



**HSNC UNIVERSITY, MUMBAI
(2023-2024)**

Ordinances and Regulations

With Respect to

Choice Based Credit System (CBCS)

For the Programme Under

The Faculty of Science & Technology

Curriculum – First Year Information Technology

Undergraduate Programme

2023-2024

Syllabus for F.Y B.Sc. (IT)

(With effect from the academic year 2023-2024)

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 8446677463

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



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 2023-2024 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. **Honours 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	Self-Learning Evaluation – Active participation in routine class instructional deliveries Overall Performance – Attendance Record	15

2. For Courses with Practicals -

Practical Assessment– 25 Marks (50 Marks converted into 25 Marks) Duration – 2 Hours

Sr. No	Evaluation type	Marks
1	Two Best Practical a. Evaluation of One Program	20
	b. Evaluation of Second Program	20
2	Journal	05
3	Viva	05

B) Theory Assessment–60%**60 marks****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: -**

Q-No.	Particulars	Marks
Q-1	All Units	15 Marks
Q-2	Unit-I	15 Marks
Q-3	Unit-II	15 Marks
Q-4	Unit-III	15 Marks

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.

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. The marks of the internal assessment should not be disclosed to the students till the results of the corresponding semester is declared.



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The Faculty of Science and Technology

For the Course

Information Technology

Curriculum – First Year Undergraduate Program

Semester-I and Semester -II

2023-2024

Part 1- Preamble

The revised and restructured curriculum for the B.Sc. (IT) under NEP is integrated course as 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 four 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.

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.

PROGRAMME OUTCOMES (POs)-

Upon the Successful Completion of B.Sc. (IT) Programme:

PO1. Technical Knowledge: Graduates should have a comprehensive understanding of core concepts and principles in information technology, including programming languages, database management, and networking, operating systems, Linux administration, software engineering, web technologies and Cloud Computing.

PO2. Problem Solving Skills: Graduates should be able to identify and analyses IT-related problems and apply appropriate methodologies and tools to devise effective solutions.

PO3. Programming Proficiency: Graduates should be proficient in programming and have the ability to design, implement, and test software applications to meet specific requirements.

PO4. Information Management: Graduates should possess skills in managing and organizing information effectively, including data analysis, storage, retrieval, and security.

PO5. Systems Analysis and Design: Graduates should be able to analyse user requirements, design IT systems, and apply relevant methodologies to develop efficient and user-friendly solutions.

PO6. Networking and Communication: Graduates should have a solid understanding of computer networks, protocols, and communication technologies, enabling them to design, configure, and

troubleshoot network infrastructures.

PO7. Web Development: Graduates should be capable of designing and developing dynamic and interactive web applications using relevant technologies and frameworks.

PO8. Software Testing and Quality Assurance: Graduates should understand software testing techniques and be able to ensure the quality and reliability of software applications.

PO9. Information Security: Graduates should be aware of information security principles and practices and be able to implement security measures to protect data and systems from potential threats.

PO10. Project Management: Graduates should possess basic project management skills, including planning, scheduling, and teamwork, to successfully complete IT projects.

PO11. Professional Ethics: Graduates should demonstrate ethical and professional behavior in their work, considering the societal and legal implications of IT solutions.

PO12. Continuous Learning: Graduates should be equipped with the ability to adapt to emerging technologies and trends in the field through self-learning and professional development.

PO13. Communication Skills: Graduates should be able to communicate effectively, both orally and in writing, to convey technical concepts and collaborate with team members and clients.

PO14. Adaptability and Environmental Sustainability: Recognizing the dynamic nature of technology, graduates will be prepared to adapt to new tools and methodologies throughout their careers through continuous learning.

PO15. Multidisciplinary Approach: Graduates should be able to apply IT principles in various domains, such as business, healthcare, finance, education, and more.

**Part 2- The Scheme of Teaching and Examination is as under NEP:
Summary**

Year	Sem.	Theory / Practical	Paper Code	Course Title	No of Credits	No of Lectures Hours	Total Credits
1	I	M1	US-FIT-101	Object Oriented Programming with C++	4	60	Major = 8 Minor =4
		M2	US-FIT-102	Digital Electronics	4	60	
		Mi3	US-FIT-103	Mathematics I	4	60	
	II	M4	US-FIT- 201	Python Programming	4	60	Major = 8 Minor =4
		M5	US-FIT- 202	Microprocessor Architecture and Interfacing	4	60	
		Mi6	US-FIT- 203	Mathematics II	4	60	
2	III	M7	US-SIT-301	Web Programming	4	60	Major = 8 Minor =4
		M8	US-SIT-302	Database Management System	4	60	
		Mi9	US-SIT-303	Applied Mathematics	4	60	
	IV	M10	US-SIT- 401	Core Java	4	60	Major = 8 Minor =4
		M11	US-SIT- 402	Data Structures and Analysis	4	60	
		Mi12	US-SIT- 403	Software Engineering	4	60	
	V	M13	US-TIT-501	Enterprise Java	4	60	Major = 8 + DSE = 6 Total = 14 Minor =2
		M14	US-TIT-502	Embedded System with IoT	4	60	
		DSE1	US-TIT-503	Introduction to Artificial Intelligence	4	60	
		DSE2	US-TIT-504	Data Communication and Networking	2	30	
		Mi15	US-TIT-505	Software Testing and Quality Assurance	2	30	
	VI	M16	US-TIT-601	DevOps (Development & Operations)	4	60	Major = 8 + DSE = 6 Total = 14
		M17	US-TIT-602	Cryptography & Information Security	4	60	
		DSE3	US-TIT-603	Data Mining & Business Intelligence	4	60	
		DSE4	US-TIT-604	Introduction to Unity and Virtual Reality	2	30	

Honours (H)/ Honours with Research (H+R) Major and Discipline Specific Elective

YEAR		Sem.	Theory / Practical	Paper Code	Course Title	No of Credits	No of Lectures Hours	Total Credits
4 (H)		VII	M18		Introduction to Data Science and Big Data Analysis	8	120	12 + 4 = 16
			M19		Artificial Neural Network	4	60	
			DSE5		Cloud Computing	4	60	
			Mi 20 (RM)					
		VIII	M21		Machine Learning	8	120	12 + 4 = 16
			M22		Statistical Thinking and Data Analysis	4	60	
			DSE6		Digital Forensics and Incident Response	4	60	
4 (H+R)		VII	M18		Robotic Process Automation	8	120	12
			M19		Image Processing and Pattern Recognition	4	60	
			Mi20 (RM)					
		VIII	M21		Project Implementation	8	120	12
			M22		Data Science Implementation	4	60	

