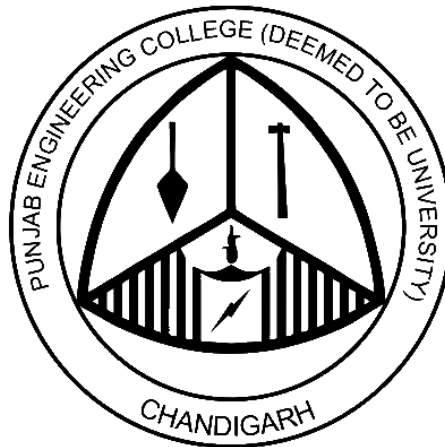# PG-Curriculum
(Structure and Course Contents)
Computer Science &Information Security
With effect from July 2018

Cyber Security Research Centre
Punjab Engineering College
(Deemed to be University)
Chandigarh

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PG Curriculum Structure

Semester-I

Sr. No.	Course Stream	Course Name	Course Code	Credits	Segment {Fractal system(each section of 0.5 Credits and 7 contact hours)}					
					1	2	3	4	5	6
1	Soft Computing	Internet of Things	SCM5011	1.5	█	█	█			
		Machine Learning	SCM5012	1.5				█	█	█
2	Design of Experiments and Research Methodology	Design of Experiments and Research Methodology	DRM5011	3	█	█	█	█	█	█
3	Program Core-I	Applied Cryptography	ISM5011	3	█	█	█	█	█	█
4	Program Core-II	Introduction to Information Security	ISM5021	3	█	█	█	█	█	█
5	Program Elective-I: E1	Cyber Crime and related IT laws	ISM5101	1.5	█	█	█			
		Information Security Audit and Security Management	ISM5102	1.5	█	█	█			
		Smartphone and Next Generation Computing	ISM5103	1.5	█	█	█			
		Database security	ISM5104	1.5	█	█	█			
		Cyber Crimes in Deep Web	ISM5105	1.5	█	█	█			
		Next Generation Digital Technologies – I	ISM5106	1.5	█	█	█			
6	Program Elective-I: E2	Crowd Sensing and Pervasive Computing	ISM5201	1.5				█	█	█
		Advanced Machine Learning	ISM5202	1.5				█	█	█
		Cloud computing and security	ISM5203	1.5				█	█	█
		Next Generation Digital Technologies – II	ISM5204	1.5				█	█	█
		Secure Development and Testing	ISM5205	1.5				█	█	█
		Cryptocurrency and Blockchain Technology	ISM5206	1.5				█	█	█
7	Engineering Mathematics (EM)	*EM1:*Number Theory and Finite Fields	EMM5014	1	█	█				
		*EM2:*Discrete Mathematics	EMM5015	1			█	█		
		*EM3:*Optimization Techniques and Genetic Algorithms	EMM5012	1					█	█

| 8 | Bridge course** | Bridge course on Foundation of Computer Science | ISM5000 | Nil | | | | | | |
| | | **Total** | | **18** | | | | | | |

** Bridge course will be offered in December vacations

Semester-II

Sr. No.	Course Stream	Course Name	Course Code	Credits	Segment {Fractal system (each section of 0.5 Credits and 7 contact hours)}					
					1	2	3	4	5	6
1	Soft Skills and Management	Communication Skills	SSM5021	1.5	▨	▨	▨			
		Management Entrepreneurship and IPR	SSM5022	1				▨	▨	
		Professional Ethics	SSM5023	0.5						▨
2	Program Core III	Digital and Mobile Forensics	ISM5031	3	▨	▨	▨	▨	▨	▨
3	Program Core-IV	Ethical Hacking	ISM5041	3	▨	▨	▨	▨	▨	▨
4	Program Elective-II: E3	Biometrics Security	ISM5301	1.5	▨	▨	▨			
		Image Analysis and Forensics	ISM5302	1.5	▨	▨	▨			
		Privacy and Security in Online Social Media	ISM5303	1.5	▨	▨	▨			
		Network Anonymity and Privacy	ISM5304	1.5	▨	▨	▨			
		Cryptanalysis	ISM5305	1.5	▨	▨	▨			
		Data Mining	ISM5306	1.5	▨	▨	▨			
		Social Network Analysis	ISM5307	1.5	▨	▨	▨			
		Information Retrieval	ISM5308	1.5	▨	▨	▨			
		Big Data Analysis and Data Privacy	ISM5309	1.5	▨	▨	▨			
5	Program Elective-II: E4	Pattern Recognition and Computer Vision	ISM5401	1.5				▨	▨	▨
		Information Warfare	ISM5402	1.5				▨	▨	▨
		Advanced Programming in R, Python and Weka	ISM5403	1.5				▨	▨	▨
		Advanced Biometrics	ISM5404	1.5				▨	▨	▨
		Deep Learning	ISM5405	1.5				▨	▨	▨
		Information Retrieval from Cyber Physical Social Systems	ISM5406	1.5				▨	▨	▨
		Data Protection Laws	ISM5407	1.5				▨	▨	▨
6	Open Electives	1(a) Next Generation Digital Technologies – I	CIO5001	1.5	▨	▨	▨			
		1(b) Next Generation Digital Technologies – II	CIO5002	1.5				▨	▨	▨
		2. Introduction to Information Security	CIO5003	3	▨	▨	▨	▨	▨	▨
		3(a). Cybercrime and related IT laws		1.5	▨	▨	▨			

		3(b)I.Cryptocurrency and blockchain technology *OR* 3(b)II. Advanced Programming in R, Python and Weka	CIO5004	1.5						
7		Mini Project/ Pre-dissertation	ISP5001	3						
		Total		**18**						

Summer Term *

Sr. no.	Course Code	Course Name	Credits
1		Industrial Visit(3 days to 1 week of visit, Submission and presentation of visit report)	Satisfactory/ Non-satisfactory

*After Examination of second semester in the first week of summer vacation industry visit can be undertaken

Course No.	Course Name	Credits	Segment	When it runs in a semester					
				1	2	3	4	5	6
Semester III									
1	Dissertation / Industry Project	14							

Course No.	Course Name	Credits	Segment	When it runs in a semester					
				1	2	3	4	5	6
Semester IV									
2	Dissertation /Industry Project	18							

Total credits – 68

- *20% courses/ semester can be offered in blended mode MOOC's/Industry.*
- *MOOC's/Industry offered course is having fractional credits. Industry offering course content will be designed by industry will be as per expert availability. Industry person will deliver and evaluate this subject. As per the duration of MOOC's/industry offered course, credits of this course can be decided (fractional credits).*

SEMESTER – I

SOFT COMPUTING

Course Name	:	Internet of Things
Course Code	:	SCM5011
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-3

Total no. of lectures: 14
Total no. of Lab hrs : 14

Course Objectives:

The main objectives of this course are:	
1.	Understanding of core technology, applications, sensors used and IOT architecture along with the industry perspective.
2.	Principles and operations of different types of sensors commonly used on mobile platform will be taught in a manner that by the end of the course the students will be able to design and implement real time solutions using IOT.

Course Contents:

Sr.No.	Course Contents	No. of Lectures
1	**Introduction to IoT** What is IoT, how does it work? Difference between Embedded device and IoT device, Properties of IoT device, IoT Ecosystem, IoT Decision Framework, IoT Solution Architecture Models, Major IoT Boards in Market	2
2	**Setting Up Raspberry/Arduino to Create Solutions** Explore Raspberry Pi, Setting up Raspberry Pi, Showing working of Raspberry Pi using SSH Client and Team Viewer, Understand Sensing actions, Understand Actuators and MEMS	3
3	**Communication Protocols used in IoT** Types of wireless communication, Major wireless Short-range communication devices, properties, comparison of these devices (Bluetooth, WIFI, ZigBee, 6LoWPAN), Major wireless Long-range communication devices, properties, comparison of these devices (Cellular IoT, LPWAN)	3
4	**IoT Applications** Industrial Internet 4.0, Applications such as: Smart home, wearables, smart city, smart grid, connected car, connected health(digital health, telehealth, telemedicine), smart retail	3
5	**Sensors:** Applications of various sensors: Google Maps, Waze, WhatsApp, Ola Positioning sensors: encoders and accelerometers, Image sensors: cameras, Global positioning sensors: GPS, GLONASS, IRNSS, Galileo and indoor localization systems, Motion & Orientation Sensors: Accelerometer, Magnetometer, Proximity Sensor, Gyroscope Calibration, noise modeling and characterization and noise filtering and sensor data processing. Privacy &Security	3

Lab Work:

Sr. No.	Lab contents	No. of Hours

1.	Design and build systems that will use sensors, communication protocol and actuators.	14

Course Outcomes:

At the completion of this course, students will be able to:	
1.	Understand concept of IOT and ability to implement in real time scenarios
2.	Design solutions based on IOT architecture and applications in various fields
3.	Critically analyze security and privacy issues in IOT
4.	Apply knowledge to Design and develop variousapplicationsofsensorsinIndustrial,healthcare,commercial,andbuildingautomation

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1	Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT	2014
2	Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1stEdition, Apress Publications	2013
3	CunoPfister, Getting Started with the Internet of Things, O Reilly Media	2011
4	Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing	2015

MOOCs on this course are available at:

1) Introduction to Internet of Things - https://www.edx.org/course/introduction-to-the-internet-of-things-iot
2) IoT Programming and Big Data -https://www.edx.org/course/iot-programming-big-data-curtinx-iot4x

Course Name	:	**Machine Learning**
Course Code	:	**SCM5012**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	To formulate machine learning problems corresponding to different applications.
2.	To understand a range of machine learning algorithms along with their strengths and weaknesses.
3.	To develop reasoning behind Model selection, model complexity, etc.

