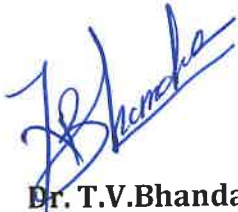# Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Information Technology
S.Y. B. Tech Syllabus 2024-25 (As per NEP 2020)

Syllabus: HONORS Information Technology
w. e. f. AY:2024-2025
SEMESTER-III,IV,V,VI,VII

Honors in Cyber Security

SEM	Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
III	HOIT23281	Cryptography and Network Security	2	2		10	20	50	20	20		120	2	1		3
IV	HOIT23291	Ethical Hacking	2	2		20	20	50	20	20		130	2	1		3
V	HOIT23381	Information Security	3	2		20	20	70	20	20		150	3	1		4
VIII	HOIT23391	Cyber Security	3	2		20	20	70	20	20		150	3	1		4
VII	HOIT23481	Digital Forensics	3	2		20	20	70	20	20		150	3	1		4
Total			13	10	0	90	100	310	100	100	0	700	13	5	0	18

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Engineering & Technology, Baramati
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Honors in Artificial Intelligence

SEM	Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
III	HOIT23282	Artificial Intelligence: Search Methods and Knowledge Representation	2	2		10	20	50	20	20		120	2	1		3
IV	HOIT23292	Deep Learning for Computer Vision	2	2		20	20	50	20	20		130	2	1		3
V	HOIT23382	Reinforcement Learning	3	2		20	20	70	20	20		150	3	1		4
VI	HOIT23392	Generative AI and Large Language Models	3	2		20	20	70	20	20		150	3	1		4
VII	HOIT23482	Applied Accelerated Artificial Intelligence	3	2		20	20	70	20	20		150	3	1		4
	Total		13	10	0	90	100	310	100	100	0	700	13	5	0	18

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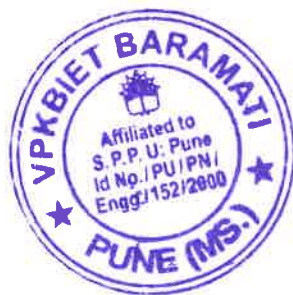
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Bucket of HONORS DEGREE

HONORS DEGREE
(only for students having CGPA >= 7.5)
Honor: Computational Intelligence
Honor: Cloud Computing and Virtualization, Data Science
Honor: Data Science
Honor: Artificial Intelligence
Honor: Cyber security
Honor: VLSI Design Technology
Honor: Advanced Communication Systems
Honor: Advances in Construction Technology
Honor: Advanced Structural Engg.
Honor: Robotics and Automation
Honor: Refrigeration & Air-conditioning
Honor: Renewable Energy and E- mobility

SEMESTER I

B.Tech. Information Technology	Semester: III

HOIT23281: Cryptography and Network Security

Course Code : IT23281	Course Credits: 3	Course Type: HONOR

Teaching Scheme	Evaluation Scheme						

TH	PR	TUT	ACTIVITY	ISE	ESE	TW	PR	OR
2	2		10	20	50	20	20	

Prerequisite Course Mapping:
1.Basics of Computer Networks

Future Course Mapping: Cyber Security

Importance of Course: This Subject will help to get acquainted with skills and knowledge required network administrator.

Course Objectives:
1.To learn network security concepts
2. To differentiate private and public key cryptography.

Course Outcomes:
1.Understand Network security concepts
2.Identify software Vulnerabilities
3.Understand Private Key Cryptography
4.Understand and Analyse Public key cryptography

Syllabus		
UNIT No.	Syllabus	Teaching Hours
I	**Introduction to Security:** Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services. key security properties - Confidentiality, Integrity, Availability. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks.	6

II	**Software vulnerabilities:** Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing	6
III	**Private Key Cryptography:** Mathematical background for cryptography: modulo arithmetic, GCD (Euclid's algorithm), Role of random numbers in security, Importance of prime number, DES, AES. Chinese remainder theorem.	6
IV	**Public key cryptography:** RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Diffie-Hellman key exchange	6

Text Books:
1. "Cryptography and Network Security-Principles and Practices" by William Stallings, Pearson Education, 2006, ISBN 81-7758-774-9, 4th Edition.
2. "Network Security and Cryptography", by Bernard Menezes, Cengage Learning, 2010, ISBN 81
315-1349-1, 1st Edition.

