

# UNIVERSITY OF MUMBAI



**Syllabus for Sem V & VI**  
**Program: Bachelor of Science**  
**Course: Computer Science**

Credit Based Semester and Grading System with  
effect from  
Academic Year 2018-2019

## **Preamble**

This is the third year curriculum in the subject of Computer Science. The revised structure is designed to transform students into technically competent, socially responsible and ethical Computer Science professionals. In these Semesters we have made the advancements in the subject based on the previous Semesters Knowledge.

In the first year basic foundation of important skills required for software development is laid. Second year of this course is about studying core computer science subjects. The third year is the further advancement which covers developing capabilities to design formulations of computing models and its applications in diverse areas.

The proposed curriculum contains two semesters, each Semester contains two Electives: Elective-I and II. Every Elective contains three papers based on specific areas of Computer Science. It also includes one Skill Enhancement paper per semester, helps the student to evaluate his/her computer science domain specific skills and also to meet industry expectations. This revised curriculum has not only taken the specific areas of computer science into consideration but will also give the opportunity to the student to prove his/her ability in the subject practically through the Project Implementation. In Semester V and Semester VI student has to undertake a Project. It can boost his/her confidence and also can encourage the student to perform innovations in the subject as the choice of the Project topic is kept open covering most of the areas of Computer Science subject as per the students interest and the subject they have learned during the Course.

Proposed Curriculum contains challenging and varied subjects aligned with the current trend with the introduction of Machine Intelligence specific subject such as Artificial Intelligence, Information Retrieval. Data Management related subjects such as Cloud Computing and Data Science. Image processing topics such as Game Programming, Digital Image Processing. Introduction of physical world through Architecting of IoT and Wireless Sensor Networks and Mobile Communication. Security domain is also evolved by the introduction of Ethical Hacking, Cyber Forensic and Information and Network Security. To get the hands on experience Linux Server Administration and Web Services topics are included.

In essence, the objective of this syllabus is to create a pool of technologically savvy, theoretically strong, innovatively skilled and ethically responsible generation of computer science professionals. Hope that the teacher and student community of University of Mumbai will accept and appreciate the efforts.

**T.Y.B.Sc. (Semester V and VI)**  
**Computer Science Syllabus**  
**Credit Based Semester and Grading System**  
**To be implemented from the Academic year 2018-2019**

<b>SEMESTER V</b>			
<b>Course</b>	<b>TOPICS</b>	<b>Credits</b>	<b>L / Week</b>
	<b>Elective-I (Select Any Two)</b>		
USCS501	Artificial Intelligence	3	3
USCS502	Linux Server Administration	3	3
USCS503	Software Testing and Quality Assurance	3	3
	<b>Elective-II (Select Any Two)</b>		
USCS504	Information and Network Security	3	3
USCS505	Architecting of IoT	3	3
USCS506	Web Services	3	3
	<b>Skill Enhancement</b>		
USCS507	Game Programming	2	3
	<b>Practical</b>		
USCSP501	Practical of Elective-I	2	6
USCSP502	Practical of Elective-II	2	6
USCSP503	Project Implementation	1	3
USCSP504	Practical of Skill Enhancement : USCS507	1	3

<b>SEMESTER VI</b>			
<b>Course</b>	<b>TOPICS</b>	<b>Credits</b>	<b>L / Week</b>
	<b>Elective-I (Select Any Two)</b>		
USCS601	Wireless Sensor Networks and Mobile Communication	3	3
USCS602	Cloud Computing	3	3
USCS603	Cyber Forensics	3	3
	<b>Elective-II (Select Any Two)</b>		

USCS604	Information Retrieval	3	3
USCS605	Digital Image Processing	3	3
USCS606	Data Science	3	3
	<b>Skill Enhancement</b>		
USCS607	Ethical Hacking	2	3
	<b>Practical</b>		
USCSP601	Practical of Elective-I	2	6
USCSP602	Practical of Elective-II	2	6
USCSP603	Project Implementation	1	3
USCSP604	Practical of Skill Enhancement : USCS607	1	3

## SEMESTER VI

### THEORY

<b>Course:</b> <b>USCS606</b>	<b>TOPICS (Credits : 03 Lectures/Week: 03)</b> <b>Data Science</b>	
<b>Objectives:</b> Understanding basic data science concepts. Learning to detect and diagnose common data issues, such as missing values, special values, outliers, inconsistencies, and localization. Making aware of how to address advanced statistical situations, Modeling and Machine Learning.		
<b>Expected Learning Outcomes:</b> After completion of this course, the students should be able to understand & comprehend the problem; and should be able to define suitable statistical method to be adopted.		
<b>Unit I</b>	<b>Introduction to Data Science:</b> What is Data? Different kinds of data,	<b>15L</b>
	Introduction to high level programming language + Integrated Development Environment (IDE), Exploratory Data Analysis (EDA) + Data Visualization, Different types of data sources, <b>Data Management:</b> Data Collection, Data cleaning/extraction, Data analysis & Modeling	
<b>Unit II</b>	<b>Data Curation:</b> Query languages and Operations to specify and transform data, Structured/schema based systems as users and acquirers of data Semi-structured systems as users and acquirers of data, Unstructured systems in the acquisition and structuring of data, Security and ethical considerations in relation to authenticating and authorizing access to data on remote systems, Software development tools, Large scale data systems, Amazon Web Services (AWS)	<b>15L</b>

