domains and Modes
b	Configuring EtherChannel
7	WAN and Enterprise Edge
a	Configure ISDN interface and Testing.
b	Configure MPLS.
8	VLAN and Spanning Tree
a	Per-VLAN Spanning Tree Behavior
b	Multiple Spanning Tree
9	Internal VLAN Routing
a	Inter-VLAN Routing with an External Router
b	Inter-VLAN Routing with an Internal Route Processor
10	Configure NAT Services

Course Code: US-TIT-5P4 Virtual Reality (Elective I)

Sr No.	Practical
Unit (1 to 5)	Content
1.	Create a User Interface using Photoshop
2.	Create A 360 Image for Virtual Reality
3.	Creating an Environment
4.	Creating Infographic Video in Virtual Reality
5.	Create a Virtual reality Walkthrough
6.	Creating an Interactive UI
7.	Creating an interactive application in Uinty
8.	Create Interactions with 3d object in a 3d Environment
9.	Create a Virtual Reality Experience for PC VR
10.	Create a Virtual Reality Experience for Mobile VR

Course Code: US-TIT-5P5
Introduction to Artificial Intelligence Practical (Elective II)

Sr no.	Practical
Unit (1 to 5)	Content
1.	Write a program to implement Rule-Based System.
2.	Implement Conditional probability and Joined Probability.
3.	Implement Bayes Theorem.
4.	Write a program to implement different Fuzzy set operations.
5.	Design a chat-bot using AIML.
6.	Simulate ANN using R.
7.	A. Write a program to simulate 4-Queen / N-Queen problem. B. Write a program to solve tower of Hanoi problem.
8.	A. Write a program to solve water jug problem B. Design the simulation of tic – tac – toe game using min-max algorithm
9.	A. Write a program to shuffle Deck of cards. B. Solve traveling salesman problem using artificial intelligence technique.
10.	Text-to-Speech and Speech to Text conversion.
11.	A. Write a program to implement depth first search algorithm. B. Write a program to implement breadth first search algorithm. C. Write a program to implement A* algorithm.

Course Code: US-TIT-5P6
Linux System Administration Practical (Elective II)

Sr. No	Practical
Unit (1 to 5)	Content
1.	Installing Packages
2.	User Management
3.	File Sharing 1. Using Samba 2. Using NFS 3. Using FTP
4.	Configuring Mail server.
5.	Configuring Apache server.
6.	Configuring DHCP.
7.	Configuring Firewall.
8.	Firewall Configuration in Windows.
9.	Study of Important LINUX Services.
10.	Using gcc ++ compiler (Programming using C++).
11.	Do the following changes in Grub file a. Write the path where the grub file is located? b. Change the timeout and title of the system.

Course Code: US-TIT-5P7 Enterprise Java Practical (Elective -III)

Sr. No	Practical
Unit (1 to 5)	Content
1.	Write a Java Servlet Program to implement a dynamic Html using Servlet (username and Password should be accepted using HTML and displayed using Servlet)
2.	Write a Java Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such type of pages, you would need to refresh your webpage regularly; Java Servlet make this job easy by providing refresh automatically after a given interval)
3.	Write a Java Servlet Program using Cookie to remember user preference.
4.	Write a Java Servlet program to track Http Session by accepting username and password using HTML and display the profile page on successful login.
5.	Write a JSP program to implement all the attributes of page directive tag
6.	Write a JSP Program to get student information through a HTML and create a JAVA Bean class, populate Bean and display the same information through another JSP.
7.	Using JSF Standard Component and Facelet Tags
8.	Demonstrate an EJB application that demonstrates Session Bean (with appropriate business logic).
9.	Study and implement Hibernate.
10.	Study and Implement MVC using Spring Framework.

Course Code: US-TIT-5P8 NoSQL DB Practical (Elective -III)

Sr. No	Practical
Unit (1 to 5)	Content
1.	Write a MongoDB query to display all the documents in the collection restaurants
2.	Write a MongoDB query to display the fields' restaurant_id, name, borough and cuisine for all the documents in the collection restaurant.
3.	Write a MongoDB query to display the fields' restaurant_id, name, borough and cuisine, but exclude the field _id for all the documents in the collection restaurant.
4.	Write a MongoDB query to display the fields' restaurant_id, name, borough and zip code, but exclude the field _id for all the documents in the collection restaurant.
5.	Write a MongoDB query to display the entire restaurant which is in the borough Bronx.
6.	Write a MongoDB query to display the first 5 restaurant which is in the borough Bronx
7.	Write a MongoDB query to display the next 5 restaurants after skipping first 5 which are in the borough Bronx.
8.	Write a MongoDB query to find the restaurants who achieved a score more than 9
9.	Write a MongoDB query to find the restaurants that achieved a score, more than 80 but less than 100.
10.	Write a MongoDB query to find the restaurants which locate in latitude value less than -95.754168

Part 5- The Scheme of Teaching and Examination is as under:
Third Year Semester –VI Summary

Choice Based Credit System			
Sr. No.	Course Type	Course Title	Subject Code
1.	Skill Enhancement Course	Project	US-TIT-601
2.	Skill Enhancement Course	Cryptography & Information Security	US-TIT-602
3.	Discipline Specific Elective (Any One)	Data Mining & Business Intelligence	US-TIT-603
		Cyber Laws, Compliance & Frameworks	US-TIT-604
4.	Discipline Specific Elective (Any One)	Mobile & Cloud Computing	US-TIT-605
		Virtualization Concepts & Applications	US-TIT-606
5.	Discipline Specific Elective (Any One)	DevOps (Development & Operations)	US-TIT-607
		Entrepreneurship Development & Management	US-TIT-608
6.	Skill Enhancement Course Practical	Project	US-TIT-6P1
7.	Skill Enhancement Course Practical	Cryptography & Information Security Practical	US-TIT-6P2
8.	Discipline Specific Elective Practical (Any One)*	Data Mining & Business Intelligence Practical	US-TIT-6P3
		Virtual Reality	US-TIT-6P4
9.	Discipline Specific Elective Practical (Any One)*	Mobile Communication & Computing Practical	US-TIT-6P5
		Virtualization Concepts & Applications Practical	US-TIT-6P6
10.	Discipline Specific Elective Practical (Any One)*	DevOps (Development & Operations)Practical	US-TIT-6P7
		Entrepreneurship Development & Management Practical	US-TIT-6P8