Multi-Disciplinary / General Elective

Year	Sem.	Papers	Paper Code	Course Title	No of Credits	No of Lectures Hours	Total Credits
1	I	ME1	US-FIT-104	Green Computing	2	30	2
	II	ME2	US-FIT-204	Digital Marketing	2	30	2
2	III	ME3	US-SIT-304	Data Analytics using R	3	45	3
	IV	ME4	US-SIT-404	Cyber Laws	3	45	3

Vocational Courses Linked to Major/Minor

Year	Sem.	Papers	Paper Code	Course Title	No of Credits	No of Lectures Hours	Total Credits
1	I	V1	US-FIT-105	Operating System	1	15	1
	II	V2	US-FIT-205	Linux System Administration	1	15	1
2	III						
	IV						
3	V	V2	US-TIT-506	Mobile & Cloud Computing	2	30	2
	VI	V3	US-TIT-605	Software Project Management	4	60	4

Skill Enhancement Courses

Year	Sem.	Papers	Paper Code	Course Title	No of Credits	No of Lectures Hours	Total Credits
1	I						
	II						
2	III	S1	US-SIT-305	Andriod Programming	3	45	3
	IV	S2	US-SIT-405	.Net Technologies	3	45	3
3	V						
	VI						

First Year Semester I – Units – Topics- Teaching Hours

S.N	Subject Code & Title	Subject Unit Title		Total Lectures	Credit	Total Marks
1	US-FIT-101 Object Oriented Programming with C++	1	Basic Concepts of OOPS	45 L	3	60
		2	Program Development			
		3	Memory Allocation & Overloading			
2	US-FIT-102 Digital Electronics	1	Introduction and Number System	45 L	3	60
		2	Combinational Logic Circuits and Memory organization			
		3	Multiplexer, De-multiplexer, Encoder and Decoder			
3	US-FIT-103 Mathematics -I	1	Set Theory, Number Theory, Compound Statement	45 L	3	60
		2	Matrices, Functions			
		3	Relations, Counting and Probability			
4	US-FIT-1P1	1	Practicals based on US-FIT-101 Object Oriented Programming with C++	30 L	1	40
5	US-FIT-1P2	2	Practicals based on US-FIT-102 Digital Electronics	30 L	1	40
6	US-FIT-1P3	3	Practicals based on US-FIT-103 Mathematics -I	30 L	1	40

Part 3: Detailed Scheme Theory Semester -I

US-FIT-101 -Object Oriented Programming with C++ Course Objectives

- The basic programming and OOPs concepts
- Creating C++ programs
- Tokens, expressions and control structures in C++
- Arranging same data systematically with arrays
- Classes and objects in C++
- Constructors and destructors in C++
- Files management and templates in C++

Course Outcomes

- Demonstrate an understanding of algorithms in the problem-solving process.
- Identify the necessary properties of good problem-solving techniques.
- Describe OOPs concepts
- Use functions and pointers in program
- Understand tokens, expressions, and control structures
- Explain arrays and strings and create programs using them
- Describe and use constructors and destructors
- Understand and employ file management mechanism.

Course Code: US-FIT-101 Object Oriented Programming with C++

Unit	Content	No. of Lectures
	<p>1.1 Object Oriented Methodology: Introduction, Advantages and Disadvantages of Procedure Oriented Languages, what is Object Oriented? What is Object Oriented Development? Benefits and Application of OOPS.</p> <p>1.2 Basics of C++: Structure of C++ program, tokens, keywords, identifiers, constants, basic datatypes, operators, functions.</p> <p>1.3 Basic Concepts of OOPS: Objects, Classes, Data Abstraction and Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing.</p> <p>1.4 Classes and Objects: Simple classes (Class specification, class members accessing), Defining member functions, passing object as an argument, Returning object from functions, Friend classes, Pointer to object.</p> <p>1.5 Array of pointer to object: Use of arrays to represent textual data. Multidimensional arrays. Design of medium size programs. A miniature program for marks and ranks display. Command line arguments.</p>	15

	1.6 Constructors and Destructors: Introduction, Default Constructor, Parameterized Constructor, Destructors.	
2	2.1 Program development using Inheritance: Introduction understanding inheritance, Advantages provided by inheritance, choosing the access specifier, Derived class declaration, derived class constructors, Class hierarchies, multiple inheritance, multilevel inheritance, containership, hybrid inheritance. 2.2 Polymorphism: Introduction to polymorphism, Need of polymorphism. 2.3 Virtual Functions: Introduction and need, Pure Virtual Functions, Static Functions.	15
3	3.1 Operator Overloading In C++: Concept of function overloading, Overloaded operators, Overloading unary and binary operators, overloading comparison operator, overloading arithmetic assignment operator, data conversion between objects and basic types. 3.2 Working with Files: Introduction, Various File Modes, File Pointer and their Manipulation, File Operations. 3.2 Dynamic memory allocation: Basic mechanisms and pitfalls. Design of a "String" class that has automated memory management. Copy constructors and destructors. Introduction to the standard library. Use of the standard library in designing programs.	15

Self-Learning topics

Topic
<ul style="list-style-type: none"> • Use of arrays to represent textual data. Multidimensional arrays. Design of medium size programs. A miniature program for marks and ranks display. Command line arguments. • Multilevel inheritance, containership, hybrid inheritance. • Overloading comparison operator, overloading arithmetic assignment operator, data conversion between objects and basic types. • Dynamic memory allocation. Basic mechanisms and pitfalls. Design of a "String" class that has automated memory management. Copy constructors and destructors. Introduction to the standard library. Use of the standard library in designing programs.