<p><b>Unit III</b></p>	<p><b>Statistical Modelling and Machine Learning:</b>  Introduction to model selection: Regularization, bias/variance tradeoff e.g. parsimony, AIC, BIC, Cross validation, Ridge regressions and penalized regression e.g. LASSO</p> <p><b>Data transformations:</b> Dimension reduction, Feature extraction, Smoothing and aggregating</p> <p><b>Supervised Learning:</b> Regression, linear models, Regression trees, Time-series Analysis, Forecasting, Classification: classification trees, Logistic regression, separating hyperplanes, k-NN</p> <p><b>Unsupervised Learning:</b> Principal Components Analysis (PCA), k-means clustering, Hierarchical clustering, Ensemble methods</p>	<p><b>15L</b></p>
<p><b>Textbook(s):</b></p> <ol style="list-style-type: none"> <li>1) Doing Data Science, Rachel Schutt and Cathy O’Neil, O’Reilly,2013</li> <li>2) Mastering Machine Learning with R, Cory Lesmeister, PACKT Publication,2015</li> </ol> <p><b>Additional Reference(s):</b></p> <ol style="list-style-type: none"> <li>1) Hands-On Programming with R, Garrett Golemund,1<sup>st</sup> Edition, 2014</li> <li>2) An Introduction to Statistical Learning, James, G., Witten, D., Hastie, T., Tibshirani, R.,Springer,2015</li> </ol>		

## Suggested List of Practical – SEMESTER VI

<b>Course:</b> <b>USCSP602</b>	<b>(Credits : 02 Lectures/Week:06)</b> <b>Practical of Elective-II</b>	
<b>USCS606:Data Science</b>		
<i>Practical shall be performed using R</i>		
<ol style="list-style-type: none"><li>1. Practical of Data collection, Data curation and management for Unstructured data (NoSQL)</li><li>2. Practical of Data collection, Data curation and management for Large-scale Data system (such as MongoDB)</li><li>3. Practical of Principal Component Analysis</li><li>4. Practical of Clustering</li><li>5. Practical of Time-series forecasting</li><li>6. Practical of Simple/Multiple Linear Regression</li><li>7. Practical of Logistics Regression</li><li>8. Practical of Hypothesis testing</li><li>9. Practical of Analysis of Variance</li><li>10. Practical of Decision Tree</li></ol>		

## Scheme of Examination

### 1. Theory:

#### I. Internal 25 Marks :

##### a) Test – 20 Marks

20 marks Test – Duration 40 mins

It will be conducted either using any open source learning management system like Moodle (Modular object-oriented dynamic learning environment)

**OR**

A test based on an equivalent online course on the contents of the concerned course (subject) offered by or build using MOOC (Massive Open Online Course) platform.

##### b) 5 Marks – Active participation in routine class instructional deliveries

Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.

#### II. External 75 Marks as per University Guidelines

**11. Practical and Project Examination:**

There will be separate Practical examination for Elective-I, II, Skill enhancement and project of these Elective-I 100, Elective-II: 100 and Skill Enhancement: 50 and Project Implementation: 50.

In the Practical Examination of Elective-I and II, the student has to perform practical on each of the subjects chosen. The Marking Scheme for each of the Elective is given below:

	<b>Subject Code</b>	<b>Experiment-I</b>	<b>Experiment-II</b>	<b>Total Marks</b>
<b>Elective-I</b>	<b>USCSP501/ USCSP601</b>	Experiment-40+Journal-5 +viva-5  Total:50M	Experiment-40+Journal-5+viva-5  Total:50M	100 M
<b>Elective-II</b>	<b>USCSP502/ USCSP602</b>	Experiment-40+Journal-5 +viva-5  Total:50M	Experiment-40+Journal-5+viva-5  Total:50M	100 M
<b>Project Implementation</b>	<b>USCSP503/ USCSP603</b>	<b>**Project Evaluation Scheme</b>		<b>50M</b>
<b>Skill Enhancement</b>	<b>USCSP504/ USCSP604</b>	Experiment-40+Journal:5+viva-5  Total-50M		<b>50M</b>
<b>Total Marks</b>				<b>300M</b>

**(Certified Journal is compulsory for appearing at the time of Practical Examination)**

**\*\*Project Evaluation Scheme:**

<b>Presentation</b>	<b>Working of the Project</b>	<b>Quality of the Project</b>	<b>Viva</b>	<b>Documentation</b>
10Marks	10 Marks	10 Marks	10 Marks	10Marks

**(Certified Project Document is compulsory for appearing at the time of Project Presentation)**

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