Third Year Semester -VI Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week (Period of 45min)							Internals			Total Marks	
			U	S. L.	L	T	P	Cred it	S. L. E	CT + AT = 15+5	P A		SEE	
1.	US-TIT-601	Project	4	20%*	5	0	0	2	10	20	10		60	100
2.	US-TIT-602	Cryptography & Information Security	4	20%*	5	0	0	2	10	20	10		60	100
3.	US-TIT-603	Data Mining & Business Intelligence	4	20%*	5	0	0	2	10	20	10		60	100
4.	US-TIT-604	Cyber Laws, Compliance & Frameworks	4	20%*	5	0	0	2	10	20	10		60	100
5.	US-TIT-605	Mobile & Cloud Computing	4	20%*	5	0	0	2	10	20	10		60	100
6.	US-TIT-606	Virtualization Concepts & Applications	4	20%*	5	0	0	2	10	20	10		60	100
7.	US-TIT-607	DevOps (Development & Operations)	4	20%*	5	0	0	2	10	20	10		60	100
8.	US-TIT-608	Entrepreneurship Development & Management	4	20%*	5	0	0	2	10	20	10		60	100
9.	US-TIT-6P1	Project Based US-TIT- 601	-	-	0	-	3	2					50 (40+10)	50

10.	US-TIT-6P2	Practicals Based US-TIT- 602	-	-	0	-	3	2					50 (40 +1 0)	50
11.	US-TIT-6P3	Practicals Based US-TIT- 603	-	-	0	-	3	2					50 (40 +1 0)	50
12.	US-TIT-6P4	Practicals Based US-TIT- 604	-	-	0	-	3	2					50 (40 +1 0)	50
13.	US-TIT-6P5	Practicals Based US- TIT-605	-	-	0	-	3	2					50 (40+ 10)	50
14.	US-TIT-6P6	Practicals Based US- TIT-606	-	-	0	-	3	2					50 (40+ 10)	50
15.	US-TIT-6P7	Practicals Based US- TIT-607	-	-	0	-	3	2					50 (40+ 10)	50
16.	US-TIT-6P8	Practicals Based US- TIT-608	-	-	0	-	3	2					50 (40+ 10)	50
	Total Periods/ Credit		(25+45) per week / 20					20						750

***One to two lectures to be taken for CONTINUOUS self -learning evaluation**

Third Year Semester – VI Units – Topics – Teaching Hours

Sr N	Subject Code & Title	Subject Unit Title	Lectures (48 min)	Total Lectures	Cre dit	Tot al Mar ks
1.	US-TIT-601 Project	Project Implementation	-	60 L	2	100 (60+40)
2.	US-TIT-602 Cryptography & Information Security	1 Introduction to Information Security	15	60 L	2	100 (60+40)
		2 Cryptography: Concepts and Techniques	15			
		3 Digital Certificates and Public Key Infrastructure (PKI)	15			
		4 Network Security, Firewalls and Virtual Private Network (VPN), Voice over IP (VoIP) and PBX Security	15			
3.	US-TIT-603 Data mining & Business Intelligence (Elective-I)	1 Introduction to Data Mining, Data Exploration, Data Preprocessing	15	60 L	2	100 (60+40)
		2 Classification, Clustering, Outlier Analysis	15			
		3 Frequent Pattern Mining, Introduction to Business Intelligence	15			
		4 Decision Support System, BI and Data Mining Applications	15			
4.	US-TIT-604 Cyber Laws, Compliance & Frameworks (Elective-I)	1 Introduction to Cybercrime	15	60 L	2	100 (60+40)
		2 Cyber offenses & Cybercrime ,Tools and Methods Used in Cyberline	15			
		3 The Security Aspect of Cyber Law, Protection of Cyber Consumers in India	15			
		4 The Indian Evidence Act of 1872 v. Information Technology Act, 2000, Information Security Standard compliances	15			
5.	US-TIT-605 Mobile & Cloud Computing (Elective-II)	1 Cloud Computing Mobile Cloud Computing	15	60 L	2	100 (60+40)
		2 Offloading in Mobile Cloud Computing Architecture of Mobile Cloud Computing	15			
		3 Green Mobile Cloud Computing Resource Allocation in Mobile cloud computing	15			
		4 Business Aspects of Mobile Cloud Computing ,Application of Mobile Cloud Computing Future Research Scope of Mobile Cloud Computing	15			

6.	US-TIT-606 Virtualization Concepts & Applications (Elective-II)	1	Overview of Virtualization	15	60 L	2	100 (60+40)
		2	Server Consolidation	15			
		3	Virtualizing Storage	15			
		4	Blades and Virtualization	15			
7.	US-TIT-607 DevOps (Development & Operations) (Elective- III)	1	Introduction to Devops	15	60 L	2	100 (60+40)
		2	Continue Integration and Continuous Delivery	15			
		3	Docker	15			
		4	GIT	15			
8.	US-TIT-608 Entrepreneurship Development & Management (Elective- III)	1	Introduction	15	60 L	2	100 (60+40)
		2	Entrepreneurship Development and Leadership Business	15			
		3	Marketing the Product or Service Small Business Marketing	15			
		4	Financing & Managing Venture	15			
9.	US-TIT-6P1	1	Practicals based on US-TIT-601		36 L x3 batches = 108 lectures	2	50
10.	US-TIT-6P2	2	Practicals based on US-TIT-602		36 L x3 batches = 108 lectures	2	50
11.	US-TIT-6P3 (Elective-I)	3	Practicals based on US-TIT-603		36 L x3 batche s= 108 lecture s	2	50
12.	US-TIT-6P4 (Elective-I)	4	Practicals based on US-TIT-604		36 L x3 batche s= 108 lecture s	2	50

13.	US-TIT-6P5 (Elective-II)	5	Practicals based on US-TIT-605		36 L x3 batche s= 108 lecture s	2	50
14.	US-TIT-6P6 (Elective-II)	6	Practicals based on US-TIT-606		36 L x3 batches = 108 lectures	2	50
15.	US-TIT-6P7 (Elective-III)	7	Practicals based on US-TIT-607		36 L x3 batches = 108 lectures	2	50
16.	US-TIT-6P8 (Elective-III)	8	Practicals based on US-TIT-608		36 L x3 batches = 108 lectures	2	50
			TOTAL			20	750

