Academic Council _________
Item No: 4.100

University Of Mumbai

Syllabus for M.Sc. I.T. Part II
Semester III and IV
Programme: M.Sc.
Subject: Information Technology
CHOICE BASED(REVISED)
with effect from the academic year
2020 – 2021

Artificial Intelligence Track
Image Processing Track
Cloud Computing Track
Security Track

SEMESTER - III					
	Course Title				
Course Code	Theory	Credits	Course Code	Practical	Credits
PSIT301	Technical Writing and Entrepreneurship Development	4	PSIT3P1	Project Documentation and Viva	2
Elective 1: Select Any one from the courses listed below along with corresponding practical course					
PSIT302a	Applied Artificial Intelligence	4	PSIT3P2a	Applied Artificial Intelligence Practical	2
PSIT302b	Computer Vision		PSIT3P2b	Computer Vision Practical	
PSIT302c	Cloud Application Development		PSIT3P2c	Cloud Application Development Practical	
PSIT302d	Security Breaches and Countermeasures		PSIT3P2d	Security Breaches and Countermeasures Practical	
Elective 2: Select Any one from the courses listed below along with corresponding practical course					
PSIT303a	Machine Learning	4	PSIT3P3a	Machine Learning Practical	2
PSIT303b	Biomedical Image Processing		PSIT3P3b	Biomedical Image Processing Practical	
PSIT303c	Cloud Management		PSIT3P3c	Cloud Management Practical	
PSIT303d	Malware Analysis		PSIT3P3d	Malware Analysis Practical	
Elective 3: Select Any one from the courses listed below along with corresponding practical course					
PSIT304a	Robotic Process Automation	4	PSIT3P4a	Robotic Process Automation Practical	2
PSIT304b	Virtual Reality and Augmented Reality		PSIT3P4b	Virtual Reality and Augmented Reality Practical	
PSIT304c	Data Center Technologies		PSIT3P4c	Data Center Technologies Practical	
PSIT304d	Offensive Security		PSIT3P4d	Offensive Security Practical	
	Total Theory Credits	**16**		Total Practical Credits	**8**
Total Credits for Semester III: 24					

SEMESTER - IV					
	Course Title				
Course Code	Theory	Credits	Course Code	Practical	Credits
PSIT401	Blockchain	4	PSIT4P1		2
Elective 1: Select Any one from the courses listed below along with corresponding practical course					
PSIT402a	Natural Language Processing	4	PSIT4P2a	Natural Language Processing Practical	2
PSIT402b	Digital Image Forensics		PSIT4P2b	Digital Image Forensics Practical	
PSIT402c	Advanced IoT		PSIT4P2c	Advanced IoT Practical	
PSIT402d	Cyber Forensics		PSIT4P2d	Cyber Forensics Practical	
Elective 2: Select Any one from the courses listed below along with corresponding practical course					
PSIT403a	Deep Learning	4	PSIT4P3a	Deep Learning Practical	2
PSIT403b	Remote Sensing		PSIT4P3b	Remote Sensing Practical	
PSIT403c	Server Virtualization on VMWare Platform		PSIT4P3c	Server Virtualization on VMWare Platform Practical	
PSIT403d	Security Operations Center		PSIT4P3d	Security Operations Center Practical	
Elective 3: Select Any one from the courses listed below. Project Implementation and Viva is compulsory					
PSIT404a	Human Computer Interaction	4	PSIT4P4	Project Implementation and Viva	2
PSIT404b	Advanced Applications of Image Processing				
PSIT404c	Storage as a Service				
PSIT404d	Information Security Auditing				
	Total Theory Credits	**16**		Total Practical Credits	**8**
Total Credits for Semester IV: 24					

If a student selects all 6 papers of Artificial Intelligence Track, he should be awarded the degree **M.Sc. (Information Technology), Artificial Intelligence Specialisation.**

If a student selects all 6 papers of Image Processing Track, he should be awarded the degree **M.Sc. (Information Technology), Image Processing Specialisation.**

If a student selects all 6 papers of Cloud Computing Track, he should be awarded the degree **M.Sc. (Information Technology), Cloud Computing Specialisation**

If a student selects all 6 papers of Artificial Security Track, he should be awarded the degree **M.Sc. (Information Technology), Security Specialisation**

All other students will be awarded M.Sc. (Information Technology) degree.

