

AC – 29/06/2021

Item No: 6.38

UNIVERSITY OF MUMBAI



Syllabus

For the

Program: F.Y.B.Sc. Sem -I CBCS

Course: Computer Science

**(Choice Based and Credit System with effect from the
academic year 2021-22)**

Preamble

The rise of Information and Communication Technology (ICT) has profoundly affected modern society. Increasing applications of computers in almost all areas of human endeavor has led to vibrant industries with concurrent rapid change in technology.

As the computing field advances at a rapid pace, the students must possess a solid foundation that allows and encourages them to maintain relevant skills as the field evolves. Specific languages and technology platforms change over time. Thus students must continue to learn and adapt their skills throughout their careers. To develop this ability, students will be exposed to multiple programming languages, tools, paradigms and technologies as well as the fundamental underlying principles throughout this programme.

The programme offers required courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering; as well as specialized courses in artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other current topics in computer science.

The core philosophy of this programme is to –

- Form strong foundations of Computer Science
- Nurture programming, analytical & design skills for the real world problems.
- Introduce emerging trends to the students in gradual way.
- Groom the students for the challenges of ICT industry

The students these days not only aspire for a career in the industry but also look for research opportunities. The main aim of this programme is to deliver a modern curriculum that will equip graduates with strong theoretical and practical backgrounds to enable them to excel in the workplace and to be lifelong learners. Not only does it prepare the students for a career in Software industry, it also motivates them towards further studies and research opportunities. Graduating students, can thus take up postgraduate programmes in CS leading to research as well as R&D, can be employable at IT industries, or can adopt a business management career.

In the first year i.e. for semester I & II, basic foundation of important skills required for software development is laid. The syllabus proposes to have four core subjects of Computer science and two core courses of Mathematics-Statistics. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research-oriented acumen. Ability Enhancement Courses on Soft Skill Development will ensure an overall and holistic development of the students. The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science.

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 hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus.

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. We further thank Chairperson and members of Board of Studies for their confidence in us.

Special thanks to Department of Computer Science and colleagues from various colleges, who volunteered or have indirectly, helped designing certain specialized courses and the syllabus as a whole.

F.Y.B.Sc. Computer Science Syllabus

Choice Based Credit System (CBCS)

with effect from

Academic year 2021-2022

Semester – II				
Course Code	Course Type	Course Title	Credits	Lectures/Week
USCS201	Core Subject	Design & Analysis of Algorithms	2	3
USCSP201	Core Subject Practical	Design & Analysis of Algorithms – Practical	1	3
USCS202	Core Subject	Advanced Python Programming	2	3
USCSP202	Core Subject Practical	Advanced Python Programming – Practical	1	3
USCS203	Core Subject	Introduction to OOPs using C++	2	3
USCSP203	Core Subject Practical	Introduction to OOPs using C++ – Practical	1	3
USCS204	Core Subject	Database Systems	2	3
USCSP204	Core Subject Practical	Database Systems – Practical	1	3
USCS205	Core Subject	Calculus	2	3
USCSP205	Core Subject Practical	Calculus – Practical	1	3
USCS206	Core Subject	Statistical Methods	2	3
USCSP206	Core Subject Practical	Statistical Methods – Practical	1	3
USCS207	Ability Enhancement Course	E-Commerce & Digital Marketing	2	3

Semester II

Course Code	Course Title	Credits	Lectures /Week
USCS205	Calculus	2	3
<p>About the Course: Calculus is a branch of mathematics that involves the study of rates of change. In Computer Science, Calculus is used in Machine Learning, Data Mining, Scientific Computing, Image Processing, and creating the graphics and physics engines for video games, including the 3D visuals for simulations.</p>			
<p>Course Objectives:</p> <ul style="list-style-type: none"> <input type="checkbox"/> The primary objective of this course is to introduce the basic tools of Calculus which are helpful in understanding their applications to the real world problems. <input type="checkbox"/> The course is designed to have a grasp of important concepts of Calculus in a scientific way. <input type="checkbox"/> It covers topics from as basic as definition of functions to partial derivatives of functions in a gradual and logical way. <input type="checkbox"/> The learner is expected to solve as many examples as possible to get complete clarity and understanding of the topics covered. 			
<p>Learning Outcomes: After successful completion of this course, learners would be able to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Develop mathematical skills and enhance thinking power of learners. <input type="checkbox"/> Understand mathematical concepts like limit, continuity, derivative, integration of functions, partial derivatives. <input type="checkbox"/> Appreciate real world applications which use the learned concepts. <input type="checkbox"/> Skill to formulate a problem through Mathematical modelling and simulation. 			
Unit	Topics	No of Lectures	
I	<p>DERIVATIVES AND ITS APPLICATIONS: Review of Basic Concepts: Functions, limit of a function, continuity of a function, derivative function.</p> <p>Derivative In Graphing And Applications: Increase, Decrease, Concavity, Relative Extreme; Graphing Polynomials, Rational Functions, Cusps and Vertical Tangents. Absolute Maxima and Minima, Applied Maximum and Minimum Problems, Newton's Method.</p>	15	
II	<p>INTEGRATION AND ITS APPLICATIONS: Integration: An Overview of the Area Problem, Indefinite Integral, Definition of Area as a Limit; Sigma Notation, Definite Integral, Evaluating Definite Integrals by Substitution, Numerical Integration: Simpson's Rule.</p> <p>Applications of Integration: Area between two curves, Length of a plane curve.</p> <p>Mathematical Modeling with Differential Equations: Modeling with</p>	15	