Reference Books:
1. "Computer Security: Art and Science", by Matt Bishop, Pearson Education, 2002, ISBN 0201440997, 1st Edition.
2. "Network security, private communication in a public world", by Charlie Kaufman, Radia Perlman
and Mike Spencer, Prentice Hall, 2002, ISBN 9780130460196, 2nd Edition.

Online Resources: https://archive.nptel.ac.in/courses/106/105/106105162/

Cryptography and Network Security Lab

Guidelines for Instructor's Manual:
The faculty member should prepare the laboratory manual for all the assignments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal:
1.Students should submit term work in the form of a handwritten journal based on a specified list of assignments.
2.Practical Examination will be based on the term work.
3.Students are expected to know the theory involved in the experiment.
   The practical examination should be conducted if and only if the journal of the candidate is   complete in all respects

Guidelines for Lab /TW Assessment:
1.Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2.Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out. Appropriate knowledge of usage of software and hardware related to respective laboratories should be as a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be hand-written write-ups for every assignment in the journal.

3.The HDD/SSD/USB drive containing student programs should be attached to the journal by every student and the same to be maintained by the department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Term work shall consist of 5 assignments and Practical's on each Unit-1 to Unit-4 and is based on performance and continuous internal assessment

Guidelines for Laboratory Conduction:

1.All the assignments should be implemented.

2.All assignments are compulsory.

3.The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.

4.All the assignments should be conducted on latest version of Windows OS and MS office.

5.The following practical should be conducted batch wise using Computer System, with Webcam and headphone facility.

Practical for the subject shall be engaged in minimum four batches (batch size of 20 students

Guidelines for Practical Examination:

1. Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to **the satisfactory** implementation of the problem statement.

2. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation.

The evaluation should be done by both external and internal examiners.

List of Assignments

1.Implement symmetric key algorithm.

2 Implement asymmetric key algorithm and key exchange Algorithm.

3.Demonstrate intrusion detection system using any tool.

4.Explore network monitoring tools as wire shark , snort etc.

5.Study to configure Firewall.

6. Study and analyse the Honey Pots.

7. Configuration of Virtual Private Network .

8. Study and Analyse Digital Signature standards.

HOIT23282: ARTIFICIAL INTELLIGENCE: SEARCH METHODS AND KNOWLEDGE REPRESENTATION

Course Code : IT23282	Course Credits: 03	Course type: HONOR

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	ACTIVITY	ISE	ESE	TW	PR	OR
3			10	20	50	20	20	0

Prerequisite Course Mapping:
1. Discrete Mathematics
2. Machine Learning
3. Data Structures and Algorithms

Future Course Mapping:
1. Deep Learning

Importance of Course: This course forms the basis for all computer learning and is also the future of all complex decision making.

Course Objectives:
1. To understand Fundamental concepts of Artificial Intelligence
2. Application of different search strategies for problem solving.
3. To understand Fundamentals of Game Theory.
4. To explore Various knowledge representations and reasoning schemes.