SEMESTER III

M. Sc (Information Technology)		Semester – III	
Course Name: Offensive Security		Course Code: PSIT304d	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Internal	--	40

Course Objectives:

- Understanding of security requirements within an organization
- How to inspect, protect assets from technical and managerial perspectives
- To Learn various offensive strategies to penetrate the organizations security.
- To learn various tools that aid in offensive security testing.

Unit	Details	Lectures	Outcome
I	Fault Tolerance and Resilience in Cloud Computing Environments, Securing Web Applications, Services, and Servers, Wireless Network Security, Wireless Sensor Network Security: The Internet of Things, Security for the Internet of Things, Cellular Network Security	12	CO1
II	Social Engineering Deceptions and Defenses, What Is Vulnerability Assessment, Risk Management, Insider Threat, Disaster Recovery, Security Policies and Plans Development	12	CO2
III	Introduction to Metasploit and Supporting Tools The importance of penetration testing Vulnerability assessment versus penetration testing The need for a penetration testing framework Introduction to Metasploit When to use Metasploit? Making Metasploit effective and powerful using supplementary tools Nessus NMAP w3af Armitage Setting up Your Environment Using the Kali Linux virtual machine - the easiest way Installing Metasploit on Windows Installing Metasploit on Linux Setting up exploitable targets in a virtual environment Metasploit Components and Environment Configuration Anatomy and structure of Metasploit Metasploit components Auxiliaries Exploits Encoders Payloads Post, Playing around with msfconsole Variables in Metasploit Updating the Metasploit Framework 55	12	CO3

IV	Information Gathering with Metasploit Information gathering and enumeration Transmission Control Protocol User Datagram Protocol File Transfer Protocol Server Message Block Hypertext Transfer Protocol Simple Mail Transfer Protocol Secure Shell Domain Name System Remote Desktop Protocol Password sniffing Advanced search with shodan Vulnerability Hunting with Metasploit Managing the database Work spaces Importing scans Backing up the database **NMAP** NMAP scanning approach **Nessus** Scanning using Nessus from msfconsole Vulnerability detection with Metasploit auxiliaries Auto exploitation with db_autopwn **Post exploitation** What is meterpreter? Searching for content Screen capture Keystroke logging Dumping the hashes and cracking with JTR Shell command Privilege escalation Client-side Attacks with Metasploit Need of client-side attacks What are client-side attacks? What is a Shellcode? What is a reverse shell? What is a bind shell? What is an encoder? **The msfvenom utility** Generating a payload with msfvenom Social Engineering with Metasploit Generating malicious PDF Creating infectious media drives	**12**	**CO4**
V	Approaching a Penetration Test Using Metasploit Organizing a penetration test Preinteractions Intelligence gathering/reconnaissance phase Predicting the test grounds Modeling threats Vulnerability analysis Exploitation and post-exploitation Reporting Mounting the environment Setting up Kali Linux in virtual environment The fundamentals of Metasploit Conducting a penetration test with Metasploit Recalling the basics of Metasploit Benefits of penetration testing using Metasploit Open source Support for testing large networks and easy naming conventions Smart payload generation and switching mechanism Cleaner exits The GUI environment	**12**	**CO5**