Online Resources

<https://nptel.ac.in/courses/106/105/106105151/>

Reference Books:

1. Object Oriented Programming with C++ by E. Balagurusamy, Tata McGraw Hill, and 4th Edition.
2. Object Oriented Analysis and Design by Timothy Budd, TMH 3rd Edition.
3. Mastering C++ by K R Venugopal, Rajkumar Buyya, T Ravishankar, Tata McGraw Hill, 2nd Edition
4. C++ for beginners by B. M. Hirwani, SPD, 2013
5. Effective Modern C++ by Scott Meyers, SPD, 2014

US-FIT-102 -Digital Electronics

Course Objectives

- To introduce to the concept of logic in digital electronics.
- To interpret and using number systems and the conversions of number systems
- To analyze and reduction of the Boolean expressions.
- To design logic circuits using tools such as Boolean algebra and Karnaugh Mapping.
- To understand the concept of a memory cell and its types using flip-flops.
- To create simple digital systems using counters, registers etc.

Course Outcomes

- Apply number conversion techniques in real digital systems
- Solve Boolean algebra expressions
- Derive and design logic circuits by applying K Map.
- Design and develop Combinational and Sequential circuits
- Understand and develop digital applications.

Course Code: US-FIT-102 Digital Electronics

Unit	Content	No. of Lectures
1	<p>1.1 Introduction: Relation between switching and logic operation; Use of Diode and Transistor as switch.</p> <p>1.2 Number System: numbering system, binary number system, octal numbersystem, hexadecimal number system, conversion from one number system to another, Gray code, Code conversion. Error detection.</p> <p>1.3 Binary Arithmetic: Binary addition, Binary subtraction, Negative numberrepresentation, Subtraction using 1's complement and 2's complement, Binarymultiplication and division, BCD addition and subtraction.</p> <p>1.4 Boolean Algebra and Logic Gates: Introduction, Logic (AND OR NOT), Boolean theorems, Boolean Laws, De Morgan's Theorem, Perfect Induction, Reduction of Logic expression using Boolean Algebra, Deriving Boolean expression from given circuit, exclusive OR and Exclusive NOR gates, UniversalLogic gates, Implementation of other gates using universal gates.</p>	15

2	<p>2.1 Karnaugh Maps: Introduction, min terms and sum of min term form, maxterm and Product of maxterm form, Reduction technique using Karnaugh maps – 2/3/4 variable K-maps, Grouping of variables in K-maps,</p> <p>2.2 K-maps for product of sum form, minimize Boolean expression using K-map and obtain K-map from Boolean expression.</p> <p>2.3 Combinational Logic Circuits: Introduction, Multi-input, multi-output Combinational circuits, Code converters design and implementations.</p> <p>2.4 Arithmetic Circuits: Introduction, Adder, BCD Adder, Binary Subtractors, BCD Subtractor, Comparator.</p> <p>2.5 Memory organization: Internal organization types of memory, RAM, ROM, EPROM technology used for memory construction. Memory organization and operation: Memory expansion; Memory cell; Different types of memory, ROM, PROM.</p>	15
3	<p>3.1 Multiplexer, De-multiplexer, Encoder and Decoder: Introduction, Multiplexer, De-multiplexer, Decoder, Encoders.</p> <p>3.2 Sequential Circuits, Flip-Flop: Introduction, Terminologies used, S-R flip-flop, D flip-flop, JK flip-flop, Race-around condition, Master – slave JK flip-flop, T flip-flop. Application of flip-flops</p> <p>3.3 Counters: Introduction, Asynchronous counter, Terms related to counters, IC7493 (4-bit binary counter), Synchronous counter,</p> <p>3.4 Shift Register: Introduction, parallel and shift registers, serial shifting, serial-in serial-out, serial-in parallel-out, parallel-in parallel-out, Ring counter, Johnson counter, Applications of shift registers, IC7495, Seven Segment displays.</p> <p>3.5 Signal Converters: Digital to analog converters: weighted resistor/converter, binary ladder, converter, accuracy and resolution; analog to digital converter: quantization and encoding, different types of conversion, accuracy and resolution.</p>	15

Self-Learning topics

Topic
<ul style="list-style-type: none"> • Applications of shift registers, IC7495, Seven Segment displays. • Memory organization: Internal organization types of memory, RAM, ROM, EPROM technology used for memory construction. • Memory organization and operation: Memory expansion; Memory cell; Different types of memory, ROM, PROM. • Signal Converters: Digital to analog converters: weighted resistor/converter, binary ladder, converter, accuracy and resolution; • Analog to digital converter: quantization and encoding, different types of conversion, accuracy and resolution.

Online Resources

<https://nptel.ac.in/course/s/117/106/117106114/>

<https://nptel.ac.in/course/s/117/106/117106114/>

Reference Books

1. Modern Digital Electronics by R. P. Jain, Tata McGraw Hill ,3rd Edition
2. Digital Electronics and Logic Design by N. G. Palan ,Technova, 2nd Edition
3. Make Electronics by Charles Platt, O'Reilly, 1 st Edition, 2010
4. Digital Principles and Applications by Malvino and Leach, Tata McGraw Hill, 2ndEdition.
5. Digital Electronics: Principles, Devices and Application by Anil K. Maini, Wiley, 2007

US-FIT-103 -Mathematics -I

Course Objectives

- Construct mathematical arguments using logical connectives and quantifiers.
- Verify the correctness of an argument using symbolic logic and truth tables.
- Construct proofs using direct proof, proof by contradiction, and proof by cases, or mathematical induction.
- Solve problems using counting techniques and combinatorics.
- Perform operations on discrete structures such as sets, functions, relations or sequences.
- Solve problems involving recurrence relations and generating functions.

Course Outcomes

- **Mathematical Reasoning:** Students will be able to understand mathematical reasoning in order to read, comprehend, and construct mathematical arguments which serves as the foundation for the subsequent discussions of methods of proof.
- **Discrete Structures:** Students can work with discrete structures, which are the abstract mathematical structures used to represent discrete objects and relationships between these objects. These discrete structures include sets, permutations, relations, graphs, trees.
- **Mathematics** has applications to almost every conceivable area of study.