Course Outcomes:
1. **Identify** and **apply** suitable Intelligent agents for various AI applications
2. **Implement** smart system using different informed search / uninformed search or heuristic approaches
3. **Application** of adversarial search techniques and **designing** of games.
4. **Illustrate** knowledge reasoning and knowledge representation methods.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction** Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents.	6
II	**Problem Solving** Search Strategies: Problem spaces (states, goals and operators), problem solving by search, Uninformed search (breadth-first, depth-first, depth first with iterative deepening) Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction. Local Search algorithms.	6
III	**Adversarial Search and Games** Game Theory, Optimal Decisions in Games, Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction	6

	Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.	
IV	**Reasoning** Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Knowledge Representation, Ontological Engineering, Categories and Objects, Events, Mental Objects and Modal Logic, Reasoning Systems for Categories, Reasoning with Default Information	6

List of Practical Assignments:
1. Implement depth first search algorithm and Breadth First Search algorithm. Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure.
2. Implement n-queens problem using A star (A*) Algorithm for any game search problem.
3. Write a program for the Information Retrieval System using appropriate NLP tools (such as NLTK, Open NLP, ...) a. Text tokenization b. Count word frequency c. Remove stop words d. POS tagging.
4. Develop an elementary chatbot for any suitable customer interaction application.
5. Implement Greedy search algorithm for any of the following application: I. Selection Sort II. Minimum Spanning Tree III. Single-Source Shortest Path Problem IV. Job Scheduling Problem V. Prim's Minimal Spanning Tree Algorithm VI. Kruskal's Minimal Spanning Tree Algorithm VII. Dijkstra's Minimal Spanning Tree Algorithm

Text Books :
1. Stuart Russel, Peter Norvig, "AI – A Modern Approach", Third Edition, Pearson Education, 2009 2.
2. Elaine Rich, Kevin Knight and Shivashankar B Nair", Artificial Intelligence ", Tata McGraw Hill Edition 3rd Edition, 2009

Reference Books:
1. Algorithmic Game theory Edited by N Nishan, T Roughgarden; Cambridge University Press
2. Allen B. Downey, "Think Stats", Second Edition, O'Reilly Media, ISBN: 978-1-491-90733-7
3. Game Theory - D Fudenberg & J Tirole; MIT Press
4. K. Boyer, L. Stark, H. Bunke, "Applications of AI, Machine Vision and Robotics, World Scientific PubCo, 1995

Online Resources:
1. https://nptel.ac.in/courses/106102220
2. http://onlinestatbook.com/Online_Statistics_Education.pdf
3. https://london.ac.uk/sites/default/files/study-guides/introduction-tonatural-language-processing.pdf
4. https://www.deeplearningbook.org/contents/TOC.html
5. https://cvlesalfabegues.com/search/natural-language-understanding-2nd--dition/ww.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epubpdf/

SEMESTER II

HOIT23291: Ethical Hacking

Course Code : IT23291	Course Credits: 03	Course type: HONOR

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	ACTIVITY	ISE	ESE	TW	PR	OR
2	02 hrs./ week	–	20	20	50	20	20	-

Prerequisite Course Mapping:
1.   Computer Network, Cyber security basics, operating system

Future Course Mapping:
1.   Certified Ethical Hacking, Ethical Hacking NPTEL

Importance of Course: Ethical Hacking concepts will be understood and those are important to become cyber security analyst

Course Objectives:
1.   Understand Importance of Ethical Hacking and legalities of penetration Testing
2.   Create awareness about web application security and Hacking
3.   Analyze Meta sploit tool with Kali Linux for penetration testing
4.   Apply WiFi Hacking and security Techniques

Course Outcomes:
1.   Identify Ethical hacking processes and become acquainted with Penetration testing.
2.   Construct Secure Web Applications to understand Hacking Techniques.
3.   Build knowledge about Meta sploit tool with Kali Linux
4.   Recognize Wifi Hacking and Security techniques.

