

# **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>USCS603</b>	<b>TOPICS (Credits :03 Lectures/Week:03)</b> <b>Cyber Forensics</b>	
<p><b>Objectives:</b> To understand the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered</p> <p><b>Expected Learning Outcomes :</b> The student will be able to plan and prepare for all stages of an investigation - detection, initial response and management interaction, investigate various media to collect evidence, report them in a way that would be acceptable in the court of law.</p>		
<b>Unit I</b>	<p><b>Computer Forensics :</b> Introduction to Computer Forensics and standard procedure, Incident Verification and System Identification ,Recovery of Erased and damaged data, Disk Imaging and Preservation, Data Encryption and Compression, Automated Search Techniques, Forensics Software</p> <p><b>Network Forensic :</b> Introduction to Network Forensics and tracking network traffic, Reviewing Network Logs, Network Forensics Tools, Performing Live Acquisitions, Order of Volatility, Standard Procedure</p> <p><b>Cell Phone and Mobile Device Forensics:</b> Overview, Acquisition Procedures for Cell Phones and Mobile Devices</p>	<b>15L</b>
<b>Unit II</b>	<p><b>Internet Forensic :</b> <b>Introduction</b> to Internet Forensics, World Wide Web Threats, Hacking and Illegal access, Obscene and Incident transmission, Domain Name Ownership Investigation, Reconstructing past internet activities and events</p> <p><b>E-mail Forensics :</b> e-mail analysis, e-mail headers and spoofing, Laws against e-mail Crime, <b>Messenger Forensics:</b> Yahoo Messenger</p> <p><b>Social Media Forensics:</b> Social Media Investigations</p> <p><b>Browser Forensics:</b> Cookie Storage and Analysis, Analyzing Cache and temporary internet files, Web browsing activity reconstruction</p>	<b>15L</b>

<b>Unit III</b>	<p><b>Investigation, Evidence presentation and Legal aspects of Digital Forensics:</b>          Authorization to collect the evidence , Acquisition of Evidence, Authentication of the evidence, Analysis of the evidence, Reporting on the findings, Testimony</p> <p><b>Introduction to Legal aspects of Digital Forensics:</b> Laws &amp; regulations, Information Technology Act, Giving Evidence in court, Case Study – Cyber Crime cases, Case Study – Cyber Crime cases</p>	<b>15L</b>
<p><b>Textbook(s):</b></p> <ol style="list-style-type: none"> <li>1. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology,5th Edition,2015</li> </ol> <p><b>Additional Reference(s):</b></p> <ol style="list-style-type: none"> <li>2. Incident Response and computer forensics, Kevin Mandia, Chris Prosis, Tata McGrawHill,2<sup>nd</sup> Edition,2003</li> </ol>		

## Suggested List of Practical – SEMESTER VI

<b>Course:</b> <b>USCSP601</b>	<b>(Credits : 02 Lectures/Week:06)</b> <b>Practical of Elective-I</b>	
<b>USCS603: Cyber Forensics</b>		
<ul style="list-style-type: none"><li>. Creating a Forensic Image using FTK Imager/Encase Imager :<ul style="list-style-type: none"><li>- Creating Forensic Image</li><li>- Check Integrity of Data</li><li>- Analyze Forensic Image</li></ul></li><li>2. Data Acquisition:<ul style="list-style-type: none"><li>- Perform data acquisition using:<ul style="list-style-type: none"><li>- USB Write Blocker + Encase Imager</li><li>- SATA Write Blocker + Encase Imager</li><li>- Falcon Imaging Device</li></ul></li></ul></li><li>3. Forensics Case Study:<ul style="list-style-type: none"><li>- Solve the Case study (image file) provide in lab using Encase Investigator or Autopsy</li></ul></li><li>4. Capturing and analyzing network packets using Wireshark (Fundamentals) :<ul style="list-style-type: none"><li>- Identification the live network</li><li>- Capture Packets</li><li>- Analyze the captured packets</li></ul></li><li>5. Analyze the packets provided in lab and solve the questions using Wireshark :<ul style="list-style-type: none"><li>- What web server software is used by www.snopes.com?</li><li>- About what cell phone problem is the client concerned?</li><li>- According to Zillow, what instrument will Ryan learn to play?</li><li>- How many web servers are running Apache?</li><li>- What hosts (IP addresses) think that jokes are more entertaining when they are explained?</li></ul></li><li>6. Using Sysinternals tools for Network Tracking and Process Monitoring :<ul style="list-style-type: none"><li>- Check Sysinternals tools</li></ul></li></ul>		

- Monitor Live Processes
- Capture RAM
- Capture TCP/UDP packets
- Monitor Hard Disk
- Monitor Virtual Memory
- Monitor Cache Memory

#### 7. Recovering and Inspecting deleted files

- Check for Deleted Files
- Recover the Deleted Files
- Analyzing and Inspecting the recovered files

Perform this using recovery option in ENCASE and also Perform manually through command line

#### 8. Acquisition of Cell phones and Mobile devices

#### 9. Email Forensics

- Mail Service Providers
- Email protocols
- Recovering emails
- Analyzing email header

#### 10. Web Browser Forensics

- Web Browser working
- Forensics activities on browser
- Cache / Cookies analysis
- Last Internet activity



# 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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