Course Code: US-FIT-103 Mathematics-I

Unit	Content	No. of Lectures
1	1.1 Set Theory: Introduction: Variables, The Language of Sets, The Language of Relations and Function. 1.2 The Logic of Compound Statements: Definitions and the Element Method of Proof, Properties of Sets, Disproofs, Algebraic Proofs, Boolean Algebras. 1.3 Logical Form and Logical Equivalence, Conditional Statements, Valid and Invalid Arguments. 1.4 Elementary Number Theory and Methods of Proof: Rational Numbers, Divisibility, the Quotient- Remainder Theorem.	15
2	2.1 Matrices: Introduction to Matrices, Operation on matrices, Matrix multiplication, Invertibility, Elementary row and column operations, rank of matrix. 2.2 Sequences, Mathematical Induction, and Recursion: Sequences, Mathematical Induction solving recurrence relations by iteration recurrence relations coefficients. 2.3 Functions: Functions Defined on General Sets, One-to-One and Onto, Inverse Functions, Composition of Functions.	15

3	<p>3.1 Relations: Relations on Sets, Reflexivity, Symmetry, and Transitivity, Equivalence Relations.</p> <p>3.2 Graphs and Trees: Definitions and Basic Properties, Trails, Paths, and Circuits, Matrix Representations of Graphs, Trees, Rooted Trees, weighted trees Spanning trees and shortest paths.</p> <p>3.3 Counting and Probability: Introduction, Possibility Trees and the Multiplication Rule, Possibility Trees and the Multiplication Rule, Counting Elements of Disjoint Sets: The Addition Rule, Counting Subsets of a Set: Combinations, r-Combinations with Repetition Allowed, Probability Axioms and Expected Value, Conditional Probability.</p>	15
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Self-Learning topics

Topic
Matrix multiplication, Invertibility, Review of elementary row operations, rank, determinants, Diagonalization, Characteristic polynomials, Adjoins, normal.

Online Resources

1. https://nptel.ac.in/course/110/105/111105111/
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Reference Books

1. Discrete Mathematics with Applications by Sussana S. Epp Cengage Learning 4th Edition.
2. Introductory Methods of Numerical Methods by S. S. Shastri, 3rd Edition
3. Discrete Mathematics, Schaum's Outlines Series Seymour Lipschutz by Marc Lipson Tata McGraw Hill, 2007
4. Discrete Mathematics and its Applications by Kenneth H. Rosen Tata McGraw Hill, 7th Edition.
5. Discrete mathematical structures by B Kolman RC Busby, S Ross PHI, 2nd Edition
6. Discrete structures by Liu, Tata McGraw, 3rd Edition.

**Part - 4 Detailed Scheme Practicals
Semester- I**

Course Code: US-FIT-1P1 Object Oriented Programming with C++ Practical

Practical I	Object Oriented Programming	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures (30)
1	Basic of C++	
2	Practicals will be based on Classes and methods.	
3	Practicals will be based on friend functions	
4	Practicals will be based on Constructors and method overloading	
5	Practicals will be based on Operator Overloading	
6	Practicals will be based on Inheritance	
7	Practicals will be based on Virtual functions and abstract classes	
8	Practicals will be based on File handling	

Course Code: US-FIT-1P2 Digital Electronics Practical

Practical	Digital Electronics	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures (30)
1	Study of Logic gates and their ICs and universal gates (7400, 7402, 7404, 7408).	
2	Implement combinational circuits. (K Map output implementation) 7402 or 7400	
3	Implement code converters Implement combinational circuits. 7486	
4	Implement Adder and Subtractor Arithmetic circuits 7483, 7486, 7404, 7408	
5	Implement Arithmetic circuits multiplier and comparator 7485, 74284 & 285	
6	Implement Encode and Decoder and Multiplexer and De-multiplexers 74138, 74139, 74147, 74154,	
7	Study of flip-flops and counters 7473, 7474, 7476, 7493, 7490, 74190, 74193	
8	Design of shift registers and shift register counters. 74164, 74194	

Course Code: US-FIT-1P3 Mathematic- I

Practical	Mathematics I	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures (30)
1	Practical based on Set Theory	
2	Practical based on Functions and Algorithms	
3	Practical based on Counting	
4	Practical based on Probability Theory	
5	Practical based on Graph Theory	
6	Practical based on Directed Graphs	
7	Practical based on Algebraic Systems	
8	Practical based on Boolean Algebra	

First Year Semester II – Units – Topics- Teaching Hours

S. N	Subject Code & Title	Subject Unit Title		Total Lectures	Credit	Total Marks
1	US-FIT-201 Python Programming	1	Introduction , Variables and Expressions, Functions	45 L	3	60
		2	List, Exception, Variables			
		3	Classes, Objects, Layout Management			
2	US-FIT-202 Microprocessor Architecture and Interfacing	1	Microprocessor Architecture and Micro-computer System	45 L	3	60
		2	Introduction to 8085 Assembly Language Programming			
		3	Stacks and Sub-Routines			
3	US-FIT-203 Mathematics - II	1	Mathematical Modeling and Engineering Problem Solving	45 L	3	60
		2	Differentiation and Integration			
		3	Random variables and Correlation Theory			
4	US-FIT-2P1	1	Practicals based on US-FIT-201 Python Programming	30 L	1	40
5	US-FIT-2P2	1	Practicals based on US-FIT-202 Microprocessor Architecture and Interfacing	30 L	1	40
6	US-FIT-2P3	1	Practicals based on US-FIT-203 Mathematics -II	30 L	1	40

Part 5: Detailed Scheme Theory Semester -II

US-FIT-201 –Python Programming

Course Objectives

- To become familiar with the basics of Python Programming, how to use variables and expressions, conditional statements, loops and control statements.
- To become familiar with the various operators used in Lists, functions of tuples and dictionaries
- To get familiar with the topics of regular expressions, classes and objects.
- To learn how to create a GUI application by adding widgets, applying layout management features and connecting the application to a MySQL database.

Course Outcomes

- Install, debug and run a Python program, differentiate between brackets, braces, and parentheses, define variables, identify keywords, Operators and Operands, Expressions, perform type conversion, use if, if-else, for, while loops.
- Access elements in lists, traverse a list, delete elements from list, perform concatenation, repetition, In operator, built in list, tuple and dictionary functions, methods and operators, basic tuples operations, updating, deleting elements from dictionary, dictionary keys, operations.
- Get familiar types of regular expressions, match functions, classes, objects, built-in class attributes, inheritance, method overriding, data encapsulation, data hiding
- Use controls like Button, Canvas, Checkbutton, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radio button, Scale, Scrollbar, text, Spinbox, LabelFrame,tkMessageBox, proper Layout Management
Features, can store data in MySQL Database via GUI and perform the insert, update, delete command.