Course Code: US-TIT-602 Cryptography and Information Security

Unit	Details	Lectures
I	<p>Introduction to Information Security : The Importance of Information Protection, The Evolution of Information Security, Justifying Security Investment, Security Methodology, How to Build a Security Program, The Impossible Job, The Weakest Link, Strategy and Tactics, Business Processes vs. Technical Controls.</p> <p>Risk Analysis: Threat Definition, Types of Attacks, Risk Analysis.</p> <p>Secure Design Principles: The CIA Triad and Other Models, Defense Models, Zones of Trust, Best Practices for Network Defense.</p>	15
II	<p>Cryptography: Concepts and Techniques – Introduction, plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption. Cryptographic hash functions, Properties of secure hash function, MD5, SHA.</p> <p>Symmetric Key Algorithms- Overview of Symmetric Key Cryptography Algorithm Types and Modes, Diffie-Hellman Key Exchange, DES, AES, RC4, Blowfish.</p> <p>Asymmetric Key Algorithms, Digital Signatures and RSA- Overview of Asymmetric Key Cryptography, RSA Algorithm, Symmetric and Asymmetric key cryptography together, Digital Signatures.</p>	15
III	<p>Digital Certificates and Public Key Infrastructure (PKI) – Introduction, Digital Certificates, X.509 Certificates Private Key Management.</p> <p>User Authentication and Kerberos –Introduction, Authentication Basics, Passwords, Authentication Tokens, and Certificate based Authentication, Biometric Authentication, and Kerberos.</p> <p>Internet Security Protocols- Introduction, Secure Socket Layer(SSL),Transport Layer Security(TLS),Secure Hyper Text Transfer Protocol(SHTTP),Time Stamp Protocol(TSP), Secure Electronic Transaction(SET),SSL vs SET.</p>	15
IV	<p>Network Security, Firewalls and Virtual Private Network (VPN) – Introduction, TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN).</p> <p>Intrusion Detection and Prevention Systems: IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM).</p> <p>Voice over IP (VoIP) and PBX Security: Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM: Telecom Expense Management.</p>	15

Text Books and References

1. William Stallings, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013.
2. Behrouz A. Ferouzan, —Cryptography & Network Securityll, Tata Mc Graw Hill.
3. Bernard Menezes, —Cryptography & Network Securityll, Cengage Learning.

4. Network Security Bible, Eric Cole, Second Edition, Wiley.
5. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.
6. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.

SLE Topics

Sr. No	Topics
2.1	Steganography, key range and key size
2.3	Knapsack Algorithm, Elliptic Curve Cryptography(ECC) , ELGamal, Problems with the Public Key Exchange
3.1	PKIX Model, Public Key Cryptography Standards(PKCS),XML,PKI and Security, Creating Using Java
3.2	Key Distribution Center(KDC),Security Handshake Pitfalls, Single Sign On(SSO) Approaches.
3.3	3-D secure protocol, Electronic Money, Wireless Application Protocol (WAP) Security, Security in GSM, Security in 3G.

Online Resource

<https://onlinecourses.nptel.ac.in/>

Course Code: US-TIT-603 Data Mining and Business Intelligence

Unit	Details	Lectures
I	<p>Introduction to Data Mining - Definition of Data Mining ,Working of Data Mining ,Architecture of Data Mining ,Kinds of Data that can be mined, Data Mining Functionalities, Types of Data Mining Systems ,Advantages of Data Mining, Disadvantages of Data Mining, Ethical Issues in Data Mining.</p> <p>Data Exploration – Data ,Data Visualization</p> <p>Data Preprocessing - Why Preprocessing? , Data Cleaning, Data Integration, Data Reduction, Data Transformation, Data Discretization and Concept Hierarchy Generation.</p>	15
II	<p>Classification -Basic Concepts, Classification Methods, Prediction Model Evaluation and Selection, Combining Classifiers (Ensemble Methods)</p> <p>Clustering -Introducing Cluster Analysis, Clustering Methodologies: K-Means.</p> <p>Outlier Analysis-Real-World Applications, Types of Outliers, Outlier Challenges, Outlier Detection Approaches, Outlier Detection Methods- Supervised, Semi-Supervised, Unsupervised.</p> <p>Proximity-Based Outlier Analysis ,Clustering-Based Outlier Analysis</p>	15
III	<p>Frequent Pattern Mining - Market Basket Analysis, Efficient and Scalable Frequent Item set Mining Methods, Mining Multilevel and Multidimensional Association Rules, Association Mining to Correlation Analysis</p> <p>Introduction to Business Intelligence - Data, Information and Knowledge ,Defining Business Intelligence, Important Factors in Business Intelligence, Business Intelligence Architecture, Business Intelligence Framework, Role of Mathematical Models in BI, Factors Responsible for a Successful BI Project, Development of BI System, Obstacles to Business Intelligence in an Organization, Ethics and Business Intelligence.</p>	15
IV	<p>Decision Support System - Concept of Decision Making ,Techniques of Decision Making, Understanding Decision Support System (DSS), Evolution of Information System, Development of Decision Support System, Application of DSS , Role of Business Intelligence in Decision Making</p> <p>BI and Data Mining Applications</p> <ol style="list-style-type: none"> 1. ERP and Business Intelligence 2. BI Applications in CRM 3. BI Applications in Marketing 4. BI Applications in Logistics and Production 5. Role of BI in Finance 6. BI Applications in Banking 7. BI Applications in Telecommunications 8. BI Applications in Fraud Detection 9. BI Applications in Clickstream Mining 10. BI Applications in the Retail Industry 	15

Text Books and References:

1. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition.
2. P. N. Tan, M. Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education.
3. Paulraj Ponniah "Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals" Wiley Publications
4. Business Intelligence: Data Mining and Optimization for Decision Making by Carlo Verrellis, Wiley India Publications.
5. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", 2nd Edition, Wiley India.
6. Decision support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda,
7. Dursun Delen, Pearson Edition, 9th Edition, 2011.
8. Fundamental of Business Intelligence Grossmann W, Rinderle-Ma, Springer, First Edition, 2015.

SLE Topics

Sr. No	Topics
1.1	Overview and concepts Data Warehousing
2.3	Data Pre-processing
3.3	Association Rule Mining
4.3	Data envelopment analysis

Online Resource

<https://onlinecourses.nptel.ac.in/>

Data Mining https://onlinecourses.nptel.ac.in/noc21_cs06/preview

[Business Intelligence & Data Mining Course - Online Video Lessons | Study.com](#)