	Differential Equations, Separation of Variables, Slope Fields, Euler's Method, First-Order Differential Equations and Applications.	
III	<p>PARTIAL DERIVATIVES AND ITS APPLICATIONS:</p> <p>Functions of Several Variables: Functions of two or more variables, Limits and Continuity of functions of two or three variables.</p> <p>Partial Derivatives: Partial Derivatives, Differentiability, Differentials, and Local Linearity, Chain Rule, Implicit Differentiation, Directional Derivatives and Gradients,</p> <p>Applications of Partial Derivatives: Tangent Planes and Normal Vectors, Maxima and Minima of Functions of Two Variables.</p>	15
<p>Textbooks:</p> <p>1. Calculus: Early transcendental (10th Edition): Howard Anton, Irl Bivens, Stephen Davis, John Wiley & sons, 2012.</p> <p>Additional References:</p> <p>1. Calculus and analytic geometry (9th edition): George B Thomas, Ross L Finney, Addison Wesley, 1995</p> <p>2. Calculus: Early Transcendentals (8th Edition): James Stewart, Brooks Cole, 2015.</p> <p>3. Calculus (10th Edition): Ron Larson, Bruce H. Edwards, Cengage Learning, 2013.</p> <p>4. Thomas' Calculus (13th Edition): George B. Thomas, Maurice D. Weir, Joel R. Hass, Pearson, 2014.</p>		

Course Code	Course Title	Credits	Lectures /Week
USCSP205	Calculus – Practical	1	3
1	<p>Review of Basic Concepts –</p> <p>a. Functions of one variable, its domain and range, Operations on functions</p> <p>b. Limits of functions of one variable</p> <p>c. Continuity of functions of one variable</p> <p>d. Derivatives of functions of one variable</p>		
2	<p>Applications of Derivatives I –</p> <p>a. Increasing and Decreasing functions</p> <p>b. Concavity and inflection points</p> <p>c. Relative Extrema</p> <p>d. Absolute Extrema</p>		
3	<p>Applications of Derivatives II –</p> <p>a. Analysis of polynomials</p> <p>b. Graphing rational functions</p> <p>c. Graphs With Vertical Tangents And Cusps</p> <p>d. Newton's method to find approximate solution of an equation</p>		

4	Integration – <ol style="list-style-type: none"> Finding area using rectangle method and antiderivative method Indefinite and definite integrals Properties of integrals Numerical integration using Simpson's rule.
5	Applications of Integration – <ol style="list-style-type: none"> Area between two curves Length of a plane curve
6	Differential Equations – <ol style="list-style-type: none"> Solution of a first order first degree differential equation using variable separable method Solution of a first order linear differential equation using integrating factor Numerical solution of first-order equations using Euler's method Modeling using differential equation
7	Functions of Several Variables – <ol style="list-style-type: none"> Functions of two or more variables, its domain and range, Operations on functions, level curves Limits of functions of two or three variables Continuity of functions of two or three variables
8	Partial Derivatives I – <ol style="list-style-type: none"> Partial derivatives of functions, First and Second order partial derivatives, Mixed derivative theorem, Higher order partial derivatives Differential for functions of two or three variables Local linear approximation for functions of two or three variables
9	Partial Derivatives II – <ol style="list-style-type: none"> Chain rule for functions of two or three variables Implicit differentiation Directional derivatives and gradient
10	Applications of Partial Derivatives– <ol style="list-style-type: none"> Tangent Planes and Normal Vectors for functions of two or three variables Maxima and Minima of Functions of Two Variables
NOTE	Above Practical's can also to be implemented using Sage Math/ Geogebra.

Evaluation Scheme

I. Internal Evaluation for Theory Courses – 25 Marks

(i) Mid-Term Class Test– 15Marks

- It should be conducted using any **learning management system** such as **Moodle** (Modular object-oriented dynamic learning environment)
- The test should have **15 MCQ's** which should be solved in a time duration of **30 minutes**.

(ii) Assignment/ Case study/ Presentations– 10 Marks

- Assignment / Case Study Report / Presentation can be uploaded on any **learning management system**.

II. External Examination for Theory Courses – 75 Marks

- Duration: **2.5 Hours**
- Theory question paper pattern:

All questions are compulsory.			
Question	Based on	Options	Marks
Q.1	Unit I	<i>Any 4 out of 6</i>	20
Q.2	Unit II	<i>Any 4 out of 6</i>	20
Q.3	Unit III	<i>Any 4 out of 6</i>	20
Q.4	Unit I,II and III	<i>Any 5 out of 6</i>	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question maybe sub-divided into subquestions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 50 Marks
40 marks + 05 marks (journal) + 05 marks (viva)
- Duration: **2 Hours** for each practical course.
- Minimum **80% practical** from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam**
- The final submission and evaluation of **journal in electronic form** using a Learning Management System / Platform can be promoted by college.