Course Code: US-FIT-201 Python Programming

Unit	Content	No. of Lectures
1	<p>1.1 Introduction: The Python Programming Language, History, features, Installing Python, Running Python program, Debugging: Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference between Brackets, Braces, and Parentheses.</p> <p>1.2 Variables and Expressions: Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode.</p> <p>1.3 Conditional Statements: Order of Operations. if, if-else, nested if –else</p> <p>1.4 Looping: for, while, nested loops.</p> <p>1.5 Control statements: Terminating loops, skipping specific conditions.</p> <p>1.6 Functions: Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types</p> <p>1.7 Strings: A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.</p>	15
2	<p>21 Lists: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods</p> <p>22 Tuples and Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions</p> <p>23 Files: Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods, Text Files,</p>	15

Self-Learning topics

Topics
<ul style="list-style-type: none"> • Conditional Statements: Order of Operations. if, if-else, nested if –else • Looping: for, while, nested loops • Pandas dataframe and dataframe related operations on dataset: Reading files Exploratory data analysis, Data preparation and preprocessing

	<p>The File Object Attributes, Directories.</p> <p>2.4 Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions.</p> <p>2.5 Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.</p>	
3	<p>3.1 Classes and Objects: Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding</p> <p>3.2 Creating the GUI Form and Adding Widgets: Widgets: Button, Canvas, Check button, Entry, Frame, Label, List box, Menu button, Menu, Message, Radio button, Scale, Scrollbar, text, Toplevel, Spinbox, Paned Window, Label Frame, tkMessageBox. Handling Standard attributes and Properties of Widgets.</p> <p>3.3 Layout Management: Designing GUI applications with proper Layout Management features. Look and Feel Customization: Enhancing Look and Feel of GUI using different appearances of widgets.</p> <p>3.4 Storing Data in MySQL: Connecting to a MySQL database from Python, Configuring the MySQL connection, Designing the Python GUI database,</p> <p>3.5 Pandas data frame and data frame related operations on dataset: Reading files, Exploratory data analysis, Data preparation and preprocessing.</p>	15

Online Resources

<https://nptel.ac.in/courses/106/106/106106145/>

Reference Books:

1. Think Python by Allen Downey, Green Tea Press, 1st Edition.
2. An Introduction to Computer Science using Python 3 by Montojo, Jennifer Campbell, Paul Gries, 2nd Edition.
3. Introduction to Problem Solving with Python by E. Balagurusamy, 4th Edition.
4. Python GUI Programming Cookbook by Burkhard A. Meie, 2015
5. Object-oriented Programming in Python by Michael H. Goldwasser, David Letscher Pearson Prentice Hall, 2007

US-FIT-202 - Microprocessor Architecture and Interfacing

Course Objectives

- To understand the basic concept of Micro Computer Systems
- To develop background knowledge in 8085 Microprocessor
- To write Assembly language Programs of 8085

Course Outcomes

- Understand the basic concepts of Micro Computer Systems
- Understand the architecture and hardware aspects of 8085
- Write assembly language programs in 8085

Course Code: US-FIT-202 Microprocessor Architecture and Interfacing

Unit	Content	No. of Lectures
1	<p>1.1 Micro-processor, micro-computers, and Assembly Language: Microprocessor, Microprocessor Instruction Set and Computer Languages, From Large Computers to Single- Chip Microcontrollers, Applications.</p> <p>1.2 Microprocessor Architecture and Micro-computer System: Microprocessor Architecture and its operation's, Memory, I/O Devices, Microcomputer System, Logic Devices and Interfacing, Microprocessor-Based System Application</p> <p>1.3 8085 Micro-processor Architecture, Memory Interface: Introduction, 8085 Microprocessor unit, 8085- Based Microcomputer, Memory Interfacing,</p> <p>1.4 Interfacing of I/O Devices: Basic Interfacing concepts, Interfacing Output Displays, Interfacing Input Devices, Memory Mapped I/O</p>	15
2	<p>2.1 Introduction to 8085 Assembly Language Programming: The 8085 Programming Model, Instruction Classification, Instruction, Data and Storage, Writing assembling and Execution of a simple program, Overview of 8085 Instruction Set, Writing and Assembling Program.</p> <p>2.2 Introduction to 8085 Instructions: Data Transfer Operations, Arithmetic Operations, Logic Operation, Branch Operation, Writing Assembly Languages Programs</p> <p>2.3 Programming Techniques with Additional Instructions: Programming Techniques: Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Instruction Related to Memory, Logic Operations: Rotate, Logics Operations: Compare.</p> <p>2.4 Counters and Time Delays: Counters and Time Delays.</p>	15
3	<p>3.1 Stacks and Sub-Routines: Stack, Subroutine, Restart, Conditional Call, Return Instructions, Advanced Subroutine concepts</p> <p>3.2 Interrupts: The 8085 Interrupt, 8085 Vectored Interrupts, Restart as</p>	15

	<p>S/W, Instructions, Additional I/O Concepts and processes.</p> <p>3.3 Interfacing peripherals: Interfacing peripheral IC 8255 and 8155, interfacing 8255- modes of 8255, control word, i/o mode, hand shaking mode, buffered i/o mode, 8255 Interfacing Examples Interfacing of DC and Stepper Motors, Interfacing of Key board, Display, USART. Interfacing 8155- control word, modes of operation of 8155, timer of 8155.</p> <p>3.4 The Pentium and Pentium Pro micro-processors: Introduction, Special Pentium registers, Pentium instructions, Pentium Pro microprocessor, Special Pentium Pro features. Core 2 and later Microprocessors: Introduction, Pentium II software changes, Pentium IV and Core 2, i3, i5 and i7.</p>	
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Self-Learning topics

Topics
<ul style="list-style-type: none"> • Interfacing peripherals: Interfacing peripheral IC 8255 and 8155, interfacing 8255- modes of 8255, control word, i/o mode, hand shaking mode, buffered i/o mode, 8255 Interfacing Examples Interfacing of DC and Stepper Motors, Interfacing of Key board, Display, USART. Interfacing 8155- control word, modes of operation of 8155, timer of 8155. • The Pentium and Pentium Pro micro-processors: Introduction, Special Pentium registers, Pentium instructions, Pentium Pro microprocessor, Special Pentium Pro features. Core 2 and later Microprocessors: Introduction, Pentium II software changes, Pentium IV and Core 2, i3, i5 and i7.