Course Code: US-TIT-604 Cyber Laws, Compliance & Frameworks

Textbooks and References-

Unit	Details	Lectures
I	<p>Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.</p> <p>Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000: Concept of “Cyber Crime “ and the IT Act , 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cyber Cheating, Virus on the Internet, Defamation, Harassment and Email Abuse, Cyber Pornography, Other IT Act Offences, Monetary Penalties, Adjudication and Appeals Under IT Act , 2000, Network Service Providers, Jurisdiction and Cyber Crime, Nature of Cyber Criminality, Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications on Cyber Crime.</p>	15
II	<p>Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops</p> <p>Tools and Methods Used in Cyberline Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)</p>	15
III	<p>The Security Aspect of Cyber Law -The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law.</p> <p>Protection of Cyber Consumers in India Are Cyber Consumers Covered Under the Consumer Protection Act? Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices, Instances of Unfair Trade Practices, Reliefs Under CPA, Beware Consumers, Consumer Foras, Jurisdiction and Implications on cyber Consumers in India, Applicability of CPA to Manufacturers, Distributors, Retailers and Service Providers Based in Foreign Lands Whose Goods are Sold or Services Provided to a Consumer in India. Amendments in Indian IT Act 2000.</p>	15

IV	The Indian Evidence Act of 1872 and Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages, Other Amendments in the Indian Evidence Act by the IT Act, Amendments to the Bankers Books Evidence Act, 1891 and Reserve Bank of India Act, 1934. Indian IT Act. Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments. Information Security Standard compliances SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	15
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2. Cyber Law Simplified- Vivek Sood TMH Education 2001
3. Cybersecurity Law- Jeff Kosseff, Wiley, 2017.
4. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
5. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
6. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
7. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
8. Kenneth J. Knapp, *Cyber Security & Global Information Assurance* Information Science Publishing.

SLE Topics

Sr. No	Topics
1.1	Power of Arrest Without Warrant Under the IT Act, 2000:
2.3	Jurisdiction in the Cyber World
3.3	E-Commerce Taxation: Real Problems in the Virtual World:
4.3	Protection of Cyber Consumers in India:

Online Resource

<https://onlinecourses.nptel.ac.in/>

The Information Technology ACT, 2008- TIFR :

<https://www.tifrh.res.in>

A Compliance Primer for IT professional :

<https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>

Course Code: US-TIT605- Mobile and Cloud Computing

Unit	Details	Lectures
I	<p>Cloud Computing Virtualization Techniques, Cloud Infrastructure, Architecture Design of Compute and Storage Clouds, Design challenges-Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Cloud Sim Simulator.</p> <p>Mobile Cloud Computing Introduction, Motivation to Mobile Cloud Computing, Architecture of Mobile Cloud Computing, Platform and Technologies, Mobile Augmentation Approaches, Issues of Mobile Cloud Computing, Advantages of Mobile Cloud Computing, Applications of Mobile Cloud computing, Research Challenges in Mobile Cloud Computing</p>	15
II	<p>Offloading in Mobile Cloud Computing Introduction, Offloading Decision, Types of Offloading, Topologies of Offloading, Offloading in Cloud Computing and in Mobile Cloud Computing: Similarities and Differences, Adaptive Computation Offloading from Mobile Devices, Cloud Path Selection for Offloading, Mobile Data Offloading Using Opportunistic Communication.</p> <p>Architecture of Mobile Cloud Computing Three-Tier Architecture of Mobile Cloud Computing, Requirements of Data Offloading, Performance Analysis of Offloading Techniques Multi-Cloud Offloading in Mobile Cloud Computing Environment</p>	15
III	<p>Green Mobile Cloud Computing Introduction, Green Mobile Computing, Green Mobile Network, Green Cloud Computing, Green Mobile Cloud Computing, Green Mobile Devices Using Mobile Cloud Computing, Green Femtocell Using Mobile Cloud Computing, Green Seamless Service Provisioning with Mobile Cloud Computing, Green Location Sensing within Mobile Cloud Computing Environment</p> <p>Resource Allocation in Mobile cloud computing Significance of Resource Allocation in Mobile Cloud Computing, Resource-Allocation Strategies in Mobile Cloud Computing, Research Challenges in Resource Allocation in Mobile Cloud Computing.</p>	15
IV	<p>Business Aspects of Mobile Cloud Computing Cloud Business Models, Business Model of Mobile Computing Environment, Cooperation among Service Providers, Weblet-Based Mobile Cloud Computing Model, Mobile Cloud Service Insurance Brokerage, Business Aspects of Social Mobile Cloud Computing</p> <p>Application of MobileCloud Computing Introduction, Cloud Mobile Media Application, Biometric Application, Vehicle Monitoring, Mobile Learning, Application in Social Cloud, Context-Aware Navigation System.</p>	15

	Future Research Scope of Mobile Cloud Computing Efficient Bandwidth Allocation, Use of Cloudlet in Mobile Cloud Computing, Cross-Cloud communication, Elastic Application Model, Resource Management.	
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Text Books & References

1. Mobile Cloud Computing: Architectures, Algorithms and Applications, by Debashis De , CRC press
2. Mobile Clouds: Exploiting Distributed resources in wireless mobile and social networks, by Frank Fitzek, Marcos D. Katz Wiley
3. Mobile Cloud computing: Principles and paradigms by Khanna, Sarishma.
4. Architecting the cloud by Kavis Wiley publication
5. Advances in Mobile cloud computing systems by F. Richard Yu. , Victor Leung, CRC press
6. Mobile computing with Cloud by Ishwarya Chandrasekaran Springer
7. Mobile cloud computing: An Introduction by Jyoti Grover and Gaurav K. Heterpal , IGI Global

SLE Topics

Sr. No	Topics
1.2	Advantages of Mobile Cloud Computing, Applications of Mobile Cloud computing, Research Challenges in Mobile Cloud Computing
4.2	Application of Mobile Cloud Computing Introduction, Cloud Mobile Media Application, Biometric Application, Vehicle Monitoring,

Online Resource

<https://nptel.ac.in/courses/106106147>
<https://nptel.ac.in/courses/117104099>

Course Code: US-TIT606- Virtualization

Unit	Details	Lectures
I	Overview of Virtualization Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization- Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts.	15
II	Server Consolidation Hardware Virtualization – Virtual Hardware Overview - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Server Virtualization – Uses of Virtual server Consolidation – Planning for Development –Selecting server Virtualization Platform.	15
III	Virtualizing Storage SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables –Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.	15
IV	Blades and Virtualization Building Blocks for Next- Generation Data Centers, Evolution of Computing Technology Setting the Stage, Evolution of Blade and Virtualization Technologies, Blade Architecture, Assessing Needs Blade System Hardware Considerations	15

Text Books & References

1. Professional Xen Virtualization - William von Hagen, Wrox, Publications, January, 2008.
2. Virtualization: From the Desktop to the Enterpris, Chris Wolf, Erick M.Halter APRESS, 2005.
3. Network virtualization Kumar Reddy, Victor Moreno , Cisco Press, 2006

SLE Topics

Sr. No	Topics
3.1	Fiber Channel –Fiber Channel Cables –Fiber Channel Hardware Devices
4.1	Needs Blade System