	Penetration testing an unknown network Assumptions Gathering intelligence Using databases in Metasploit Modeling threats Vulnerability analysis of VSFTPD backdoor The attack procedure The procedure of exploiting the vulnerability Exploitation and post exploitation Vulnerability analysis of PHP-CGI query string parameter vulnerability Exploitation and post exploitation Vulnerability analysis of HFS Exploitation and post exploitation Maintaining access Clearing tracks Revising the approach Reinventing Metasploit Ruby – the heart of Metasploit Creating your first Ruby program Interacting with the Ruby shell Defining methods in the shell Variables and data types in Ruby Working with strings Concatenating strings The substring function The split function Numbers and conversions in Ruby Conversions in Ruby Ranges in Ruby Arrays in Ruby Methods in Ruby Decision-making operators Loops in Ruby Regular expressions Wrapping up with Ruby basics **Developing custom modules** Building a module in a nutshell The architecture of the Metasploit framework Understanding the file structure The libraries layout Understanding the existing modules The format of a Metasploit module Disassembling existing HTTP server scanner module Libraries and the function Writing out a custom FTP scanner module Libraries and the function Using msftidy Writing out a custom SSH authentication brute forcer Rephrasing the equation Writing a drive disabler post exploitation module Writing a credential harvester post exploitation module **Breakthrough meterpreter scripting** Essentials of meterpreter scripting Pivoting the target network Setting up persistent access API calls and mixins Fabricating custom meterpreter scripts Working with RailGun Interactive Ruby shell basics Understanding RailGun and its scripting Manipulating Windows API calls Fabricating sophisticated RailGun scripts		

	The Exploit Formulation Process The absolute basics of exploitation The basics The architecture System organization basics Registers Exploiting stack-based buffer overflows with Metasploit Crashing the vulnerable application Building the exploit base Calculating the offset Using the pattern_create tool Using the pattern_offset tool Finding the JMP ESP address Using Immunity Debugger to find executable modules Using msfbinscan Stuffing the space Relevance of NOPs Determining bad characters Determining space limitations Writing the Metasploit exploit module Exploiting SEH-based buffer overflows with Metasploit Building the exploit base Calculating the offset Using pattern_create tool Using pattern_offset tool *Table of Contents* Finding the POP/POP/RET address The Mona script Using msfbinscan Writing the Metasploit SEH exploit module Using NASM shell for writing assembly instructions **Bypassing DEP in Metasploit modules** Using msfrop to find ROP gadgets Using Mona to create ROP chains Writing the Metasploit exploit module for DEP bypass		

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Computer and Information Security Handbook	John R. Vacca	Morgan Kaufmann Publisher	3rd	2017
2.	Metasploit Revealed: Secrets of the Expert Pentester	Sagar Rahalkar	Packt Publishing		2017

Evaluation Scheme

Internal Evaluation (40 Marks)

The internal assessment marks shall be awarded as follows:

1. **30 marks (Any one of the following):**
   a. **Written Test or**
   b. **SWAYAM (Advanced Course) of minimum 20 hours and certification exam completed or**
   c. **NPTEL (Advanced Course) of minimum 20 hours and certification exam completed or**
   d. **Valid International Certifications (Prometric, Pearson, Certiport, Coursera, Udemy and the like)**
   e. **One certification marks shall be awarded one course only. For four courses, the students will have to complete four certifications.**

2. **10 marks**
   The marks given out of 40 (30 in Semester 4) for publishing the research paper should be divided into four course and should awarded out of 10 in each of the four course.

i. **Suggested format of Question paper of 30 marks for the written test.**

Q1.	**Attempt *__any two__* of the following:**	**16**
a.		
b.		
c.		
d.		
Q2.	**Attempt *__any two__* of the following:**	**14**
a.		
b.		
c.		
d.		

ii. **10 marks from every course coming to a total of 40 marks, shall be awarded on publishing of research paper in UGC approved / Other Journal with plagiarism less than 10%. The marks can be awarded as per the impact factor of the journal, quality of the paper, importance of the contents published, social value.**

External Examination: (60 marks)

	All questions are compulsory	
Q1	**(Based on Unit 1) Attempt *__any two__* of the following:**	**12**
a.		
b.		
c.		
d.		
Q2	(Based on Unit 2) Attempt any two of the following:	12
Q3	(Based on Unit 3) Attempt any two of the following:	12
Q4	(Based on Unit 4) Attempt any two of the following:	12
Q5	(Based on Unit 5) Attempt any two of the following:	12