Online Resources

<https://nptel.ac.in/courses/108/105/108105102>

Reference Books:

1. Microprocessors Architecture, Programming and Applications with the 8085 by Ramesh Gaonkar PENRAM 5th Edition.
2. Computer System Architecture by M. Morris Mano PHI, 3rd Edition.
3. Structured Computer Organization by Andrew C. Tanenbaum PHI, 5th Edition.

US-FIT-203 -Mathematics -II

Course Objectives

- The methods include techniques for simple optimization, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, under random influences.
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

Course Outcomes

- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyze and evaluate the accuracy of common numerical methods.

Course Code: US-FIT-203 Mathematics-II

Unit	Content	No. of Lectures
1	1.1 Mathematical Modeling and Engineering Problem Solving: Simple Mathematical Model, Conservation Laws and Engineering Problems. Different types of data, Tables, charts, histograms, frequency distributions 1.2 Approximations and Round-Off Errors: Significant Accuracy and Precision, Error Definitions, Round-Off Errors 1.3 Solutions of Algebraic and Transcendental Equations: The Bisection Method, The Newton-Raphson Method, The Regula-falsi method, The Secant Method. 1.4 Interpolation: Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation.	15

2	<p>2.1 Solution of simultaneous algebraic equations (linear) using iterative methods: Gauss-Jordan Method, Gauss-Seidel Method.</p> <p>2.2 Differentiation and Integration-I: Numerical Differentiation. Newton-Cotes Quadrature.</p> <p>2.3 Numerical integration: Trapezoidal Rule, Simpson's 1/3rd and 3/8th rules.</p> <p>2.4 Differentiation and Integration-II: Gaussian Quadrature, Monte-Carlo Method and Double Integration.</p> <p>2.5 Ordinary Differential Equations-I: Runge-Kutta Methods. Predictor-Corrector Methods.</p> <p>2.6 Sampling Theory: Mean, median, mode, Normal Distribution, Binomial Distribution, Frequency Distribution in R. Confidence Intervals, Tests of Hypotheses and Significance, Degrees of Freedom.</p> <p>2.7 Least-Squares Regression: Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares, Nonlinear Regression.</p>	15
3	<p>3.1 Random variables: Discrete and Continuous random variables, Probability density function, Probability distribution of random variables, Expected value, Variance.</p> <p>3.2 Moments, Skewness, and Kurtosis : Moments , Moments for Grouped Data ,Relations Between Moments , Computation of Moments for Grouped Data, Charlie's Check and Sheppard's Corrections, Moments in Dimensionless Form, Skewness, Kurtosis, Population Moments, Skewness, and Kurtosis.</p> <p>3.3 Distributions: Discrete distributions: Uniform, Binomial, Poisson, Bernoulli, Continuous distributions: uniform distributions, Exponential, Normal distribution state all the properties and its applications.</p> <p>3.4 Correlation Theory: Correlation and Regression, Linear Correlation, Measures of Correlation, Coefficient of Correlation, Sampling Theory of Correlation, Sampling Theory of Regression.</p>	15

Self-Learning topics

Topics
<ul style="list-style-type: none"> • Different types of data, Tables, charts, histograms, frequency distributions • Differentiation and Integration-I: Numerical Differentiation. Newton-Cotes Quadrature • Differentiation and Integration-II: Gaussian Quadrature, Monte-Carlo Method and Double Integration. • Ordinary Differential Equations-I: Runge-Kutta Methods. Predictor-Corrector Methods.

Online Resources

<https://nptel.ac.in/courses/111/105/111105038/>

Reference Books:

1. Introductory Methods of Numerical Methods by S. S. Shastri, WordPress, 5th Edition
2. Numerical Methods for Engineers by Steven C. Chapra, Raymond P. Canale, 2010
3. Numerical Analysis by Richard L. Burden, J. Douglas Faires, 9th Edition, 2011

Part - 6 Detailed Scheme Practicals
Semester- II

Course Code: US-FIT-2P1 Python Programming

Practical I	Python Programming	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures(30)
1	Basic programs using Python	
2	Based on String related programs	
3	Programs based on lists	
4	Programs based on File operation	
5	Programs on Class operation	
6	Programs on Graphics using python	
7	Programs on Design widget and modifications	
8	Programs on Design database applications	
9	Programs based on Exception handling	

Course Code: US-FIT-2P2 Microprocessor Architecture and Interfacing

Practical II	Microprocessor Architecture and Interfacing	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures (30)
1	Assembly Language programs Perform the given Operations related to memory locations	
2	Simple assembly language programs	
3	Packing and unpacking operations programs	
4	Register Operations programs	
5	Multiple memory locations	
6	Calculations with respect to memory locations	
7	Assembly programs on memory locations	
8	Calculations on memory locations	

Course Code: US-FIT-2P3 Mathematics II

Practical	Mathematics II	Total Credits: 1
Unit (1 to 3)	Content	No. of Lectures(30)
1	Programs on Iterative Calculation	
2	Program on Solution of algebraic and transcendental equations	
3	Program on Interpolation	
4	Program on Solving linear system of equations by iterative methods	
5	Program on Solution of differential equation	
6	Program on Regression	
7	Program on Random variables	
8	Program on Distributions	

SYLLABUS FOR GENERAL ELECTIVE (NEP)

TITLE – Interactive and Sustainable Technology

SEMESTER	UNIT	TOPIC	LECTURES
1	Green Computing		30
	<p><u>Course Objectives</u></p> <ul style="list-style-type: none"> • This course educates and empowers students to reduce wastage, energy usage, carbon footprint and other environmental impacts of IT systems. • They are taught to reduce life cycle costs of processes, improve business efficiency by lowering costs while improving the product design and creating new jobs thereby achieving sustainability. • To learn the fundamentals of Green Computing. • To analyze the Green computing Grid Framework. • To understand the issues related with Green compliance. • To study and develop various case studies. <p><u>Course Outcomes</u></p> <ul style="list-style-type: none"> • To understand what Green Computing is and how it can help improve environmental Sustainability. • To understand the principles and practices of Green Computing. • To understand how Green Computing is adopted or deployed in enterprises. • Apply the Green computing practices to save energy. • Discuss how the choice of hardware and software can facilitate a more sustainable operation. • Use methods and tools to measure energy consumption. 		
	I	<p>1.1 Overview, Issues and Problems: Toxins, Power Consumption, Equipment Disposal, Company’s Carbon Footprint: Measuring, Details, reasons to bother, Plan for the Future, Cost Savings: Hardware, Power.</p> <p>1.2 Initiatives and Standards: Global Initiatives: United Nations, Basel Action Network, Basel Convention, WEEE Directive, RoHS, National Adoption in India</p> <p>1.3 Minimizing Power Usage: Power Problems, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Virtualization, Management, Bigger Drives, Involving the Utility Company, Low-Power Computers, Computer Settings, Storage, Monitors, Power Supplies, Wireless Devices, Software.</p>	15