Online Resource

<https://nptel.ac.in/courses/108106167>

Course Code: US-TIT607- DevOPs

Unit	Details	Lectures
I	Introduction to Devops- What is Devops? History of Devops, Devops definition Devops main objective, Devops and software development life cycle: Water model and Agile Model. Devops Architecture, Lifecycle, Workflow; Principle, DevOps Tools.	15
II	Continue Integration and Continuous Delivery -What is version Control System? GIT Automated Build Version: Maven and Jenkins Master and Slaves Configuration Integration Jenkins with jfrog and SonarQube.	15
III	Docker: Overview, Installation on windows and linux, Docker hub, image, container, working with container Docker Architecture, Configuring Docker, Docker file, managing port, private registries, Docker command, storage, networking Working with Nodes.js, setting MongoDB, Docker setting with asp.net. Kubernetes: Overview, Kubernetes Architecture, Installing Kubernetes, Building a Kubernetes Cluster, Managing a Kubernetes Cluster, Deploying a Micro Services Application on Kubernetes.	15
IV	GIT: What is GIT? Install Git on Window, Git Environment Setup , Git Tools, Git Command, Git Flow Staging and Commit, Undoing Changes, inspecting changes Branching and Merging, Collaborating.	15

Textbooks & References

1. DevOps Bootcamp, Sybgen Learning
2. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication.
3. Len Bass, Ingo Weber, Liming Zhu, "DevOps, A Software Architects Perspective", Addison Wesley Pearson Publication.
4. John Ferguson Smart, "Jenkins, The Definitive Guide", O'Reilly Publication.
5. Optimize enterprise-grade environment performance with Puppet, by Ryan Russell- Yates Packt Publishing (September 29, 2018)
6. Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", Wiley Publication
7. Httermann, Michael, "DevOps for Developers", Apress Publication.
8. Joakim Verona, "Practical DevOps", Pack publication

SLE Topics

Sr. No	Topics
1.2	Scrum, Kanban, Agile
3.2	Docker Compose, Docker Swarm.
4.2	Ansible, Saltstack

Online Resource

<https://www.ibm.com/in-en/cloud/devops>
<https://www.udemy.com/course/learn-devops>

Course Code: US-TIT608- Entrepreneurship Development and Management

Unit	Details	Lectures
I	Introduction -Concept, meaning and definition of Entrepreneur and Entrepreneurship. Evolution of Entrepreneurship, Role of Entrepreneurship in economic Development; Managerial vs entrepreneurial approach; Classification and types of Entrepreneurs. Characteristics and qualities of successful Entrepreneurs; Women Entrepreneurs; Corporate & Social entrepreneurship. Role of Money and Capital Markets in Entrepreneurial Development :Contribution of Government Agencies on Sourcing Information for Entrepreneurship	15
II	Entrepreneurship Development and Leadership Business- Plan and Importance of Capital to Entrepreneurship: Preliminary and Marketing Plan, Management and Personal ,Start-up Cost and Financing as well as Projected Financial Statement Creative Business Ideas: Identify and Recognizing Opportunities: Observing Trends and solving problems, Creativity: Concept, Components and types, Sources of New Venture Ideas: Concept, Pre-selection Process, Sources of Business Idea, Preliminary Research, Business Idea Evaluation, and Other Analysis. Writing a Business Plan: Introduction of Business Plan, Guidelines for writing A Business Plan, Layout of Business Plan (Executive summary, Business Description, Industry Analysis, Market Analysis, Management Team and Company Structure, Operations Plan, Product Design and Development Plan, Financial Projections and Critical Risk Assessment, Harvest Strategy, Milestone Scheduling), Presenting the Business Plan to Investors. Why some Business Plans Fail.	15
III	Marketing the Product or Service Small Business Marketing: Strategy and Research: Concept, Marketing Strategies, and Market Research. Product: Heart of Marketing Mix, Purchasing, Selecting Suppliers, Managing and controlling Inventor. Place: Location Types, Layout Design. Price and Promotion: Economics of Pricing, Breakeven Analysis, Pricing-Setting Techniques, Credit Policies, Promotions	15
IV	Financing & Managing Venture - Growth and Development of the Venture, Social Responsibility. Small Business Growth: Growing Firm, Transition to Professional Management, The Next Step: An Exit Strategy, Leadership in Action: Leadership Attributes, Negotiations, Delegation, Motivation Employees, HRM: Job Analysis, Recruitments, Selections, Trainings, Compensations, Introduction of Social Responsibility, Corporate Social Responsibility (CSR), Dimensions of CSR.	15

Textbooks & References

1. Entrepreneurship; Robert Hisrich, Michael Peters; Tata McGraw Hill Publication.
2. Entrepreneurship: New venture creation by David Holt, Prentice Hall of India Pvt. Ltd.
3. E- Business & E- Commerce Management: Strategy, Implementation, Practice – Dave Chaffey, Pearson Education
4. E-commerce – A Managerial Perspective- P. T. Joseph, Prentice Hall India Publications. Content References:
5. Entrepreneurship and Innovations in E-business An Integrative Perspective by Fang Zhao, Idea Group Publications.
6. Business Driven Technology –Haag/Baltzan/Philips –Tata McGraw Hill Publication.

SLE Topics

Sr. No	Topics
1.2	Difference between Entrepreneurs, Intrapreneurs & Ultraprenurs
2.2	Writing business plan for benefiting to an Entrepreneurs
3.2	Role of Digital Marketing for an entrepreneur as promoting their product
4.2	Operation management responsibilities in managing Small Business

Online Resource

http:// www.startupindia.gov.in
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Course Code: US-TIT602- Cryptography and Information Security Practical

Sr No	Practical
1.	Implementation of Substitution Techniques. 5. Implement Ceaser Cipher. 6. Implement Modified Caesar Cipher.
2.	Implementation of Transposition Techniques. 4. Implement Rail Fence Cipher. 5. Implement Vernam Cipher.
3.	Implementing DES Algorithm.
4.	Implementing AES Algorithm.
5.	Implementing RSA Algorithm.
6.	a. Implementing RC4. b. Implementing Blowfish Algorithm
7.	Configure Routers a. OSPF MD5 authentication. b. to support SSH connections
8.	Configure AAA Authentication. a. Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA. b. Verify local AAA authentication from the Router console and the PC-A client
9.	Configure, Apply and Verify an Extended Numbered ACL.
10.	a. Configuring a Zone-Based Policy Firewall. b. Configure IOS Intrusion Prevention System (IPS) Using the CLI.