Course Contents:

Sr.No.	Course Contents	No. of Lectures
1	**BASICS OF MACHINE LEARNING:** Applications of Machine Learning, processes involved in Machine Learning, Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.	3
2	**SUPERVISED LEARNING:** Classification and Regression: K-Nearest Neighbour, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R2,confusionmatrix,precision,recall,F-Score,ROC-Curve.	6
3	**UNSUPERVISED LEARNING:** Introduction to clustering, Types of Clustering: Hierarchical-Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering, Principal Component Analysis, ICA.	5

Lab Work:

Sr.No.	Lab Contents	No. of hours
1	Python Introduction: Loops and Conditions and other preliminary stuff, Functions, Classes and Modules, Exceptions, Database access, Mathematical computing with Python packages like: numpy, Mat- plotLib, pandas Tensor Flow, Keras	8
2	Application Oriented Project Work	6

Course Outcomes:

At the completion of this course, students will be able to:	
1.	Design and implement machine learning solutions to classification, regression and clustering problems
2.	Evaluate and interpret the results of the different ML techniques

| 3. | Design and implement various machine learning algorithms in a range of Real-world applications. |
| 4. | Use Python for various applications. |

Bibliography:

Sr.No.	Book Detail	Year of Publishing
1.	Tom Mitchell, Machine Learning, McGraw Hill,	2017
2.	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer,	2011.
3.	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e,	2008.
4.	Yuxi (Hayden) Liu, "Python Machine Learning By Example", Packet Publishing Limited	2017

MOOCs on this course are available at:

1) Data Science: Machine Learning -https://www.edx.org/course/data-science-machine-learning
2) Machine Learning - https://www.coursera.org/learn/machine-learning

DESIGN OF EXPERIMENTS
&
RESEARCH METHODOLOGY

Course Name	:	**Design of Experiments and Research Methodology**
Course Code	:	**DRM5011**
Credits	:	**3**
L T P	:	**2 0 2**
Segment	:	**1-6**

<div align="right">

Total No. Lectures: 28
Total No. of Lab hrs. 28

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Course Objectives:

The main objectives of this course are:

1.	To develop an understanding of how to identify research topics, formulate research questions / hypotheses, select an appropriate research and, where applicable, experimental design.
2.	Provides a basis so the student can effectively develop a research proposal for either a capstone project, master's thesis, research project, or designed experiment.

Course Contents:

Sr. No.	Course contents	No. of Lectures
1.	**Introduction**: Types of Research and Their Purposes, Locating, Analysing, stating and evaluating research problem, need for literature review, steps in conducting literature review, SWOT analysis, research questions and hypothesis, types of hypothesis, evaluation of hypothesis.	6
2.	**Research Design and Sampling Design**: Concept of research design, features of a good research design, concept of population and sample, characteristics of sample design, types of sampling techniques	4
3.	**Methods of data collection and measurement:** Primary data and Secondary data, data collection techniques: observation, interview, questionnaires, schedules, case-study, levels of measurement, problems in measurement in research – validity, reliability.	6
4.	**Statistical Methods of Analysis:** Descriptive statistics: mean, median, mode, range, mean deviation and standard deviation, regression and correlation analysis, inferential statistics: t-tests, Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way)	8
5.	**Procedure for writing a research report and manuscript**: Types of research reports, steps of writing a report, layout of report, layout of research paper, ethical issues related to publishing, Plagiarism and Self-Plagiarism.	4

Lab Work:

Sr. No.	Lab contents	No. of Hours
2.	Select a problem from your area of interest, identifying the type of research problem it is and perform the SWOT analysis of the existing literature.	4
3.	Generate research questions and hypotheses for a problem from your area of interest.	4
4.	Identify the population and sample for the study (highlighting the technique used for sample selection) for a problem from your area of interest.	4
5.	Design a questionnaire for the problem of interest.	4

6.	Utilizing software such as SPSS, Mini Tab, etc. for the statistical analysis of the results obtained for the desired questionnaire.	6
7.	Preparing a research paper for the problem of interest	6

Course Outcomes:

At the end of the course, students will be able to:	
1.	Identify research topics, formulate research questions and corresponding hypotheses, select an appropriate research and where applicable, experimental design.
2.	Perform required statistical analyses for any univariate application in a business / industrial setting, regardless of data form, and will be familiar with major indices for measuring correlation and association.
3.	Thoroughly review the underlying assumptions related to each statistical test.

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Probability and Statistics for Engineers and scientists by Anthony J. Hayter, Cencage Learning, 4th Edition	2016
2.	Probability and Statistics for Engineers and scientists by Walpole, Myers, Myers and Ye, 8th ed Pearson Education	2007
3.	Research Methodology - Methods and Techniques, C. K. Kothari, New Age International, 2nd Edition	2004
4.	English for writing research papers by Adrian Wallwork, 2nd Edition. Springer	2016
5.	Statistics: Concepts and Controversies by David S. Moore, William I. Notz, W. H. Freeman	2016

PROGRAM CORE

Course Name	:	**Applied Cryptography**
Course Code	:	**ISM5011**
Credits	:	**3**
L T P	:	**2 0 2**
Segment	:	**1-6**

<div align="right">

Total no. of lectures: 28
Total no. of lab hrs: 28

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Course Objectives:

The main objectives of this course are:	
1.	The student should be able to apply basic number theory in cryptography and will be able to understand the design principals of symmetric and asymmetric cryptography, AES, RSA.
2.	The course will be emphasizing on the algorithmic complexity and security vs performance trade off.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Foundations** Substitution Ciphers and Transposition Cipher, Block cipher, Stream cipher, Modes of operation, Symmetric and Asymmetric cryptography.	3
2	**Cryptographic Protocols:** IntroductiontoProtocols,CommunicationsusingSymmetricCryptography, One- Way Functions, Communications using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo Random Sequence Generation, Basic Protocols: Key Exchange, Authentication, Authentication And Key Exchange ,Formal Analysis Of Authentication And Key-Exchange Protocols, Multiple-Key Public-KeyCryptography.	6
3	**Cryptographic Techniques** Key Length & Management: Symmetric Key Length, Public-Key Key Length, Comparing Symmetric And Public-Key Key Length, Generating Keys, Nonlinear Key spaces, Transferring Keys, Verifying Keys, Updating KEYS, Storing Keys, Backup Keys.	6
4	**Cryptographic Algorithms** Mathematical Theory, NUMBER THEORY, FACTORING, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard: Description of DES, Security of DES, Differential And Linear Cryptanalysis, Design Criteria, DES Variants, DES modes of operation, Other Stream Ciphers and One- Way Hash Functions RC4, One-Way Hash Functions, MD5, Secure Hash Algorithm (SHA), Message Authentication Codes	7
5	**Public-Key Algorithms** Background , RSA, Elliptic Curve Cryptosystems, Digital Signature Algorithm, Key-Exchange Algorithms: DIFFIE-HELLMAN	6

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Cryptanalysis of following: • Symmetric KeyAlgorithm. • Asymmetric KeyAlgorithms • HashAlgorithms • DigitalSignatures • Key Generation	16
2	Project work related to implementation of confidentiality, integrity and authenticity of a communication	12

Course Outcomes:

After completion of course, students would be:	
1.	Able to apply the basic rules of public key and symmetric encryption forpractical cryptographic problems.
2.	Able to demonstrate the design and use of hash functions, digital signatures, and key Distribution with a wide range of key types.
3.	Able tomake a choice of applying different cryptographic algorithmsand protocols in different applications.
4.	Given a problem in cryptography, be able to design an algorithm to implement the solutionto that problem.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Applied Cryptography protocols, algorithms, and source code inC, Second Edition, Bruce Schneier, John Wiley & Sons	1996.
2.	Cryptography and Network Security by William Stallings, Prentice Hall	2011
3.	Handbook of Applied Cryptography, by Alfred J. Menezes, PaulC. van Oorschot and Scott A. Vanstone, CRC Press,	1996.

MOOCs on this course are available at:

1) Introduction to Applied Cryptography - https://www.coursera.org/specializations/introduction-applied-cryptography
2) Applied Cryptography - https://www.coursera.org/specializations/applied-crypto

Course Name	:	**Introduction to Information Security**	
Course Code	:	**ISM5021**	
Credits	:	**3**	
L T P	:	**2 0 2**	
Segment	:	**1-6**	

Total no. of lectures: 28
Total no. of labs hrs: 28

Course Objectives:

The main objectives of this course are:	
1.	The course will incorporate the foundational understanding of Information Security.
2.	The course will incorporate the threats and network perimeter security design principles and provide abilitiestoreviewproceduresforinstallation,troubleshootingandmonitoringofnetworkdevices to maintain integrity, confidentiality and availability of data anddevices.

Course Contents:

Sr.No.	Course Contents	No. of Lectures
1	**Introduction:** Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets	2
2	**Cryptographic Protocols -** Introduction to Protocols, Communications using Symmetric Cryptography, Substitution Ciphers and Transposition Cipher, Block cipher, Stream cipher, Modes of operation, Symmetric and Asymmetric cryptography.	2
3	**Information Security Threats:** Virus,Malware,DDoSattack,Trojan,Worm,Spyware,SocialEngineering,Phishing attacks, man-in-middle attack, DNS poisoning **Vulnerabilities:** Port Scanning, Fingerprinting, Packet Sniffing, Services, Code.	4
4	**Proxy & Firewalls** WorkingofStatefulFirewall,TheConceptofState,StatefulFilteringandStateful Inspection, Fundamentals of Proxying, Pros and Cons of Proxy Firewalls, Types of Proxies, Tools forProxying	4
5	**Security Considerations** Firewalls Policy, VPN Basics, IPSec Basics, packet filter, stateful firewalls, application level firewalls.	4
6	**Network Intrusion Detection & Prevention Systems** Network Intrusion Detection Basics, the Roles of Network IDS in a Perimeter Defence,IDSSensorPlacement,IPS,IPSLimitations,NIPS,Host-BasedIntrusion Prevention Systems, TrafficMonitoring.	4
7	**Security Procedures:** Security Policy, Securing the perimeter, physical security, securing the network, securingdevices,securingapplications,OSUpdates **CommonWaysToProtect Data:** File and folder permissions, encryption, group policy. **Protocol Standards:** SSL/TLS/ SSH/ IPSEC, Kerberos, S/Key, PKI: X.509, PGP.	5

8	**Case Studies:** Methods of War gaming, Drone wars, Mitigating attacks for Electric Smart grid, Automating Security incident response.	3

Lab Work:

Sr.No.	Lab Contents	No. of hours
1	Project work related to : • Malware Detection • Packet Sniffing • Proxy Servers • Firewall policies setup • Phishing, Spamming, XSS	14
2	Practical Use of Network Security Tools, Email Header Analysis, configuration of network security equipment such as firewall, routers, IDS, Wireless Access Points	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and design real time scenarios
2.	Implement, monitorandmaintainasecurenetworkconsistingofenterpriselevelroutersandswitches.
3.	Design and implement AAA and IPSec and firewall technologies and design network policies to securing networks
4.	Design/develop/ implement the security solution for a given application.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	W. Stallings, Network Security Essentials (3rd Edition), Prentice Hall,	2007
2.	W. R. Stevens, TCP/IP Illustrated, Vol. 1: TheProtocols,Addison-Wesley	1993
3.	D. E. Comer, Internetworking with TCP/IP, Vol.1 (4th Edition),Prentice Hall,	2000
4.	R. Oppliger, Internet and Intranet Security (2nd edition), ArtechHouse,	2002
5.	W.R.CheswickandS.M.Bellovin,FirewallsandInternetsecurity(2nd edition), Addison-Wesley,	2003

MOOCs on this course are available at:

1) Information Security: Context and Introduction - https://www.coursera.org/learn/information-security-data#syllabus

PROGRAM ELECTIVE

Course Name	:	**Cyber Crime and Related IT Laws**
Course Code	:	ISM5101
Credits	:	1.5
L T P	:	3 0 0
Segment	:	1-3

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:
1.	To examine how the online digital world has been inflicted with new cybercrimes, implications for society and law enforcement response and investigatinghowthecomputerandelectronicdeviceshavebecomebothatargetofattackandato ol for criminalactivity

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to cyber law** Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Cyber Laws of other countries: EU GDPR, PIPEDA (Canada), etc.	5
2	**Information technology Act** Overview of IT Act, 2000, Amendments in 2008/2013 and Limitations of ITAct, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Li- ability,	5
3	**Cyber law and related Legislation** Patent Law, Trademark Law, Copyright, Software Copyright or Patented, Do- main Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant SectionsofIndianEvidenceAct,RelevantSectionsofBankersBookEvidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank ofIndiaAct,LawRelatingToEmployeesAndInternet,AlternativeDisputeRes olution, Online Dispute Resolution (ODR).	6
4	**Electronic Business and legal issues** Legal issues in Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C,E security	3
5	**Application area** Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends	2

Course Outcomes:

After completion of course, students would be able to:	
1.	Analyze various types of cybercrime and formulate procedures for real world cybercrimeInvestigations
2.	Resolve challenges posed to law enforcement agents, policy makers and prosecutors
3.	Find solutions in cybercrime investigations, evidence and applicable law for real world case studies

4.	Use and Analyze the software tools and methods currently available for finding illegal activities on computer disks and in computer networks.	
5.	Analyze the criminal activity on the Internet and propose available tools to prevent suchactivity.	

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Handbook of Cyber Laws, by Vakul Sharma,Macmillan.	2002
2.	Articles in various journals and conference proceedings.	

Course Name	:	**Information Security Audit and Security Management**
Course Code	:	**ISM5102**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**1-3**

Total no. of lectures: 14
Total no. of lab hours: 14

Course Objectives:

The main objectives of this course are:	
1.	To provide students with an understanding of information security management and auditing for any organization especially enterprises.
2.	The course will emphasize ability to criticallyevaluatetechnologiesavailableforimplementingsecurityinsystems.
3.	To provide basic understanding of legal and regulatory requirements and international standards requirement,pertainingtocomputersecurityandauditindifferent nations.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction** Introduction to Information Security Management, Introduction to Management Concepts, The Information Security Life Cycle	2
2	**Security Plan** Security Plan, Business Continuity Planning, Critical Information Infrastructure Protection and BCP By Meity, Govt. of India.	3
3	**Security Analysis** Security Risk Management, Continual Security: Integrated Fault-Event Analysis and Response Framework (IFEAR), Active Security Assessment, System Avail- ability	3
4	**Security Design** Backgroundtothestandards,UseofthestandardsCertificationprocess,Overview ofISO27001,ThePDCAcycle:Scopedefinition,Riskassessment,Risktreatment plan,ThestatementofapplicabilityMonitor&reviewtheISMS	3
5	**Security Controls & Frameworks** NIST, FIPS, ISO 27000, 20 Critical Controls, other sectorial standards (HIPAA, PCI, etc)	2
6	**Security Review** Security Review through Security Audit and Case Studies	1

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	• Conduct Audit for Labs and generate phase wise audit reports • Use of Email Security tools like proofpoint, McAfee epo, QRadar SIEM	14

Course Outcomes:

	After completion of course, students would be able to:
1.	Identify information systems risks and controls
2.	Design and Implement Information Security Policies and define technical control
3.	Audit/test controls on data integrity in end-user applicationse.g. databases/ spreadsheets/ websites

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Information Security Management: Concepts and Practice, Bel G. Raggad, Pace University, Pleasantville, New York, USA, CRC Press Online	2010
2.	Information Security Based on ISO27001/ISO 17799: A Management Guide by A Calder, Van Haren Publishing.	2006

MOOCs on this course are available at:

1) Planning, Auditing and Maintaining Enterprise Systems -
   https://www.coursera.org/learn/planning-auditing-maintaining-enterprise-systems

Course Name	:	**Smartphones and Next Generation Computing**
Course Code	:	ISM5103
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-6

Total no. of lectures: 14
Total no. of Lab hrs: 14

Course Objectives:

	The main objectives of this course are:
1.	To introduce the characteristics, basic concepts and systems issues in mobile and pervasive computing
2.	To give practical experience in the area through the design and execution of a sensing based research projects
3.	To evaluate critical design tradeoffs associated with different mobile technologies, architectures, and interfaces and business models and how they impact the usability, security, privacy and commercial viability of mobile and pervasive computing services and applications

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to Smartphones** SmartPhoneandmobilecomputing,convergenceofsensing,tablet,PDA,orother digital mobile devices, Mobile Apps (Eg: Google Navigation App, Whats App Messenger,Hike,Snapdeal,MegaApps,CUTransit),Introductiontosmartphone systemarchitecture.	2
2	**Programming Platforms** Overviewofdifferentmobileprogrammingenvironments,Differencewiththeclassical programming practices, Introduction to mobile operating systems, OS, Android, Windows, Mobile applicationdevelopment.	3
3	**Data Collection, Localization & Crowd Sensing** Use of Location, User location and tracking system, Cell tower localization, Spot localization,Logicallocation,Indoorlocalization,Crowdsourcingforlocalization	3
4	**Context Aware Sensing** Categorizing uses of contexts, Separations and Generality, Event driven and State Driven Behaviors	2
5	**Human Activity Recognition** Use of Accelerometers, Barometers, Magnetometers, Gyroscopes etc. for Human Activity Recognition	2
6	**Privacy and Security** Location Privacy: Different approaches, K-anonymity, Location Privacy, Applications with location proof. Authentication on Mobile Phones, Activity based Password, Finger Taps usage as Fingerprints, tapping into SS7 signaling system, Privacy Agreements	2

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Project work related to : • Android SDK • Human Activity Recognition using mobile sensors • Analysis of data collected from mobile sensors	14

Course Outcomes:

	By the end of the course, the students will be able to:
1	Design crowd sourced and sensing based systems using smartphones
2	Analyze and compare the performance of different sensory abilities of smartphones, techniques and algorithms for mobile real-time applications
3	A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
4	Develop the ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Sensing and Systems in Pervasive Computing: Engineering Context Aware Systems, By Dan Chalmers (2011), Springer Science & Business Media	2011
2.	PrinciplesOfMobileComputing,Hansmann,LotharMerk,MartinNiclous, Stober	2013
3.	Mobile Computing, Tomasz Imielinski, Springer	2014

Course Name	:	**Database Security**
Course Code	:	**ISM5104**
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-6

Total no. of lectures: 14
Total no. of Lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	Database security has a great impact on the design of today's information systems.
2.	This course will provide an overview of database security concepts and techniques and discuss new directions of database security in the context of Internet information management.
3.	Topics covered include: Access control models for DBMSs, Inference controls, XML database security, Encrypted databases, Data Privacy and Query Authentication.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Course Description and Security Architecture, Database Security Fundamentals, Internet information management	3
2	AdministrationofUsers,AccessControl;Privileges,passwords,roles,Access ControlModels;DiscretionaryAccessControlandRolebasedAccess Control; Mandatory AccessControl	4
3	Database Application Security Models, SQL injection; Database Encryption andMasking; Virtual Private Databases; Database Auditing Models; Application Data Auditing	3
4	Multilevel Secure Relational Model; Watermarking	2
5	XML database security, Encrypted databases, Data Privacy and Query Authentication.	2

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Project work related to : • Database security models • Data Auditing • Data Privacy and anonymity	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Assess the requirement for security in databases
2.	Design and implement integrity auditing techniques for outsourced databases
3.	Compare various database security models and Implement access control policy and mechanism for relational databases
4.	Implement at security techniques of the distributed database systems

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Database security by Alfred Basta, Malissa Zgola	2011

MOOCs on this course are available at:

1) Database Infrastructure Fundamentals - https://www.edx.org/course/database-infrastructure-fundamentals

Course Name	:	**Cyber Crimes in Deep Web**
Course Code	:	ISM5105
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-3

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	Tocriticallyevaluatecuttingedgeresearchintheareaof CyberCrimeandCyberSecurity and to understand how the world of Deep Web is being used for illegal activities and cyber crimes.
2.	To develop an approach to crawl Dark Web and understand the implications of use of anonymization techniques in dark web and increasing its undesirable growth.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Cyber: A History of a Prefix, Technology and Crime: Tracking the Interface,Introduction to Surface Web, Deep Web and Dark Web; Various illegal activities over Dark Web: 1) Procurement of firearms, drones, weapons 2) Fund Raising activities	2
2	Hacking, Spoofing and Cracking, Cyber Crime grows up: Carding, Escrow and theDark Markets, Introduction to Dark Web, Crawling Data, Data Pre-processing, Pattern Mining Hacktivism: Political Protests on the web or Threat to National Security, Future Shock: Web 3.0 and Beyond	4
3	From Cyber Crime to Cyborg: The Bio-Intuitive Web, Policing the Web, Law, Torand the Web, Punishing Cyber Criminals, Bitcoins and the political economy of crime, Surveillance and the Web: Research and Investigation online, Case Studies	8

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Project work related to : • Accessing Deep web using Tor browser • Spoofing into a network • Bitcoin and crytocurrencyon deep web	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Critically evaluate penetration techniques for Dark Webs to aid Law Enforcement Agencies in investigations
2.	Advise and offer Consulting to key stake holders in the business of preventing, controllingand policing Cyber Crime for Dark Web based crimes.
3.	Develop an approach to Cyber Crime and Cyber Security that recognizes the interdisciplinary nature of the area.

