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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
USCS206	**Statistical Methods**	**2**	**3**

About the Course:
This course introduces the key concepts in probability, conditional probabilities and distribution theory, including probability laws, random variables, expectation and variance, functions of random variables and its probability distributions. Emphasis is placed on theoretical understanding combined with problem solving using various statistical inferential techniques.

Course Objectives:

- To make learner aware about basic probability axioms and rules and its application.
- To understand the concept of conditional probability and Independence of events.
- To make learner familiar with discrete and continuous random variables as well asstandard discrete and continuous distributions.
- To learn computational skills to implement various statistical inferential approaches.

Learning Outcomes:
After successful completion of this course, learners would be able to

- Calculate probability, conditional probability and independence.
- Apply the given discrete and continuous distributions whenever necessary.
- Define null hypothesis, alternative hypothesis, level of significance, test statistic and pvalue.
- Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.
- Apply non-parametric test whenever necessary.
- Conduct and interpret one-way and two-way ANOVA.

Unit	Topics	No of Lectures
I	**Probability:** Random experiment, sample space, events types and operations of events, Probability definition: classical, axiomatic, Elementary Theorems of probability (without proof). Conditional probability, „Bayes' theorem, independence, Examples on Probability. **Random Variables:** Concept and definition of a discrete random variable and continuous random variable. Probability mass function, Probability density function and cumulative distribution function of discrete and continuous random variable, Properties of cumulative distribution function.	**15**
II	**Mathematical Expectation and Variance:** Expectation of a function, Variance and S.D of a random variable, properties. **Standard Probability distributions:** Introduction, properties, examples and applications of each of the following distributions: Binomial distribution, Normal distribution, Chi-square distribution, t distribution, F distribution	**15**

III	**Hypothesis testing:** One sided, Two sided hypothesis, critical region, p-value, tests based on t, Normal and F, confidence intervals. **Analysis of Variance:** One-way, two-way analysis of variance. **Non-parametric tests:** Need of non-parametric tests, Sign test, Wilicoxon"s signed rank test, run test, Kruskal-Walis tests, Chi square test.	**15**

Textbooks:

1. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi
2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.

Additional References:

1. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
2. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
3. Hogg, R.V. and Craig R.G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
4. Walpole R. E., Myers R. H. and Myers S. L. (1985), Probability and Statistics for Engineers and Scientists
5. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.

Course Code	**Course Title**	**Credits**	**Lectures /Week**
USCSP206	**Statistical Methods – Practical**	**1**	**3**
1	**Probability-** a. Examples based on Probability definition: classical, axiomatic b. Examples based on elementary Theorems of probability		
2	**Conditional probability and independence-** a. Examples based on Conditional probability b. Examples based on „Bayes' theorem c. Examples based on independence		
3	**Discrete random variable-** a. Probability distribution of discrete random variable b. Probability mass function		
4	**Continuous random variable-** a. Probability distribution of continuous random variable b. Probability density function		

5	**Mathematical Expectation and Variance-** a. Mean of discrete and continuous Probability distribution b. S.D. and variance of discrete and continuous Probability distribution
6	**Standard probability distributions-** a. Calculation of probability, mean and variance based on Binomial distribution b. Calculation of probability based on Normal distribution
7	**Large Sample tests based on Normal (Z) -** a. Test of significance for proportion (Single proportion Ho: P = Po) b. Test of significance for difference between two proportions (Double proportion Ho: P1 = P2) c. Test of significance for mean (Single mean Ho: $\mu = \mu 0$) d. Test of significance for difference between two means. (Double mean Ho: $\mu 1 = \mu 2$)
8	**Small sample tests based on t and F-** a. t-test for significance of single mean, population variance being unknown (Single mean Ho : $\mu = \mu 0$) b. t-test for significance of the difference between two sample means (Independent samples) c. t-test for significance of the difference between two sample means (Related samples) d. F-Test to Compare Two Variances
9	**Analysis of variance -** a. Perform One-way ANOVA b. Perform Two-way ANOVA
10	**Non-parametric tests-** a. Sign test and Wilcoxon Sign rank test b. Run test c. Kruskal-Wallis (H) test d. Chi-square test
Note: Practical no. 6, 7, 8, 9 can also to be implemented using R programming.	

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	*Any 4 out of 6*	20
Q.2	Unit II	*Any 4 out of 6*	20
Q.3	Unit III	*Any 4 out of 6*	20
Q.4	Unit I,II and III	*Any 5 out of 6*	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 subjectcarries50 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.