	II	<p>2.1 Changing the Way of Work: Old Behaviors, starting at the Top, Process Reengineering with Green in Mind, Analyzing the Global Impact of Local Actions, Steps: Water, Recycling, Energy, Pollutants, Tele-workers and Outsourcing, Telecommuting, Outsourcing, how to Outsource.</p> <p>2.2 Going Paperless: Paper Problems, The Environment, Costs: Paper and Office, Practicality, Storage, Destruction, Going Paperless, Organizational Realities, Changing Over, Paperless Billing, Handheld Computers vs. the Clipboard, Electronic Data Interchange (EDI), Value Added Networks, Advantages, Obstacles.</p> <p>2.3 Recycling: Problems, Materials, Means of Disposal, Recycling, Refurbishing, Make the Decision, Life Cycle, from beginning to end, Life, Cost, Green Design, Recycling Companies, Role of quality, minimization of natural resource utilization.</p>	15
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Self-Learning topics Topic

- Minimizing Power Usage: Power Problems, Monitoring Power Usage
- Changing the Way of Work: Old Behaviors, starting at the Top, Process Reengineering with Green in Mind, Analyzing the Global Impact of Local Actions
- Role of quality, minimization of natural resource utilization

Online Resources NPTEL :

<https://nptel.ac.in/courses/112/104/112104225/>

Reference Books – Green Computing

1. Green IT Toby Velte, Anthony Velte, Robert Elsenpeter, McGraw Hill, 1st Edition
2. Green Data Center: Steps for the Journey by Alvin Galea, Michael Schaefer, Mike Ebbers Shroff Publishers and Distributers, 2011
3. Green Computing and Green IT Best Practice by Jason Harris Emereo, 2008
4. Green Computing Tools and Techniques for Saving Energy, Money and Resources by Bud E. Smith, CRC Press, 2014

2	Digital Marketing	30
<p><u>Course Objectives</u></p> <ul style="list-style-type: none"> • This course is an initiative designed to educate students in the area of Digital Marketing. Digital Marketing and Social Media have transformed marketing and business practice across the globe. • This course provides an understanding of the ever evolving digital landscape and examines the strategic role of digital marketing processes and tools in designing the overall Marketing strategy and the Digital Marketing Plan. • It explores the challenges of Interactive media, the online market place, and the creative challenges of communicating and retention strategies of customers through these media, the main search engines and the future trends in digital marketing. <p><u>Course Outcomes</u></p> <ul style="list-style-type: none"> • Translate some of the key marketing and business models that will help to shape digital marketing strategy • Review the history of digital marketing to give some perspective to digital strategic plan • Describe online market presence, segmentation and the 4 Ps of marketing and their implications for digital marketing • Discuss the opportunities and risks of integrated digital marketing • Outline an approach to developing a digital marketing plan. 		
I	<p>1.1 Introduction to Digital Media Marketing: Terms & Terminologies, Display Advertising, Introduction To Digital Selling, Driving Strategy, WordPress Setup, Understanding WordPress, Working with pages, posts, categories, tags, menus Building Website structure.</p> <p>1.2 Web Analytics: Introduction to Google Analytics, why companies use Analytics, How Analytics works, How to set up Analytics & Define Goals, Filters & Segments. Setting up Search Console, Link website to GA & Search Console, Linking Search Console, and Understanding Analytics Reports.</p> <p>1.3 Ecommerce Marketing: Understanding Electronic Commerce & Importance, How to do SEO of E-Commerce Website, Using affiliate Marketing to promote E-Commerce, Technology Infrastructure for ECommerce, E-commerce Security Issues & Controls, Implementing Ecommerce, E-Commerce Marketing, E-Commerce business models and Strategy.</p>	15
II	<p>2.1 Social Media Marketing & Content: Understanding the various Social Media Platforms, Knowing how to market/communicate through Social Media Platforms Choosing a platform to fit the brand objective, Objectives and Metrics, Research and Mapping Tools, tactics, targets and teams, Developing</p>	15

	<p>an effective Social Media Strategy, Content Marketing</p> <p>2.2 Digital Media Planning & Buying: Overview- Role of a media planner, Understanding Client Brief: decoding the expectations of the client, Setting Campaign, Objectives, Audience analysis: User behavior, online opportunities and challenges, Market research, Media formats channels and placement, Media planning tools, software & platform selection, Media research and analysis, Media buying options, art of negotiating rates, Sample media plan, Presentation to the client.</p>	
<p>Self-Learning topics Topic</p> <ul style="list-style-type: none"> • Working with pages, posts, categories, tags, menus Building Website structure. • Understanding the various Social Media Platforms, • What is E-mail? Brand Case Studies & Trends in the Industry. • Video Marketing, Influencer Marketing, Paid/Performance Marketing <p>Online Resources NPTEL : Links: https://neilpatel.com/what-is-digital-marketing/ https://www.hubspot.com/resources</p> <p>NOC:Marketing Management-II (Management) (digimat.in) NPTEL :: Management - NOC:Marketing Management – II</p> <p>Reference Books -Digital Marketing</p> <ul style="list-style-type: none"> • All-in-One for Dummies, Stephanie Diamond, Wiley and Sons, 1st 2019. • Social Media Marketing All-in-one Dummies, Jan Zimmerman, Deborah Ng, 4th Edition; John Wiley & Sons Inc, 2017. • Digital Marketing for Dummies, Ryan Deiss and Russ Henneberry. John Wiley & Sons 1st edition 2017. 		
3	<p>Data Analytics using R</p>	45
<p><u>Course Objectives</u></p> <ul style="list-style-type: none"> • The basics of statistical computing and data analysis • How to use R for analytical programming • How to implement data structure in R • R loop functions and debugging tools • Object-oriented programming concepts in R • Data visualization in R • How to perform error handling • Writing custom R functions <p><u>Course Outcomes</u></p> <ul style="list-style-type: none"> • Explain critical R programming concepts • Demonstrate how to install and configure RStudio 		