Course Code: US-TIT-603 Data Mining and Business Intelligence Practicals

Sr No	Practical
1.	Import the legacy data from different sources such as (Excel, SqlServer, and Oracle etc.) and load in the target system. (You can download sample database such as Adventureworks, Northwind, foodmart etc.)
2.	Design Star and Snowflake Schema
3.	Implement using tools or languages like JAVA/ python/R a) Data Exploration b) Data preprocessing
4.	a. Create the Data staging area for the selected database. b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP And HOLAP model.
5.	a. Import the datawarehouse data in Microsoft Excel and create the Pivot table and Pivot Chart. b. Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to Perform data analysis.
6.	Implement and evaluate using languages like JAVA/ python/R for Classification Algorithm.
7.	Implement and evaluate using languages like JAVA/ python/R for Clustering Algorithm.
8.	Implement and evaluate using languages like JAVA/ python/R for Frequent Pattern Mining Algorithm.
9.	Detailed case study of any one BI tool such as Pentaho, Tableau and QlikView
10.	Business Intelligence Mini Project: Each group assigned one new case study for this A BI report must be prepared outlining the following steps: a) Problem definition, identifying which data mining task is needed b) Identify and use a standard data mining dataset available for the problem. Some links for data mining datasets are: WEKA, Kaggle, KDD cup, Data Mining Cup, UCI Machine Learning Repository etc. c) Implement appropriate data mining algorithm d) Interpret and visualize the results Provide clearly the BI decision that is to be taken as a result of mining

Course Code: US-TIT-604 Cyber Laws, Compliance & Frameworks

Sr No	Practical
1.	HTTP Analysis using Wireshark for Text.
2.	HTTP Analysis using Wireshark for Image.
3.	Using FTK Imager to create a forensic image of a Hard Disk Storage.
4.	Using FastIR Artifacts Tool.
5.	Using Live Response Collection Tool.
6.	Using bulk_extractor Tool.
7.	Using SIFT Workstation VM.
8.	Using Python-evt Tool
9.	Using unfurl Tool
10.	a. Using ChromeCache View Tool b. Using Chrome-url-dumper Tool

Course Code: US-TIT605- Mobile and Cloud Computing Practicals

Sr No	Practical
1.	Using Power apps design an application using a Blank canvas.
2.	Using Power Apps design an application where SharePoint is the data source.
3.	Using Power Apps design an application using different screens and editing properties.
4.	Using Power Apps design an application using various insert features such as forms, media, icons etc.
5.	Using Power Apps design an application using search and filter function.
6.	Using Power Apps design an application and use different publishing and sharing options.
7.	Build a PowerApp to edit and update excel workbooks.
8.	Integrate Power Apps into Power BI reports.
9.	Use power apps rules and data validation with usage of functions.
10.	Develop a power application of your choice.

Course Code: US-TIT606- Virtualization Practicals

Sr No	Practical
1.	Implement vmwareESXi for server virtualization
2.	Implement XEN for server virtualization
3.	Implement Hyper-V server virtualization
4.	Manage vmwareESXi with vCentre server
5.	Manage xen server Xen center
6.	Understanding blade server with cisco UCS/HP eva simulator
7.	Implement vlan concept with L2/L3 switches/nexus virtual switching
8.	Simulating SAN with navisphere/netapps

Course Code: US-TIT607 - DevOPs Practicals

Sr No	Practical
1.	To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2.	To understand Version Control System / Source Code Management, install git and create a GitHub account
3.	To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
4.	To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
5.	To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
6.	To learn Docker file instructions, build an image for a sample web application using Docker file.
7.	Create a new bridge network and connect with container using Docker
8.	Docker Swarm: Create and Scale a Services
9.	Create an application with an API and deploy it to Kubernetes
10.	Create a Kubernetes Cluster on AWS

Course Code: US-TIT608 - Entrepreneurship Development and Management Practicals

Sr No	Practical
1.	a. To study listening and note-taking. b. To develop writing skills c. To develop oral presentation skills.
2.	a. To evaluate and improve presentation. b. To prepare field diary and lab record. c. To study indexing, footnote and bibliographic procedures.
3.	To study market survey to the demand for product.
4.	To study advertisements for popularization of product
5.	a. To learn preparation of project proposals. b. To Learn preparation of Business models
6.	To learn individual and group and oral presentation.
7.	To learn dyadic communication (face to face conversation)
8.	To learn salient features of participation in seminars and conferences.
9.	To learn telephone conversation and other etiquettes during conversation.
10.	To learn participating for mock interviews.

APPENDIX – 1

Project Dissertation Semester V and Project Implementation Semester VI

Chapter 1 to 4 should be submitted in Semester V in spiral binding. These chapter have also to be included in Semester VI report. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the dissertation in semester V and dissertation and viva voce in Semester VI.

I. OBJECTIVES

- Describe the Systems Development Life Cycle (SDLC).
- Evaluate systems requirements.
- Complete a problem definition.
- Evaluate a problem definition.
- Determine how to collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries.
- Evaluate methods of process description to include structured English, decision tables and decision trees.
- Evaluate alternative tools for the analysis process.
- Create and evaluate such alternative graphical tools as systems flow charts and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.
- Plan the systems design phase of the SDLC.
- Distinguish between logical and physical design requirements.
- Design and evaluate system outputs.
- Design and evaluate systems inputs.
- Design and evaluate validity checks for input data.

- Design and evaluate user interfaces for input.
- Design and evaluate file structures to include the use of indexes.
- Estimate storage requirements.
- Explain the various file update processes based on the standard file organizations.
- Decide various data structures.
- Construct and evaluate entity-relationship (ER) diagrams for RDBMS related projects.
- Perform normalization for the unnormalized tables for RDBMS related projects
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.

- Work effectively as an individual or as a team member to produce correct, efficient, well-organized and documented programs in a reasonable time.
- Recognize problems that are amenable to computer solutions, and knowledge of the tool necessary for solving such problems.
- Develop of the ability to assess the implications of work performed.
- Get good exposure and command in one or more application areas and on the software
- Develop quality software using the software engineering principles
- Develop of the ability to communicate effectively.

II. Type of the Project

The majority of the students are expected to work on a real-life project preferably in some industry/ Research and Development Laboratories/Educational Institution/Software Company. Students are encouraged to work in the areas listed below. However, it is ***not mandatory*** for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. **Approval of the project proposal is mandatory**. If approved, the student can commence working on it, and complete it. Use the latest versions of the software packages for the development of the project.