Bibliography:

Sr. No.	Book Detail
1.	The Dark Net: Inside the Digital Underworld , Jamie Bartlett, 2015
2	Future Crimes: Inside the Digital Underground and the Battle for Our Connected World by Marc Goodman, 2015

Course Name	:	**Next Generation Digital Technologies - I**
Course Code	:	**ISM5106**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**1-3**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	This course is an innovative training program covering trends in today's rapidly changing industry.
2.	The students will get to learn about several topics including Cryptocurrency, Industry 4.0, Deep web, Grid computing etc will be covered to ensure that they are on the cutting edge of the technology.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Cloud Computing** Types of cloud, applications of cloud, use of some common public cloud services (Microsoft Azure, Amazon AWS, IBM blue mix), concept of virtualization	4
2	**Big Data Analytics** Introduction to Big Data Platform, Traits of Big data, Challenges of Conventional Systems, sources, technologies, applications	4
3	**Cryptocurrency** Bit coins and cryptocurrency technology, use of block chain for cryptocurrency, success of cryptocurrency, cryptocurrency trading and wallets	3
4	**Dark Web** Introduction to dark web, deep web, crawling the data from hidden web, data pre-processing and data analysis, tor network, case studies	4
5	**Wearable Sensors** Implementationofwearablesensors,acquiringdatafromwearablesensors,applications : crowd sourcedapplications	3
6	**Case Studies:** Case studies on existing technologies and their implementation in real time environment.	3

Course Outcomes:

After completion of course, Students will be able to:	
1.	Intelligently use of technology to develop innovative solutions
2.	Resolveopenproblemsinexistingtechnologieslikehighperformancecomputing,bigdataanalytics,wearable sensors, cloud computing organization
3	Pursue research in Next Generation niche areas

Bibliography:

Sr. No.	Book Details	Year of Publication
1.	Cloud Computing: From beginning to end by Ray J Rafaels	2015
2.	Analytics in Practice, by Soumendra Mohanty, Tata Mcgraw hill Education	2011
3.	Blockchain: The Complete Step-by-step Guide to Understanding Blockchain and the Technology Behind It by Jay Isaac	2012
4.	The Dark Net: Inside the Digital Underworld , Jamie Bartlett	2015
5.	Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall/CRC Computational Science - 2010	2010

Course Name	:	Crowdsensing and Pervasive Computing
Course Code	:	ISM5201
Credits	:	1.5
L T P	:	3 0 0
Segment	:	4-6

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:

1.	This course will teach the basics of ubiquitous computing (also known as pervasive computing) as well as the basics of research, including reading research papers, speaking and presentation, formulating research questions, and empiricalinvestigation.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction:** Definitions(Mobile,UbiquitousComputing,IoT,AndroidIntroductionandSetup)	2
2	**Location-Aware computing** (determininglocation,geocoding,Maps&Googleplaces)Databases,Introduction to Context, Context-Aware computing, Introduction to sensors, Android sensor programmingHuman-centricsensing(detectinguserstate,stepcounting,activity recognition, inferring userintent	4
3	**Wearable computing & Social Media** Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper. Mobile social networking & crowd sensing, Event based social network	3
4	**Mobile affective computing** HumanActivityandEmotionSensing,HealthApps,MobileP2Pcomputing,Smart Homes and Intelligent Buildings	3
5	**IoT and data analytics** IOT and Data Management, Data cleaning and processing, Data storage models, Searchtechniques,DeepWeb,Semanticsensorweb,SemanticWebDataManagement, Searching inIOT	3
6	**Crowd Sensing** Real-time and Big Data Analytics for The Internet of Things/Mobile Sensors, HeterogeneousDataProcessing,High-dimensionalDataProcessing,Paralleland Distributed DataProcessing	4
7	**Crowd sensing data using various sensors** Incentivization Models for Crowdsourced data and Privacy Issues	2

Course Outcomes:

After completion of course, students would be able to:	
1.	Analyze the need of technological interventions in design of socio-physical systems
2.	Relate to current trends and human behaviors in pervasive computing to develop practical solutions.

3.	Develop applications for different Mobile devices to collect crowd based data, design frameworks and develop applications based on the architecture	

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Sensing and Systems in Pervasive Computing: Engineering Context Aware Systems, By Dan Chalmers (2011), Springer Science & Business Media	2011
2.	PrinciplesOfMobileComputing,Hansmann,LotharMerk,MartinNiclous, Stober	2013
3.	Mobile Computing, Tomasz Imielinski, Springer	2014
4.	Pervasive Computing, 2nd Ed., by UweHansmann,et.al.Springer Verlag	2003

Course Name	:	**Advanced Machine Learning**
Course Code	:	**ISM5202**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**4-6**

Total no. of lectures: 14

Total no. of lab hrs: 14

Course Objectives:

	The main objectives of this course are:
1.	Tointroduceadvancedconceptsandmethodsofmachinelearning and to develop an understanding oftheroleofmachinelearninginmassivescaleautomation.
2.	Todesignand implement variousmachinelearningalgorithmsin a range ofreal-worldapplications.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Artificial Neural Network:** Introduction to ANN, Perceptron, Cost Function, Gradient Checking,multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, RandomInitialization.	3
2	**Bayesian Learning and Decision Trees:** Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets. Representingconceptsasdecisiontrees,Recursiveinductionofdecisiontrees,best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, andpruning.	5
3	**Reinforcement Learning:** Reinforcement earning through feedback network, function approximation.	2
4	**Ensemble Methods:** Bagging, boosting, stacking and learning with ensembles. Random Forest.	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementation of following machine learning algorithms in various projects using Python: 1. Classification and regressionalgorithms 2. K-MeansClustering 3. Artificial Neural Network (withback-propagation) 4. DecisionTrees 5. RandomForest	14

Course Outcomes:

	After completion of course, students would be able to:
1.	Build efficient machine learning models to carry out advanced tasks with the practical approach.

| 2. | Integrate and apply their expertise to produce solutions for real-world problems. |
| 3. | Interpret and Analyze results with reasoning using different ML techniques |

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Tom Mitchell, Machine Learning, McGraw Hill,	2013
2.	EthemApaydin, Introduction to Machine Learning, 2e. The MIT Press,	2010.
3.	Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press,	2012.

MOOCs on this course are available at:

1) Machine Learning for Data Science and Analytics - https://www.edx.org/course/machine-learning-for-data-science-and-analytics

Course Name	:	**Cloud Computing and Security**
Course Code	:	**ISM5203**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**4-6**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:

1.	The course intends to analyze the components of cloud computing showing how business agility in an organization can becreated, to critiquetheconsistencyofservicesdeployedfromacloudarchitecture and to comparemodernsecurityconceptsastheyareappliedtocloudcomputing.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Cloud Computing Fundamentals** Cloud Computing definition, private, and public and hybrid cloud. Cloud types;IaaS, PaaS,SaaS.Benefitsandchallengeofcloudcomputing,publicvsprivateclouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloudarchitecture.	5
2	**Cloud Applications** Technologiesandtheprocessesrequiredwhendeployingwebservices;Deploying awebservicefrominsideandoutsideacloudarchitecture,advantagesanddisadvantages	3
3	**Information Storage Security & Design** Storagestrategyandgovernance;securityandregulations.Designingsecuresolutions; the considerations and implementations involved. Securing storage in virtualizedandcloudenvironments.Monitoringandmanagement;securityauditing andSIEM.	5
4	**Security Concepts In Cloud** Confidentiality,privacy,integrity,authentication,non-repudiation,availability,access control, defense in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS andSaaS.	4
5	**Virtualization System-Specific Attacks** Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM,codeorfileinjectionintothevirtualizedfilestructure),VMmigrationattack, hyper jacking.	4

Course Outcomes:

	After completion of course, students would be able to:
1.	Identify which cloud model will best serve that current process requirements
2.	Compare between the various cloud providers based on the services and security providedto the customer
3.	Propose security requirements needed for the processes that need to be run on a cloud and effectively select one of the available cloud services.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Cloud Computing: From beginning to end by Ray J Rafaels	2015
2.	Privacy and Security for Cloud Computing by Siani Pearson, George Yee.	2012

MOOCs on this course are available at:

1) Cloud computing - https://swayam.gov.in/courses/3742-cloud-computing

Course Name	:	**Next Generation Digital Technologies – II**
Course Code	:	**ISM5204**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**4-6**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	The goal of this course is to familiarize students with recent technologies and related issues.
2.	The technologies may be wired or wireless technologies so that the student can understand easily.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Mobile & Wireless Technologies:** Mobile IP, Wireless Networks: Wireless PANs (Sensor Networks, Bluetooth, UWB), Wireless LANs (Wi-Fi, 802.11a to n), Cellular networks: from 1 to 5G Networks,SatellitecommunicationsandDeepSpaceNetworking	6
2	**Advanced Internet Technologies:** Emergence of Social networks & Blogs, Internet telephony, Skype and other P2Psoftware's, IPTV, IP Gaming, Digital Rights Management, Web API's for e-commerce, etc., Web 2.0 andbeyond.	5
3	**Industry 4.0** Evolutionofindustry4.0,understandingcyberphysicalsystems,designprinciples andbuildingblocks,disciplinesofindustry4.0,industryexamples	2
4	**High Performance Computing Infrastructures** Parallel Architectures, Multi Cores, Graphical Processing Units, Clusters, Grid Computing, Cloud Computing.	2
5	**Case Studies:** Case studies on existing technologies and their implementation in real time environment.	6

Course Outcomes:

After completion of course,Students will have**:**	
1.	A broad knowledge of the state-of-the-art technologies.
2.	Clear Understanding of Open problems in existing technologies like wireless and mobile security, thus enhancingtheir potential to do research or pursue a career in this rapidly developing area.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Advancing the Next-Generation of Mobile Computing: Emerging Technologies, Ismail Khalil and Edgar R. Weippl	2012