	<ul style="list-style-type: none"> • Apply OOP concepts in R programming • Explain the use of data structure and loop functions • Analyze data and generate reports based on the data • Apply various concepts to write programs in R 	
I	<p>1.1 Introduction to R: Overview and History of R, Install R, RStudio, R libraries Basics of R, RStudio.</p> <p>1.2 R Basics: Markdown Data types, operations Vectors, sequences, functions Import/export, summarize data Coding style. Use of R as a calculator, functions and matrix operations, missing data and logical operators.</p> <p>1.3 Data preparation with R Transform data frames with mutate and map values Write user-defined functions Use if/else, for, while, apply, with Learn factors in R, lapply, tapply, split, mapply, apply, Coding Standards</p>	15
II	<p>2.1 Vector: indexing, factors, Data management with strings, display and formatting. Data management with display paste, split, nd and replacement, manipulations with alphabets, evaluation of strings, data frames. Data frames, import of external data in various le formats, statistical functions, compilation of data.</p> <p>2.2 Descriptive statistics & visualization with R: Use plyr, ggplot2 libraries to make summary tables, graphs, and maps, 2/5 Hypothesis testing with R Test group mean differences (t-test, Chi squared test, non-parametric and other tests), Scoping Rules, Debugging Tools</p>	15
III	<p>3.1 ANOVA: linear regression (OLS), binary/categorical independent. Variables Diagnostics, output, and other post-estimation tables, graphs and iteration functions for simulations. Graphics and plots, statistical functions for central tendency, variation, skewness and kurtosis, handling of bivarite data through graphics, correlations, programming and illustration with example.</p> <p>3.2 Linear regression with R: Assess goodness of SIT, consider alternative functional forms, interaction effects, interpret results and evaluate model assumptions with statistic tests, tables and plots, Apply these techniques to a case study</p>	15

Self-Learning topics Topic

- Data management with strings, display and formatting, statistical functions, compilation of data.
- Evaluate model assumptions with statistic tests, tables and plots, Apply these techniques to a case study.
- Install R, RStudio, R libraries Basics of R,

Online Resources NPTEL :

- ugcmoocs.inflibnet.ac.in/ugcmoocs .
- Descriptive Statistics With R Software - Course (nptel.ac.in)

- Introduction To R Software - Course (nptel.ac.in)
- Advanced Engineering Mathematics - Course (nptel.ac.in)

Reference Books –Data Analytics using R

- 1. An Introduction to R by William N. Venables and David M. Smith, Network Theory Limited, 2 nd Edition, 2009
- 2. The Art of R Programming - A Tour of Statistical Software Design by Norman Matloff, No Starch Press.2011
- 3. Getting started with R Studio by John Verzani, O'Reilly Media, 2011

4	Cyber Law	45	
	<p><u>Course Objectives:</u></p> <ul style="list-style-type: none"> • This Course is To Enable Learner to Understand, Explore, and Acquire a Critical Understanding Cyber Law. • Develop Competencies For Dealing With Frauds And Deceptions (Confidence Tricks, Scams) And Other Cyber Crimes For Example, Child Pornography Etc. That Are Taking Place Via The Internet. <p><u>Course Outcomes:</u></p> <ul style="list-style-type: none"> • Make Learner Conversant With The Social And Intellectual Property Issues Emerging From ‘Cyberspace’. • Explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace • Develop The Understanding Of Relationship Between Commerce And Cyberspace. • Give Learners In Depth Knowledge Of Information Technology Act And Legal Frame Work Of Right To Privacy, Data Security And Data Protection. • Make Study On Various Case Studies On Real Time Crimes. 		
	I	<p>1.1Introduction 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>1.2 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>The Security Aspect of Cyber Law -The Intellectual Property Aspect in Cyber Law , The</p>	15

		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.	
	III	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.	15
<p>Self-Learning topics Topic</p> <ul style="list-style-type: none"> • Power of Arrest Without Warrant Under the IT Act, 2000 • Jurisdiction in the Cyber World • E-Commerce Taxation: Real Problems in the Virtual World • Protection of Cyber Consumers in India: <p>Online Resources NPTEL :</p> <ul style="list-style-type: none"> • 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-professionals33538 <p>Reference Books –Data Analytics using R</p> <ul style="list-style-type: none"> • 1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi 2. The Art of R Programming - A Tour of Statistical Software Design by Norman Matloff, No Starch Press.2011, • 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 			

Vocational Courses Linked to Major/Minor

Operating Systems Course Outcome:

- Analyze the structure and functions of operating systems.
- Understand role of operating system as process manager, resource manager, file system manager, memory manager and I/O manager.
- Understand the Mutual exclusion and Deadlock detection.
- Understand benefits of cloud and virtualization.
- Understand differences of three types of computing: multiprocessor, multicomputer and distributed systems

Practical List

Practical	Operating Systems	Total Credits: 1
Sr.No.	Content	No. of Lectures(15)
1	Demo on Installation of virtual machine software. and Installation of Windows operating system on virtual machine	
2	Demo on Installation of Linux operating system (Red Hat) on virtual machine Practical on Installation of Linux operating system (Ubuntu) on virtual machine	
3	Practical based on Linux commands	
4	Linux commands: Working with Directories	
5	Linux commands: Working with files	
6	Windows (DOS) Commands – 1	
7	Windows (DOS) Commands – 2	
8	Exploring Internal utilities of linux	
9	Exploring Internal utilities of windows	
10	Utilize android based system using Windows.	

Linux System Administration: Course Outcomes:

- To familiarize students with Linux Installation.
- Enable Students to Install RPM and use Red hat Package Management.
- To Make Students Install Samba Server and the use of Samba Server.
- To make Students Install Apache, Send Mail. CO5 Write Shell Scripts in Linux.

Practical List

Practical	Linux System Administration	Total Credits: 1
Sr.No.	Content	No. of Lectures(15)
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.	