III. SOFTWARE AND BROAD AREAS OF APPLICATION

FRONT END / GUI Tools	.Net Technologies,Java
DBMS/BACK END	Oracle, SQL Plus, MY SQL, SQL Server,
LANGUAGES	C, C++, Java, VC++, C#, R,Python
SCRIPTING LANGUAGES	PHP,JSP, SHELL Scripts (Unix), Tcl/TK,
.NET Platform	F#,C#. Net, Visual C#. Net, ASP.Net
MIDDLE WARE (COMPONENT) TECHNOLOGIES	COM/DCOM, Active-X, EJB
UNIX INTERNALS	Device Drivers, RPC, Threads, Socket programming
NETWORK/WIRELESS TECHNOLOGIES	-

REALTIME OPERATING SYSTEM/ EMBEDDED SKILLS	LINUX, Raspberry Pi, Arduino, 8051
APPLICATION AREAS	Financial / Insurance / Manufacturing / Multimedia / Computer Graphics / Instructional Design/ Database Management System/ Internet / Intranet / Computer Networking-Communication Software development/ E-Commerce/ ERP/ MRP/ TCP-IP programming / Routing protocols programming/ Socket programming.

IV. Introduction

The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The student should start the documentation process from the first phase of software development so that one can easily identify the issues to be focused upon in the ultimate project report. The student should also include the details from the project diary, in which they will record the progress of their project throughout the course. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.

1.1 PROJECT REPORT:

Title Page
Original Copy of the Approved Proforma of the Project
Proposal Certificate of Authenticated work
Role and Responsibility Form
Abstract
Acknowledgement
Table of Contents
Table of Figures

CHAPTER 1: INTRODUCTION

1.1 Background

1.2 Objectives

1.3 Purpose, Scope, and Applicability

1.3.1 Purpose

1.3.2 Scope

1.3.3 Applicability

1.4 Achievements

1.5 Organization of Report

CHAPTER 2: SURVEY OF TECHNOLOGIES

2.1 Front – End Features

2.2 Back-End Features

2.3 Justification- Why this technology?

CHAPTER 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition

3.2 Requirements Specification

3.3 Planning and Scheduling

3.4 Software and Hardware Requirements

3.5 Preliminary Product Description

3.6 Conceptual Models

CHAPTER 4: SYSTEM DESIGN

4.1 Basic Modules

4.2 Data Design

4.2.1 Schema Design

4.2.2 Data Integrity and Constraints

4.3 Procedural Design

4.3.1 Logic Diagrams

4.3.2 Data Structures

4.3.3 Algorithms Design

4.4 User interface design

4.5 Security Issues

4.6 Test Cases Design

The documentation should use tools like star UML, Visual for windows, and Rational Rose for design as part of Software Project Management Practical Course. The documentation should be spiral bound for semester V and the entire documentation should be hard bound during semester VI.

CHAPTER 5: IMPLEMENTATION AND TESTING

5.1 Implementation Approaches

5.2 Coding Details and Code Efficiency

5.2.1 Code Efficiency

5.3 Testing Approach

5.3.1 Unit Testing

5.3.2 Integrated Testing

5.3.3 Beta Testing

5.4 Modifications and Improvements

5.5 Test Cases

CHAPTER 6: RESULTS AND DISCUSSION

6.1 Test Reports

6.2 User Documentation

CHAPTER 7: CONCLUSIONS

7.1 Conclusion-Significance of the System

7.2 Limitations of the System

7.3 Future Scope of the Project

7.4 REFERENCES

GLOSSARY

APPENDIX A

APPENDIX B

V. EXPLANATION OF CONTENTS

Title Page

Sample format of Title page is given in Appendix 1 of this block. Students should follow the given format.

Original Copy of the Approved Proforma of the Project Proposal

Sample Proforma of Project Proposal is given in Appendix 2 of this block. Students should follow the given format.

Certificate of Authenticated work

Sample format of Certificate of Authenticated work is given in Appendix 3 of this block. Students should follow the given format.

Role and Responsibility Form

Sample format for Role and Responsibility Form is given in Appendix 4 of this block. Students should follow the given format.

Abstract

This should be one/two short paragraphs (100-150 words total), summarizing the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Acknowledgements

This should express student's gratitude to those who have helped in the preparation of project.

Table of Contents: The table of contents gives the readers a view of the detailed structure of the report. The students would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections are given below.

Table of Figures: List of all Figures, Tables, Graphs, Charts etc. along with their page numbers in a table of figures.

Chapter 1: Introduction

The introduction has several parts as given below:

Background: A description of the background and context of the project and its relation to work already done in the area. Summarize existing work in the area concerned with the project work.

Objectives: Concise statement of the aims and objectives of the project. Define exactly what is going to be done in the project; the objectives should be about 30 /40 words.

Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

- **Purpose:** Description of the topic of the project that answers questions on why this project is being done. How the project could improve the system its significance and theoretical framework.
- **Scope:** A brief overview of the methodology, assumptions and limitations. The students should answer the question: What are the main issues being covered in the project? What are the main functions of the project?
- **Applicability:** The student should explain the direct and indirect applications of their work. Briefly discuss how this project will serve the computer world and people.

Achievements: Explain what knowledge the student achieved after the completion of the work. What contributions has the project made to the chosen area? **Goals achieved** - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organization of Report: Summarizing the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: Survey of Technologies

In this chapter Survey of Technologies should demonstrate the students' awareness and understanding of Available Technologies related to the topic of the project. The student should give the detail of all the related technologies that are necessary to complete the project. The should describe the technologies available in the chosen area and present a comparative study of all those Available Technologies. Explain why the student selected the one technology for the completion of the objectives of the project.

Chapter 3: Requirements and Analysis

Problem Definition: Define the problem on which the students are working in the project.

Provide details of the overall problem and then divide the problem into sub-problems. Define each sub-problem clearly.

Requirements Specification: In this phase the student should define the requirements of the system, independent of how these requirements will be accomplished. The Requirements Specification describes the things in the system and the actions that can be done on these things. Identify the operation and problems of the existing system.

Planning and Scheduling: Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, and known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. The student should show the Gantt chart and Program Evaluation Review Technique (PERT).

Software and Hardware Requirements: Define the details of all the software and hardware needed for the development and implementation of the project.

- **Hardware Requirement:** In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.
 - **Software Requirements:** In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.
- Preliminary Product Description:** Identify the requirements and objectives of the new system. Define the functions and operation of the application/system the students are developing as project.

Conceptual Models: The student should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.

Chapter 4: System Design

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.

Basic Modules: The students should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, the student should integrate all the modules into one system. In this phase, the student should briefly describe all the modules and the functionality of these modules.