Course Name	:	**Secure Development &Testing**
Course Code	:	**ISM5205**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	To find vulnerabilities in their code by covering the what, why and how of code auditing.
2.	To understand the most common and severe weaknesses in code
3.	To prevent security vulnerabilities during development
4.	Introduce and discuss secure coding guidelines

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Vulnerability Discovery Techniques** Design Principles - Least Privilege, Security vs. Obscurity; Security Vulnerabilities, Coding Guidelines, Discovery Techniques	3
2	**Basic Security Vulnerabilities** Program Memory Corruption, Program Memory Layout, Buffer Overflows.	3
3	**Language Issues** Data Storage and representation, Type conversion issues, Pointer Arithmetic Issues, Format Strings, Design (authentication, authorization, integrity), Secure Coding	4
4	**Common Crypto Issues** Obsolete Crypto, Side Channel Attacks, Randomness Issues, Trust models and web threats (XSS (Cross Site Scripting), XSRF (Cross-site request forgery)); PHP (session handling, database)	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementing secure programs using C, C++ and PHP	8
2	Programming Using PKI techniques and systems	6

Course Outcomes:

After completion of course, students would be able to:	
1.	Write secure programs
2.	Test and validate the programs written with an intention of being secure
3.	Evaluate whether a program is secure or vulnerable to some attack

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Secure coding in C and C++ by Robert C. Seacord,	2013
2.	Essential PHP Security 1 Edition by Chris Shiflett	2009

Course Name	:	**Cryptocurrency and Blockchain Technology**
Course Code	:	ISM5206
Credits	:	1.5
L T P	:	2 0 2
Segment	:	4-6

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:	
1.	To have a basic understanding of blockchain technology andcryptocurrency.
2.	This course will also allow the students tostudythesecurityissuesandsafeguardsrelatedtobitcointrading

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Course Description and Blockchain, Disruption/News**: Price Rise, Distinction between Blockchain vs Cryptocurrency vs Token, Definition diagram: Pillars of Blockchain, Industry Applications of Blockchain: Government, Healthcare, His- tory of Centralized Services, trusted third party: Shift from gold standard to flat currencytoHashcash/digitalcurrency(lookatBEM)/Bitcoin,Trustlesssystem, Immutability, Security, Privacy, Anti-fragility,etc.	6
2	**Cryptocurrency and Markets:** Cryptocurrencies - talk about Bitcoin / Ethereum,Where is the value - what are people investing in?, Methods to purchase Bit- coins/Ethereum Setting up a Wallet.	4
3	**IssueswithBlockchain:** SecurityandSafeguards,Protectionfromattackers,HacksOnexchanges, What is stopping adoption? , Scalability problems, Network attacks to destroy bitcoin, Legal adoption in various countries and laws.	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementationofblockchainconceptandrelatedprojectsthatwillgivepractical experience in real world blockchain development scenarios.	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Buildefficientblockchainmodelstocarryoutadvancedtaskswiththepracticalapproach.
2.	Evaluate the use and risks involved with Blockchain

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Blockchain: The Complete Step-by-step Guide to Understanding Blockchain and the Technology Behind It by Jay Isaac	2012
2.	Research Papers	

MOOCs on this course are available at:

1) Bitcoin and Cryptocurrency - https://www.edx.org/course/cryptocurrencies-bitcoin-and-the-crypto-space

ENGINEERING MATHEMATICS

Course Name	:	Number Theory and Finite Fields
Course Code	:	EMM5014
Credits	:	01
L T P	:	2-1-0
Segment	:	1-2

<div align="right">

Total No. of Lectures– 10
Total No. of Tutorials -5

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Course Objectives:

The main objectives of this course are:	
1	To make the students understand the fundamental properties of integers.
2	To make the students able to prove basic theorems and solve congruences.
3	To make the students understand the concepts of random numbers.
4	To make the students understand the basic concepts of groups, rings and finite fields.

Course contents:

Sr.No.	Course Contents	No. of Lectures
1	Introduction, Divisibility, The Euclidean algorithm, primes, Fundamental theorem of Arithmetic, Congruences, Residue classes and reduced residue classes, Generation of random numbers using mid square method and congruence method.	04
2	Fermat's theorem, Euler's theorem, Solution of congruences, Chinese Remainder theorem with applications, Euler's φ-function,	04
3	Groups, Rings and Fields, Finite Fields GF(p^n)	02

Course Outcomes:

At the end of this course the students will be able to	
1	Describe the fundamental properties of integers
2	Prove basic theorems and solve congruences.
3	generate random numbers

Bibliography:

Sr.No.	Name of Book / Authors / Publishers	Year of Publication/ Edition
1	"An introduction to theory of numbers", Niven I., Zuckerman S. H. and Montgomary L. H. , John Wiley and Sons.	1991
2	"Theory of Numbers", Hardy and Wright W. H., Oxford University Press.	2008
3	"Higher Arithmetic", Davenport H., Cambridge University Press	2008
4	"Elementary Number Theory", David M. Burton, Wm.C.brown Publishers, Dubuque, Ivova.	2011
5.	"Cryptography and Network Security" William Stallings, Pearson	2003

Course Name	:	**Discrete Mathematics**
Course Code	:	**EMM5015**
Credits	:	**1**
L T P	:	**2 1 0**
Segment	:	**3-4**

Total no. of lectures: 10
Total no. of tutorials: 4

Course Objectives:

	The main objectives of this course are:
1.	This course will cover theoreticalaswellaspracticalaspectsofprobabilityandgraphtheory.
2.	It willdevelopthestudent'sabilitytotestandevaluatetheperformanceofanalgorithm.

Course Contents:

Sr. No.	Course contents	No. of Lectures
1.	**Probability:** Pre-requisites: Introduction, Methods of Counting: permutation and combination,Pigeonholeprinciple;SampleSpace;ConditionalProbability; Bayes theorem anditsapplicationsinbuildingspamfilters,legitimacyofanattack.	2
2.	**Graph Theory:** Graphterminology,Handshakinglemma,Connectivity,Planarityofgraphs,Graph Coloring, Using graphs to represent social relationships, graphs and sociograms, levels ofmeasurement	4
3.	**Formal Methods of Proof:** Direct Proving Techniques: by cases, induction, strong induction and structural induction; Indirect Proving Techniques: by contradiction, by contrapositive; Application in proving the correctness of algorithms	2
4.	**Growth of Functions:** Typesofgrowthfunctions,masterstheorem,computingasymptotictimeandspace complexity ofalgorithms	2

Course Outcomes:

At the end of the course, students will be able to:	
1.	Have a clear understanding of various topics of graph theory and their application in computer science
2.	Test and evaluate a given algorithm Check efficiency of an algorithm

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Graph theory by Reinhard Diestel	2000
2.	Discrete Mathematics and its applications by Kenneth Rosen	2007
3.	An Introduction to Probability Theory and its Applications vol 1 by Willam Feller, Third Edition.	2008
4.	Introduction to Algorithms by Cormen, Leiserson, Riverst, and Stein, Third Edition.	2009

Course Name	:	**Optimization Techniques and Genetic Algorithms**
Course Code	:	**EMM5012**
Credits	:	**01**
L T P	:	**2-0-2**
Segment	:	**5-6**

Total No. of Lectures – 10
Total No. of Lab Hrs -10

Course Objectives:

The main objectives of this course are:	
1	To make the students understand the need of Optimization Techniques and develop the ability to form mathematical model of optimization problems.
2	To make the students able to identify and solve linear and non-linear models of optimization problems using Genetic Algorirhms.

Course contents:

Sr.No	Course Contents	No. of Lectures
1	Introduction to optimization problem, local and global optimum, conversion of a constrained problem to unconstrained problem.	04
2	Genetic Algorithms, Binary and Real coded Genetic Algorithms, Coding and decoding of variables, Key steps in a GA, starting population, fitness evaluation, reproduction, crossover, mutation, evaluation.	06

Lab Work:

Sr.No.	Lab. Contents	No. of Hours
1.	Using Genetic Algorithms in various optimization Problems	10

Course Outcomes:

	After completion of the course, students will be able to:
1	Form mathematical model of optimization problems .
2	Distinguish between linear and nonlinear models .
3	Solve simple problems using Mathematica/MATLAB

Bibliography:

Sr.No.	Name of Book / Authors / Publishers	Year of Publication/ Edition
1	"Practical Genetic Algorithms", Haupt, R. L. and Haupt, S.E., John Wiley & Sons	1998
2	"Genetic Algorithm in Search, Optimization and Machine Learning" , Goldberg, D.E., Addison Wesley.	1989
3	"Engineering Optimization", Ranjan, Ganguli, University Press.	2011

BRIDGE COURSE

Course Name	:	Bridge course on Foundation of Computer Science
Course Code	:	ISM5000
Course Type	:	Bridge Course
L T P	:	2 0 2

Total no. of lectures: 28
Total no. of Lab hrs : 28

Course Objectives:

The main objectives of this course are:	
1.	The course will try to inculcate the understanding of basic concepts of C/C++ among the students.
2.	The basic principles of data structures and algorithms will be taught with the objective of learning practical implementations.
3.	To Give a quick revision of the concepts of operating systems and database security systems

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**C/C++:** Recap of C/C++, Structures and Unions, Functions and Variables, Classes in C++, Operator Overloading, Initializations and Assignment, Storage Management, Inheritance, Polymorphism, Exceptions and Templets	6
2	**Data Structures:** Recap of Data Structure, Linear Data Structures, Link Lists, Graphs, Trees: Binary, Heap, Searching	6
3	**Algorithms:** Recap of various Algorithms, Sorting, Searching, Graph Traversal Algorithms: Breadth First Search, Depth First Search, Network Flow Algorithms, Dynamic Programming Techniques, Optimization Techniques.	6
4	**Operating Systems:** Recap of Scheduling algorithms, Deadlocks, Inter-process Communication and Synchronization, Memory Management	5
5	**Database Systems:** Recap of Relational Models, Relational Algebra & SQL, Transaction Processing and Concurrency Control, Normalization.	5

Lab Work:

Sr. No.	Lab contents	No. of Hours
1	Design and implementation of various algorithms and data structures in C/C++.	28

Course Outcomes:

After completion of course, students will have:	
1	Conceptual understanding of C/C++ language
2	Implementation capabilities of various algorithms studied in the class.
3	The skills to decide which data structure to be used for solving the problem.
4	The skill to practically implement the concepts of Operating systems

Sr.		
5	The ability to manage any database system and apply transaction processing and concurrency control to it.	