Unit No.	Syllabus	Teaching Hours
1	**Introduction to Basics of Ethical Hacking and Penetration Testing** Introduction to basic Terminologies of Ethical Hacking, CIA(confidentiality, Integrity Availability , Types of Hackers , Ethical Hacking Process, Different tools for Ethical Hacking, Introduction to Kali Linux, What Is a Penetration Test, Vulnerability Assessments versus Penetration Test,Types of Penetration Testing:Network Penetration Test, Web Application Penetration Test,Mobile Application Penetration Test, Social Engineering Penetration Test, Physical Penetration Test	6

2	**Web Application Hacking and Security** Introduction to Hacking Web Applications, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), XML External Entity (XXE), Injections: SQL Injection& Code Injection, Denial of Service (DoS), Exploiting Third-Party Dependencies Web Application Security: Securing Modern Web Applications, Secure Application Architecture, OWASP Top 10 Web Application Security Risks and tools	6
3	**System Security and Hacking** Introduction to Metasploit ,Reconnaissance with Metasploit , Port Scanning with Metasploit , Compromising a Windows Host with Metasploit ,Client Side Exploitation Methods , E– Mails with Malicious Attachments ,Creating a Custom Executable , Creating a Backdoor with SET – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post– Exploitation Introduction :Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Keyloggers and Spyware	6
4	**Wi-Fi Hacking and Security** Wi-Fi Security: Introduction to Wireless Security, Working, Types of Security, Protocols- WEP, WPA, WPA2 cracking, Threats to Wi-Fi Security, Secure Home and Business Wi-Fi Network, Stronger Wi-Fi Security, Updating WiFi Security Settings for Home WiFi Networks. Wi-Fi Hacking: Essential Tools for Hacking Wireless Networks, Evil Twin attack, Network Sniffing and social engineering	6

Practical Assignments	

Assign No	Title
1	Study installation of Kali Linux
2	Learn various tools related to security
3	To perform reconnaissance on a website using google dorking technique on a tryhackme room. Perform Google Dorking: https://tryhackme.com/room/googledorking
4	To perform reconnaissance on a website using web OSINT technique on a tryhackme room. Perform Web OSINT: https://tryhackme.com/room/webosint.
5	Scanning, enumeration, and analysis: To perform scanning using nmap(a powerful network scanning tool) in a tryhackme room. Perform scanning using Nmap tools: https://tryhackme.com/room/furthernmap
6	To perform scanning using nessus

7	Perform vulnerability analysis using Nessus tool: https://tryhackme.com/room/rpnessusredux
8	POST-EXPLOITATION: Perform Windows Privilege Escalation: https://tryhackme.com/room/windowsprivescarena
9	Perform Post-Exploitation: https://tryhackme.com/room/postexploit Perform Linux Privilege Escalation: https://tryhackme.com/room/linuxprivesc
10	Study Web application security tools

Text Books:
1.   Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
2.   Andrew Hoffman, Web Application Security-Exploitation and Countermeasures for Modern Web Applications, O'Reilly publication
3.   Marcus Pinto, DafyddStuttard, The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws, Wiley Publication
4.   Alexis Ahmed, "Privilege Escalation Techniques, O'Reilly Media Company. Packt publishing. 2021

Reference Books:
1.   Hacking: The Art of Exploitation by Jon Erickson
2.   Basics of Hacking and Penetration testing: Made Easy by Patrick Engebreston
3.   Penetration Testing: A Hands-on Introduction to Hacking by Georgia Weidman

Online Resources:
1.   https://resources.infosecinstitute.com/topic/process-scanning-and-enumeration/
2.   https://owasp.org/Top10
3.   https://medium.com/techloop/reconnaissance-the-key-to-ethical-hacking-3b853510d977

HOIT23292: Deep Learning for Computer Vision

Course Code : IT23292	Course Credits: 03	Course type: HONOR

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	ACTIVITY	ISE	ESE	TW	PR	OR
2	02 hrs./ week	–	20	20	50	20	20	-

Prerequisite Course Mapping:
1. Machine Learning 2. Mathematics 1. Image Processing

Future Course Mapping: Computer Vision

Importance of Course: The automatic analysis and understanding of images and videos, a field called Computer Vision, occupies significant importance in applications including security, healthcare, entertainment, mobility, etc. The recent success of deep learning methods has revolutionized the field of computer vision, making new developments increasingly closer to deployment that benefits end users. This course will introduce the students to traditional computer vision topics, before presenting deep learning methods for computer vision. The course will cover basics as well as recent advancements in these areas, which will help the student learn the basics as well as become proficient in applying these methods to real-world applications.