Data Design: Data design will consist of how data is organized, managed and manipulated.

- **Schema Design:** Define the structure and explanation of schemas used in the project.
- **Data Integrity and Constraints:** Define and explain all the validity checks and constraints provided to maintain data integrity.

Procedural Design: Procedural design is a systematic way for developing algorithms or procedurals.

- **Logic Diagrams:** Define the systematical flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.
- **Data Structures:** Create and define the data structure used in procedures.
- **Algorithms Design:** With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design: Define user, task, environment analysis and how to map those requirements in order to develop a “User Interface”. Describe the external and internal components and the architecture of user interface. Show some rough pictorial views of the user interface and its components.

Security Issues: Discuss Real-time considerations and Security issues related to the project and explain how the student intends avoiding those security problems. What are the security policy plans and architecture?

Test Cases Design: Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which the students wish to ensure the correct working of the project.

Chapter 5: Implementation and Testing

Implementation Approaches: Define the plan of implementation, and the standards the students have used in the implementation.

Coding Details and Code Efficiency: Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

The student can explain the function of the code with a shot of the output screen of that program code.

- Code Efficiency: The student should explain how the code is efficient and how the students have handled code optimization.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain the approach of testing.

- Unit Testing: Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.
- Integrated Testing: Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements: Once the students finish the testing they are bound to be faced with bugs, errors and they will need to modify your source code to improve the system. Define what modification are implemented in the system and how it improved the system.

Chapter 6: Results and Discussion

Test Reports: Explain the test results and reports based on the test cases, which should show that the project is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation: Define the working of the software; explain its different functions,

components with screen shots. The user document should provide all the details of the product in such a way that any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: Conclusions

Conclusion: The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that would have made in the other chapters.

Limitations of the System: Explain the limitations encountered during the testing of the project that the students were not able to modify. List the criticisms accepted during the demonstrations of the project.

Future Scope of the Project describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that was not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that the students acknowledge the work of others that they have used or adapted in their own work, or that provides the essential background or context to the project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports.

E.g:

Linhares, A., & Brum, P. (2007). Understanding our understanding of strategic scenarios: What role do chunks play? *Cognitive Science*, 31(6), 989-1007.
<https://doi.org/doi:10.1080/03640210701703725>

Lipson, Charles (2011). Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187. ISBN 9780226484648.

Elaine Ritchie, J Knite. (2001). Artificial Intelligence, Chapter 2 , p.p 23 - 44. Tata McGrawHill.

GLOSSARY

If you the students any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If they go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

In particular, if there are technical details of the work done that might be useful to others who wish to build on this work, but that are not sufficiently important to the project as a whole to justify being discussed in the main body of the project, then they should be included as appendices.

VI. SUMMARY

Project development usually involves an engineering approach to the design and development of a software system that fulfils a practical need. Projects also often form an important focus for discussion at interviews with future employers as they provide a detailed example of what the students are capable of achieving. In this course the students can choose your project topic from the lists given in Unit 4: Category-wise Problem Definition.

VII. FURTHER READINGS

1. Modern Systems Analysis and Design; Jeffrey A. Hoffer, Joey F. George, Joseph, S. Valacich; Pearson Education; Third Edition; 2002.
2. ISO/IEC 12207: Software Life Cycle Process (<http://www.software.org/quagmire/descriptions/iso-iec12207.asp>).
3. IEEE 1063: Software User Documentation (<http://ieeexplore.ieee.org>).
4. ISO/IEC: 18019: Guidelines for the Design and Preparation of User Documentation for Application Software.
5. <http://www.sce.carleton.ca/squall>.
6. <http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html>.
7. <http://www.sei.cmu.edu/cmm/>

PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be summarily rejected.)

PNR No.:

Roll no: _____

1. Name of the Student

2. Title of the Project

3. Name of the Guide

4. Teaching experience of the Guide _____

5. Is this your first submission? Yes ☐ No ☐

Signature of the Student

Signature of the Guide

Date:

Date:

Signature of the Coordinator

Date:

(All the text in the report should be in times new roman)

TITLE OF THE PROJECT
(NOT EXCEEDING 2 LINES, 24 BOLD,
ALL CAPS)

A Project Report (12 Bold)
Submitted in partial fulfillment of the
Requirements for the award of the Degree of (size-12)

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)(14 BOLD,
CAPS)

By (12 Bold)

Name of The Student (size-15, title case)
Seat Number (size-15)

Under the esteemed guidance of (13 bold)
Mr. /Mrs. Name of The Guide (15 bold, title case)
Designation (14 Bold, title case)

COLLEGE LOGO

DEPARTMENT OF INFORMATION TECHNOLOGY (12 BOLD, CAPS)
COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University of HSNCU) (12, Title case, bold, italic)
CITY, PIN CODE (12 bold, CAPS)
MAHARASHTRA (12 bold, CAPS)
YEAR (12 bold)

COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University of Mumbai) (13, bold, italic)
CITY-MAHARASHTRA-PINCODE (13 bold, CAPS)

DEPARTMENT OF INFORMATION TECHNOLOGY (14 BOLD, CAPS)

College Logo

CERTIFICATE (14 BOLD, CAPS, underlined, centered)

This is to certify that the project entitled, "**Title of The Project** ", is bonafied work of **NAME OF THE STUDENT** bearing Seat.No: **(NUMBER)** submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION TECHNOLOGY from University of Mumbai. (12, times new roman, justified)

Internal Guide (12 bold)

Coordinator

(Don't write names of lecturers or HOD)

External Examiner

Date:

College Seal

COMPANY CERTIFICATE (if applicable)

(Project Abstract page format)

Abstract (20bold, caps, centered)

Content (12, justified)

**Note: Entire document should be with 1.5
line spacing and all paragraphs should start with 1 tab space.**

ACKNOWLEDGEMENT

(20, BOLD, ALL CAPS, CENTERED)

The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

(Declaration page format)

DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I hereby declare that the project entitled, “**Title of the Project**” done at **place where the project is done**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

NOTE ABOUT PROJECT VIVA VOCE:

Student may be asked to write code for problem during VIVA to demonstrate his coding capabilities and he/she may be asked to write any segment of coding used in the in the project. The project can be done in group of at most four students. However, the length and depth of the project should be justified for the projects done in group. A big project can be modularized and different modules can be assigned as separate project to different students.

Marks Distribution:

Semester V: 50 Marks

Documentation: 50 marks

Semester VI: 150 Marks

Documentation: 50 Marks:

Implementation and Viva Voce: 100 Marks

The plagiarism should be maintained as per the UGC guidelines.