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1	Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles	2008
2	Schaum's Outlines Data Structure 1st Edition (English, Paperback, LIPSCHUTZ)	2014
3	The C++ Programming Language, Bjarne Stroustrup	2010

SEMESTER-II

SOFT SKILLS
&
MANAGEMENT

Course Name	:	Communication Skills
Course Code	:	SSM5021
Credits	:	1.5
L T P	:	0-1-4
Segment	:	1-3

Total No. Tutorials:- 07
Total No. Lab Hrs:-28

Course Objectives:

The main objectives of this course are:
1.	To enhance competence in communication skills: verbal and nonverbal.
2.	To provide orientation in technical communication skills: spoken and written.
3.	To sensitize students to attitude formation and behavioral skills.

Course Contents: **Total No. Tutorials:- 07**

Sr.No.	Course Contents	No. of Lectures
1.	**Introduction to Communication Skills, Soft Skills and Interpersonal Communication**	1
2.	**Speech:** Structure, Elements, Content, Organization and Delivery J-a-M	1
3.	**Writing Skills:** Letters, Minutes of Meeting	1
4.	**Technical Report Writing:** Concept & Structure	1
5.	**Research Writing:** Concept & Structural Framework	1
6.	**Power Point Presentation:** Project Presentation	1
7.	**Interviews**	1

Lab Work   **Total Contact Hours:-28**

Sr.No.	Lab. Contents	No. of Hours
1.	Self- Introduction	2
2.	Negotiation Skills & Role Play	2
3.	J-a-M Session	2
4.	Building Word Power through Reading	2
5.	Group Discussion and Case Study	4
6.	Writing Skills: Letters, Minutes of Meeting	2
7.	Technical Report Writing: Concept & Structure	4
8.	Research Writing: Concept & Structural Framework	4
9.	Power Point Presentation: Project Presentation	4
10.	Interviews	2

Course Outcomes

At the end of the course:	
1	The students will enhance their competence in communication skills and technical communication and develop awareness of attitude formation and behavioural appropriateness.
2	The course will address the gap which exists between employer expectations and student proficiency.

Bibliography

Sr.No.	Book Detail	Year of Publication
1.	Technical Communication, Meenakshi Raman and Sangeeta Sharma, Oxford University Press	2015
2.	English for Research Paper Writing, Adrian Wallwork, Springer, London	2011
3.	English Vocabulary In Use: Advanced+ CD, McCarthy Michael, CUP, Cambridge	2004
4.	Advanced English Grammar, Martin Hewings, CUP, Cambridge	2003
5.	Study Listening, Lynch Tony, CUP, Cambridge	2004
6.	Study Speaking , Anderson Kenneth, CUP, Cambridge	2010
7.	Study Reading , Glendenning H. Eric, CUP, Cambridge	2004
8.	Study Writing , Lyons Liz Hamp & Ben Heasley, CUP, Cambridge	2004
9.	Study skills in English, Michael J. Wallace, CUP, Cambridge	2004

Course Name	:	**Management Entrepreneurship and IPR**
Course Code	:	**SSM5022**
Credits	:	**1**
L T P	:	**0-3-0**
Segment	:	**4-5**

Total No. Tutorials: 14

Course Objectives:

The main objectives of this course are:	
1.	To make students familiar with the concepts of Management, Entrepreneurship and Intellectual Property Rights (IPRs).
2.	To make students understand how to initiate a new Start-up and manage it effectively.
3.	To enable students to convert their innovative ideas into different forms of IPRs.

Course Contents:

Sr. No.	Course contents	No. of Tutorials
1.	**Introduction to Management:** Concepts and Principles of Management	1
2.	**Functions of Management:** Planning Process - Hypothetical Planning of an Event/Activity, Form of Organization Structure - Case Study, Human Resource Planning and Process, Elements of Directing and Effective Control Mechanism, Activity: Role Playing/Management Game	4
3.	**Introduction to Entrepreneurship:** Concepts of Entrepreneurship and Characteristics of Entrepreneurs	1
4.	**Development Phases of Entrepreneurship:** Innovation and Idea Generation, Project Formulation and Validation (Feasibility Analysis), Business plan	2
5.	**Ecosystem for Entrepreneurship Development:** Government Schemes and Initiatives, Financial and Non-Financial Institutional Support, Legal Framework, Role of Incubator, Venture Capitalist, Angel Investor, Crowd Funding Accelerator etc.	2
6.	**Intellectual Property Rights (IPRs):** Concept and Relevance of IPRs, Process for filing IPR	2
7.	**Different Forms of IPRs:**Patents, Copyright, Trademarks, Industrial Designs and Geographic Indicator	2

Course Outcomes:

At the completion of this course, students will be able to:	
1.	Developand manage new project/Start-up.
2.	Apply managerial skills for success of entrepreneurial/business venture.
3.	To make effective use of IPR practicesin their ventures.

Bibliography:

Sr.No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	"Management Principles and Practice", Srinivasan R. and Chunawalla S.A., Himalaya Publishing House.	2017
2.	"Introduction to Management", Schermerhorn John R. Jr. And Bachrach Daniel G., 13th Edition, Wiley Publications	2016

3.	"Principles & Practice of Management", Prasad L.M., 8th Edition, Sultan Chand & Sons.	2015
4.	"The New Era of Management", Daft R.L., 11th Edition, Pubs: Cengage Learning.	2014
5.	"Case Studies in Management", Pandey Chandra Akhilesh, 2nd Edition, I.K. International Publishing House Pvt. Ltd.	2015
6.	"Harvard Business Review: Manager's Handbook", Harvard Business School Press.	2018
7.	"Entrepreneurship", Trehan Alpana, Dreamtech Press.	2016
8.	"Entrepreneurship and Small Business" Schaper Michael, Volery Thierry, Weber Paull and Lewis Kate, 3rd Asia-Pacific Edition, Wiley Publications	2018
9.	"Harvard Business Review: Entrepreneur's Handbook", 1st Edition, Harvard Business Review Press	2018
10.	"Take Me Home", Bansal Rashmi, 1st Edition, Westland.	2014
11.	"Intellectual Property Law", Narayanan P., 3rd Edition, Eastern Law House	2017
12.	"Intellectual Property Rights", Pandey Neeraj and Dharni Khushdeep, PHI Learning	2014
13.	"Intellectual Property Rights", Rosedar S.R.A., LexisNexis (Quick Reference Guide – Q&A Series)	2016
14.	MSME Annual Publications (www.msme.gov.in)	**Annual**
15.	WIPO Annual Publications (www.wipo.int)	**Annual**

MOOCs on this course are available at:

1) "Entrepreneurship: Do Your Venture", Available at edx (Offered by IIM Bangalore), Self-Paced (6 weeks).
https://www.edx.org/course/entrepreneurship-do-your-venture
2) "Becoming an Entrepreneur", Available at edx (Offered by MIT), Self-Paced (6 weeks).
https://www.edx.org/course/becoming-entrepreneur-mitx-launch-x-4
3) "How to Build a Start-up", Available at Udacity, Self-Paced (One Month).
https://in.udacity.com/course/how-to-build-a-startup--ep245
4) "Intellectual Property Rights: A Management Perspective, Available at edx (Offered by IIM Bangalore), Starts on 1 August 2018 (6 weeks).
https://www.edx.org/intellectual-property-rights-a-management-perspective

Course Name	:	**Professional Ethics**
Course Code	:	**SSM5023**
Credits	:	**0.5**
L T P	:	**0-3-0**
Segment	:	**6-6**

<div align="right">**Total No. Tutorials: 07**</div>

Course Objectives:

The main objectives of this course are:	
1.	To imbibe ethical values and understanding.
2.	To develop moral thinking that will help students to recognize their potential.
3.	To engage and motivate the students to perform ethically in their professional life.

Course Contents:

Sr. No.	Course contents	No. of Tutorials
1.	**Introduction to Ethics:** Concept of Ethics – Nature, Scope, Sources, Types, Functions and Factors influencing Ethics, Ethics in Engineering	2
2.	**Ethics in Profession:** Concepts of Honesty, Integrity, Reliability, Risk, Safety and Liability, Responsibilities and Rights of Professionals, Professional accountability.	2
3.	**Ethics and Business:** Concept of Business Ethics – Nature and Objectives, Ethical dilemmas in business ethics.	1
4.	**Self-Development:** Concept of Self-Assessment – SWOT Analysis, Self-Concepts, Self-Confidence, Self-Esteem, Managing Time and Stress, Human values.	2

Course Outcomes:

At the completion of this course, students will be able to:	
1.	Demonstrate knowledge and better understanding of self and to manage time and stress effectively.
2.	Have subjective well-being.
3.	Have ethical decision making ability in their personal and professional life.