Course Objectives:
1. Students will understand the concept of computer vision, image processing using python programming and as well as students will learn to build the model using neural network and deep learning with its algorithm
2. Students will learn the concept of image analytics, convolutional neural networks

Course Outcomes:
1. Students will understand the basic concepts and methods in the field of computer vision
2. Understand the Concept of Deep Learning and activation functions.
3. Students will be able to understand how CNN is implemented and its usage in different areas.
4. Students will be able to understand recurrent Neural network, Deep generative models and its applications.

Unit No.	Syllabus	Teaching Hours

1	**Introduction and Overview:** Introduction to Image Formation, Capture and Representation. Read, display, Linear Filtering, Correlation, Convolution. Introduction to opencv. **Visual Features and Representations:** Edge, Blobs, Corner Detection, Scale Space and Scale Selection, SIFT, SURF, HoG, LBP. **Visual Matching:** Bag-of-words, VLAD, RANSAC, Hough transform, Pyramid Matching	6
2	**Deep Learning Review:** Review of Deep Learning, Multi-layer Perceptrons, Backpropagation. **Introduction to CNN:** Convolution Operation, Parameter Sharing, Equivariant Representation, Pooling, Variants of the Basic Convolution Function, The basic Architecture of CNN, Popular CNN Architecture – AlexNet. Introduction to tensorflow, pytorch	6
3	**CNNs for Recognition, Verification, Detection, Segmentation:** CNNs for Recognition and Verification, CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, CNNs for Segmentation: FCN, SegNet, U-Net, Mask - R CNN	6
4	**Recurrent Neural Networks (RNNs):** Review of RNNs, CNN + RNN Models for Video Understanding: Spatio-temporal Models, Action/Activity Recognition. **Deep Generative Models:** Review of (Popular) Deep Generative Models: GANs, VAEs, Other Generative Models: PixelRNNs **Applications of Generative Models in Vision:** Applications: Image Editing, Inpainting, Superresolution, 3D Object Generation, Security	6

Practical Assignments		

Assign No	Title
1	Introduction to Tensorflow/pytorch, OpenCV Image Processing Tool
2	Write a program to perform following operations: 1) Read image 2) Display image along with colorbar 3) Thresholding 4) Crop, Resize, Rotation, Translation operation
3	Implement image filtering over image and comment on them
4	Design a system for edge detection

5	Visual Features and Representations: 1) Detect boundaries (edges) of objects, or regions within an image 2) BLOB extraction BLOB representation BLOB classification 3) Feature Extraction using HOG 4) Pattern & Texture extraction using LBP 5) Image Matching using SIFT & SURF
6	Implemented Hough Transform for circles detection
7	Implemented Harris Corner Detection
8	Convolutional Neural Networks (CNNs): 1) Implementation of object detection using CNN 2) Implementation of image classification using CNN 3) Apply Activation functions 4) Apply Optimizations to reduce the loss of build model
9	Perform image segmentation using Unet / Mask-RCNN
10	Image Classification: Extracted features from pretrained network model and perform classification

Text Books:
1. Gonzalez & Woods, "Digital Image Processing", Pearson Education
2. Richard Szeliski, Computer Vision: Algorithms and Applications

Reference Books:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016
2. Michael Nielsen, Neural Networks and Deep Learning, 2016
3. Yoshua Bengio, Learning Deep Architectures for AI, 2009
4. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
5. Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
6. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc21_cs93/preview
2. NPTEL Course on "Deep Learning", by Prof. Prabir Kumar Bhiswas, IIT Kharagpur. Link of the Course: https://nptel.ac.in/courses/106105215
3. NPTEL Course on "Deep Learning - Part I", by Prof. Sudarshan Iyengar, Prof Sanatan Sukhija IIT Ropar Link of the Course: https://nptel.ac.in/courses/106106184

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