Bibliography:

Sr.No	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	"Professional Ethics", Subramaniam R., 2nd Edition, Oxford University Press.	2017
2.	"Introduction to Psychology", Kalat James W., 11th Edition, Cengage Learning.	2017
3.	"Business Ethics – Text and Cases", Murthy C.S.V., 1st Edition, Himalaya Publishing House.	2014
4.	"A Foundation Course in Human Values and Professional Ethics", Gaur R.R., Sangal R. and Bagaria G.P., Excel Books.	2010
5.	"Issues and Ethics in the Helping Professions", Corey G., Corey M.S. and Callanan P., 8th Edition, Brooks/Cole, Cengage Learning.	2010
6.	"The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Leary M.R., 1st Edition, Oxford University Press.	2007

7.	"Business Ethics", Hartman L.P. and Chatterjee A., 3rd Edition, Tata McGraw Hill.	2006
8.	"Business Ethics and Professional Values", Rao A.B., Excel Books.	2006
9.	"Business Ethics – Concepts and Cases", Velasquez M.G., 5th Edition, Prentice Hall.	2001
10.	"Theories of Personality", Hall C.S., Lindzey D. and Cambell J.B., 4th Edition, Hamilton Printing Company.	1997

PROGRAM CORE

Course Name	:	**Digital and Mobile Forensics**
Course Code	:	ISM5031
Credits	:	**3**
L T P	:	**2 0 2**
Segment	:	**1-6**

Total no. of lectures: 28
Total no. of lab hrs.: 28

Course Objectives:

The main objectives of this course are:	
1.	To have technical skills and competencies in the field of forensic computing.
2.	To have the ability to protect the computer system during the forensic examination from any possible alteration, damage, data corruption, or virus introduction.
3.	To understand how information is stored and used on digital devices.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Basics of Forensics** Digital Forensic history and challenges, Mobile Forensic and Methodologies. Overviewofhardwareand operating systems: structureofstoragemedia/devices; windows/Macintosh/ Linux – registry, boot process, file systems, file metadata. **Acquisition andHandling** Data recovery: identifying hidden data, recovering deleted files, Imaging andCloning, Evidence acquisition techniques, manual acquisition with ADB & Fast boot.	7
2	**Mobile Software Design:** Fundamentalopensourcesoftware,jailbraking/rooting,passcodeprotection,encryptedbackup,MobileTools:UFED,XRY,Digitalevidencecontrols:diskimaging, recoveringswapfiles,temporary&cachefiles **Tools and Forensic Report Writing** Paraben and MOBILEDIT, detection of source device, generating report	7
3	**Mobile Network Forensic:** Introduction, Mobile Network Technology, Investigations, Collecting Evidence, Where to seek Digital Data for further Investigations, Interpretation of Digital Evidence on Mobile Network	4
4	**Software Reverse Engineering:** Defend against softwaretargetsforviruses,wormsandothermalware,improving third-partysoftwarelibrary,identifyinghostilecodes-bufferoverflow,provisionof unexpected inputs,etc.	5
5	**Computer crime and Legal issues:** Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court oflaw.	5

Lab Contents:

Sr. No.	Lab Contents	No. of hours
1	Practical problems on : 1. Data and evidence recovery 2. Mobile deviceforensics 3. Cyber forensic investigation tools 4. Web browser forensics and emailtracing	28

Course Outcomes:

	After completion of course, students would be able to:
1	Use of computer forensics tools and appropriate skills and knowledge to perform investigations
2	Analyze digital devices to establish user activity
3	Develop of new devices and technologies and how current digital forensics methods will apply to them.
4	Analyze attack profiles, investigation tools and techniques
5	Perform Critical analysis of data to identify evidence
6	Trace malicious internet activity and analyze email trails.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Digital Forensics with Open Source Tools. Cory Altheide andHarlan Carvey, Elsevier publication,	2011
2.	Computer Forensics and Cyber Crime: An Introduction (3rd Edition) by Marjie T. Britz,	2013
3.	NetworkForensics:TrackingHackersThroughCyberspace,SherriDavidoff, Jonathan Ham Prentice Hall,	2012
4.	Guide to Computer Forensics and Investigations (4[th]edition).By B. Nelson, A. Phillips, F. Enfinger, C. Steuart.Thomson,	2009
5.	Computer Forensics: Hard Disk and Operating Systems, ECCouncil, September	2009

Course Name	:	**Ethical Hacking**
Course Code	:	**ISM5041**
Credits	:	**3**
L T P	:	**2 0 2**
Segment	:	**1-6**

Total no. of lectures: 28
Total no. of lab hrs.: 28

Course Objectives:

The main objectives of this course are:	
1.	This course will help the students to gain agood understanding of ethical hacking concepts andmethodologies.
2.	It will also help the students tobeproficientinusageofhackingtools

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to Ethical hacking** Overview, Information security threats and attack vendors, hacking concepts : typesandphases,ethicalhackingconceptsandscope,information securitycontrols	4
2	**Foot printing and Reconnaissance** Foot printing concepts; methodology : website foot printing, email foot printing, DNSfoot printing,networkfoot printing,foot printingthroughsocialengineering; foot printing tools, countermeasures and penetrationtesting	6
3	**Scanning networks** Overview, network scanning techniques: check for open ports, scanning beyond IDS, scan for vulnerability, prepare proxies	6
4	**Hacking** Session hijacking, hacking web servers, hacking web application, system hacking, hacking wireless network, hacking mobile platforms	8
5	Evading IDS, Firewalls and honeypots	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Hacking into a system Project work related to Footprinting and VulnerabilityScanner	28

Course Outcomes:

After completion of course, students will be able to:	
1.	Apply Ethical Hacking Concepts and Methodologies to secure a system
2.	Use hacking tools to find vulnerabilities of a system

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Basics for Ethical Hacking - Hacking for Beginners by ManthanDesai	2010.

| 2. | Ethical Hacking by Tutorials Point. https://www.tutorialspoint.com/ethicalhacking/ethicalhackingtutorial.pdf | |

PROGRAM ELECTIVE

Course Name	:	**Biometric Security**
Course Code	:	**ISM5301**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**1-3**

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:	
1.	The course will cover a broad range of approaches to biometrics reflecting both fundamental principles and the current state-of-the-art practices.
2.	To develop an understanding of the fundamental components common to all biometricsystems and develop the student's ability to design & implement.
3.	To test and evaluate biometric systems that conform to international standards.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Biometric Fundamentals And Performance Metrics:** Introduction, Biometrics versus traditional techniques, Characteristics, Key bio- metricprocesses:Verification-Identification- Biometricmatching,Components ofabiometricsystem,Performancemeasuresinbiometricsystems.	4
2	**Physiological Biometrics:** Fingerprint, Face, Iris: Characteristics, Feature extraction and matching, Strengths and Deploymentchallenges.	5
3	**Behavioral Biometrics:** Signature scan, Keystroke scan, Voice scan, Gait recognition: Characteristics, Feature extraction and matching, Strengths and Deployment challenges.	5

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementation of following biometric projects in MATLAB/Python: 1 FingerprintBiometric 2 FaceBiometric 3 IrisBiometric 4 SignatureBiometric 5 VoiceBiometric	14

Course Outcomes:

After completion of course, students would:	
1.	Have a clear understanding of various biometric traits and the generic components of thebiometric system.
2.	Extract and process the features from the different biometric traits.
3.	Select the most appropriate biometric trait for a given application.
4.	Design, implement, test and evaluate a Biometric System.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Anil K. Jain, Michigan State University, USA, Patrick Flynn University of Notre Dame, USA, Arun A. Ross West Virginia University, USA, Handbook of Biometrics,	2008.
2.	Implementing Biometric Security (Wiley Red Books) by JohnChirillo, Scott Blaul.	2003
3.	Anil K. Jain Michigan State University, E. Lansing, Michigan andRuud Bolle and Sharath Pankanti IBM, T.J. Watson Research CenterYorktownHeights,NewYorkKluwerAcademic,Biometrics Personal Identification in NetworkedSociety, Academic Publishers New York, Boston, Dordrecht, London,Moscow.	2002
4.	Articles in various journals and conference proceedings.	

Course Name	:	Image Analysis and Forensics
Course Code	:	ISM5302
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-3

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:	
1.	This course will cover the basic theory and algorithms that are widely used in digital image processing.
2.	The aim is to present a general overview of the prevalent physical and chemical principles, methods, and instrumentation involved in the development and analysis of latent fingerprints.
3.	To gain hands-on experience in using software tools for processing digital images developing latent prints.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Fundamentals To Digital Image Processing:** Components of Digital Image Processing System, Image sampling, quantization and representation, Basic relationship between pixels.	3
2	**Image Enhancement:** Background,Basicgreyleveltransformation,Histogramprocessing,Basicsof Spatial filtering, Smoothing and Sharpening spatial filters, Introduction to Fourier Transform and the Frequency Domain, Discrete Fourier Transform, Smoothing and Sharpening Frequency Domainfilters.	5
3	**Imaging Forensics: Latent Fingerprints Processing** Introduction, Methods of developing latent fingerprints from various surfaces: Porous and Non-Porous, Powder based methods, chemical methods and touch- less based methods (RUVIS), Latent print enhancement techniques, Science of poroscopy,edgeoscopyandridgeology,Analysismethod:ACE-V,Introductionto AutomaticFingerprintIdentificationSystem(AFIS),Preparinganevidenceto be accepted in court oflaw.	6

Lab Work:

Sr. No.	Lab Contents	No. of hours

	Project work related to following image enhancement techniques in MATLAB/Python:
	   1 HistogramProcessing
	   2 Smoothing and Sharpening SpatialFilters
	   3 SmoothingandSharpeningFrequencyDomainFilters
	Developing and processing Latent Fingerprintsusing
	   1 Powdermethod
	   2 Touch-less technology: Reflected Ultra Violet Imaging system (RUVIS)
		14

1		

Course Outcomes:

	After completion of course, students would be able to**:**
1.	Analyze the breadth and practical scope of digital image processing.
2.	Applyprinciplesandtechniquesofdigitalimageprocessinginapplicationsrelatedtoforensics.
3.	Develop and process latent fingerprints using powder method and RUVIS.
4.	Make a positive professional contribution in the field of Image Analysis and Forensics.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Digital Image processing By Rafael C. Gonzalez and Richard E.Woods - Pearson Education	2012
2.	Tistarelli, Massimo, and Christophe Champod, eds. Handbook ofBiometrics for Forensic Science. Springer,	2017
3.	Digital Image Processing by A.K. Jain,	1995
4.	Digital Image processing (An algorithmic approach) by MadhuriA. Joshi - PHI	2006

Course Name	:	**Privacy and Security in Online Social Media**
Course Code	:	ISM5303
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-3

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:
1. The course intends to provide a good understanding of privacyandsecurityissuesonhonlinesocialmedia. The students will StudyandcategorizeOSMthroughvariousperspectives

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Online Social Networks : definition, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs	3
2	Collecting data from Online Social Media.	2
3	Trust, credibility, and reputations in social systems	2
4	Online social Media and Policing	2
5	Informationprivacydisclosure,revelationanditseffectsinOSMandonlinesocialnetworks	3
6	Phishing in OSM & Identifying fraudulent entities in online social networks	2

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Hands-on on OSINT tools like: Maltego, Palantir,NodeXLPythonlibrariesforsocialmediacrawlinglikeFacebookgraphAPI, tweepy, Scrapyetc	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Appreciate various privacy and security concerns (spam, phishing, fraud nodes, identitytheft) on Online Social Media
2.	Articulate various concerns comprehensively on Online Social Media

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	ProgrammingCollectiveIntelligence: BuildingSmartWeb2.0Applications by Toby Segaran,	2007
2.	Practical Web 2.0 Applications with PHP by Quentin Zervaas.	2008
3.	Building Social Web Applications by Gavin Bell.	2009

4.	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition by DafyddStuttard	2011

Course Name	:	**Network Anonymity and Privacy**
Course Code	:	**ISM5304**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**1-3**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:
1. This course will inculcate the understanding of theprinciplesofnetworkanonymityandprivacy and will enable the studentstoimplementasecurenetwork.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Introduction: Privacy, and why it matters.	3
2	Definition and value of privacy. Conceptual frameworks for reasoning about privacy: W.Prosser's Privacy Torts, D.Solove'sTaxonomy of Privacy., More on conceptualframeworksforreasoningaboutprivacy:H.Nissenbaum'sContextualIntegrity., Identity, anonymity, andpseudonymity.	8
3	CorporateNetworkSecurityPolicies,threatsandcontrols.,Firewall:Technologies,Stateful and stateless firewall, Transparent Proxy and Protocol or Application Gateway, Linux-based Firewall: ipchains& iptables, Internet Services against firewall, Demilitarized Zone (DMZ), Virtual Private Network (VPN): Concepts andtechnologies,IPSecandFreeS/WAN,VPNwithFirewall,IntrusionDetection System(IDS):Concepts,Network-basedandHost-basedIDS,tripwireorSnortor PortSentry setup and management.	10

Course Outcomes:

After completion of course, students would be able to:
1. Build a secure network for defending intrusions.
2. Work with various Intrusion Detection Systems.
3 Implement VPN, IDS and DMZ technologies.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Complete Guide to Internet Privacy, Anonymity & Security byMatthew Bailey	2011
2.	Anonymous Communication Networks: Protecting Privacy on theWeb by Kun Peng	2014

Course Name	:	**Cryptanalysis**
Course Code	:	**ISM5305**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**1-3**

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Total no. of lectures: 14
Total no. of lab hrs.: 14

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Course Objectives:

The main objectives of this course are:
1. The aim of the course is to studythe majortopicsincryptanalysis showingavarietyofwaystobreak,fix/repairandtomeasure/evaluatethesecurityofCryptographic primitives.
2. This course will also help in understandingthesecuritydesignprinciples,internalstructureand important properties of majorcryptosystems.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Historical Cryptanalysis, Groups, finite fields. Number theory. Attacks on publickey cryptosystems. Security Goals, Attacks, LFSR-based stream ciphers.	3
2	Symmetrictechniques,Pseudorandomfunctionsandpermutations,Symmetr icencryption and block cipher modes of operation	3
3	Signature schemes: intuition, formal definitions, one-time Lamport schemes	3
4	Message Authentication Codes, Cryptographic explorations with software. Protocol/mode/initialization attacks. Side channel attacks.	3
5	Digital Signature and Authentication Protocols, Electronic Mail Security, IP Security, Web Security	2

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementation of symmetric techniques and MACalgorithm Implementing Digital Signature and authenticationtechniques	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Design a new algorithm to maintain/communicate information securely.
2.	Identify vulnerability from a given encryption/decryption algorithm.
3.	Implement basic cryptanalytic attacks

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Applied Cryptanalysis: Breaking Ciphers in the Real World by Mark Stamp and Richard M. Low	2007
2	Cryptanalysis: A Study of Ciphers and Their Solution by Halen F. Gaines	1989

Course Name	:	Data Mining
Course Code	:	ISM5306
Credits	:	1.5
L T P	:	3 0 0
Segment	:	1-3

Total No. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	The course aims tointroducestudentstothebasicconceptsandtechniquesofDataMining,
2.	Todevelopskillsofusingrecentdataminingsoftwareforsolvingpracticalproblems
3.	Togainexperienceofdoingindependentstudyandresearch.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to Data Mining** DataMiningGoals,StagesoftheDataMiningProcess,DataMiningTechnique s, KnowledgeRepresentationMethods,Applications,Relatedtechnologies-Machine Learning, DBMS, OLAP,Statistics	4
2	**Data Warehouse and OLAP** Data Warehouse and DBMS , Multidimensional data model , OLAP operations, Data preprocessing, Data cleaning , Data transformation , Data reduction , Discretization and generating concept hierarchies , Installing Weka 3 Data Mining System	4
3	**Data mining algorithms:** Association rules ,Motivation and terminology, Example:miningweatherdata,Basicidea:itemsets,Generatingitemsetsandr ules efficiently,CorrelationanalysisClassification,Basiclearning/miningtasks,I nfer- ring rudimentary rules: 1R algorithm, Decision trees,Covering rules Prediction, The prediction task , Statistical (Bayesian) classification, Bayesian networks,Instance-based methods (nearest neighbor), Linear models	7
4	**Clustering** Basic issues in clustering, First conceptual clustering system: Cluster/2 , Partitioning methods: k-means, expectation maximization (EM) , Hierarchical methods:distance-basedagglomerativeanddivisibleclustering,Conceptualclustering: Cobweb	6

Course Outcomes:

After completion of course, students would able to:	
1.	Apply data warehousing and mining techniques to a database
2.	Develop and analyze new data mining algorithms
3.	Apply clustering techniques to a dataset and analyze their complexities and correctness

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann,	2005

Course Name	:	Social Networks Analytics
Course Code	:	ISM5307
Credits	:	1.5
L T P	:	2 0 2
Segment	:	1-3

Total No.of Lectures: 14
Total No. of Lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	Ingest and visualize social media data, render network visualizations, and understand accuracy, bias, validity, and repeatability in social media representation.

Course Contents:

Sr. No.	Course contents	No. of Lectures
1.	**Overview of Social Media:** Definitions, cognitive and sociological theories for motivation to use social media, history of social media, varied uses of different platforms, APIs.	2
2.	**Graphs and Centrality:** Terminology, basic graph theory, and network centrality measures. Students will be taught to calculate basic centrality measures by hand.	2
3.	**Social Theory and Network Topology:** Sociological theories behind the formation of relationships and group structure. The six social forces (prestige, reciprocity, homophily, propinquity, transitivity, and structural balance) will be introduced.	2
4.	**Clustering and Subgroup Analysis:** A review of common clustering algorithms for use in networks and their application. Block modelling, modularity, graph reduction, localized network measure.	2
5.	**Network and Community Measures:** Centralization, fragmentation, clustering coefficient, density, and other graph-level and community measures.	2
6.	**Data and APIs:** Data considerations to include changing APIs, differing data storage challenges for weighted/unweighted, sparse/dense networks. Collection bias for network chaining, random sampling, missing data, and other collection issues.	2
7.	**Statistical Analysis of Networks:** Introduction to exponential random graph models. Hypothesis testing and time series analysis.	2

Lab Work:

Sr. No.	Lab contents	No. of Hours
1.	Provide a general overview of NLP application in social media analysis to include: machine translation, named entity recognition, part-of-speech tagging, stemming, co-reference resolution.	7
2.	Sentiment Analysis and Topic Classification: sentiment analysis (happy/sad) and topic classification (what are they happy/sad about).	7

Course Outcomes:

	At the end of the course, students will be able to :
1.	Characterize social media clusters and discourse using natural language processing, sentiment analysis and topic classification
2.	Conduct basic social network analysis to include centrality, subgroup analysis, social theory, and statistical analysis of networks.
3.	Conduct over-time network analysis including statistical change detection, exponential random graph modelling, and stochastic actor oriented modelling

Bibliography:

Sr. No.	Book Details	Year of Publication
1.	Marshall Sponder, "Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics"	2013
2.	**Gonçalves**, Alex, "Social Media Analytics Strategy Using Data to Optimize Business Performance"	2017

Course Name	:	Information Retrieval
Course Code	:	ISM5308
Credits	:	1.5
L T P	:	3 0 0
Segment	:	1-3

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:
1.	The course aims to inculcate the understanding of information retrieval models amongstudents and the performance evaluation methods of the information retrievalmodels

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to Information Retrieval** The nature of unstructured and semi-structured text. Inverted index and Boolean queries.	3
2	**Text Indexing, Storage and Compression** Text encoding: tokenization, stemming, stop words, phrases, indexoptimization. Indexcompression:lexiconcompressionandpostingslistscompression.Gapencoding, gamma codes, Zipf'sLaw. Index construction. Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, real-worldissues.	6
3	**Retrieval Models** Boolean, vector space, TF-IDF, Okapi, probabilistic, language modeling, latent semanticindexing.Vectorspacescoring.Thecosinemeasure.Efficiencyconsiderations.Documentlengthnormalization.Relevancefeedbackandqueryexpansion.	7
4	**Performance Evaluation** Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, interlude agreement.	5

Course Outcomes:

After completion of course, students would be able to:	
1.	Retrieve information from textual data and implement basic text indexing, storage andcompression
2.	Evaluate retrieval models using the techniques discussed

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Introduction to Information Retrieval Manning, Raghavan andSchutze, Cambridge University Press, draft.	2008
2.	Mining the Web, SoumenCharabarti, Morgan-Kaufmann,	2002
3.	ModernInformationRetrievalBaeza-YatesandRibeiro-Neto,Addison	1999

	Wesley,	
4.	A comprehensive survey by Ed Green grass	2005

Course Name	:	**Big Data Analytics and Data Privacy**
Course Code	:	**ISM5309**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**1-3**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	This course will enable the students to apply big data flow to actual projects as well as apply data analytics life cycle to big data projects.
2.	It will help them to identify and successfully apply appropriate techniques and tools to solve big data problems.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction To Big Data** Introduction to Big Data Platform, Traits of Big data, Challenges ofConventional Systems, Web Data, Evolution of Analytic Scalability, Analysis vs Reporting, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference, PredictionError.	3
2	**Basic Data Analysis And Data Analytic Methods** Regression Modelling, Multivariate Analysis, Bayesian Modelling, Inference and Bayesian Networks, Analysis of Time Series: Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks: Learning And Generalization, Competitive Learning, Fuzzy Logic: Extracting Fuzzy Models from Data Fuzzy Decision Trees, Stochastic Search Methods.	5
3	**Mining Data Streams** Introduction to Streams Concepts: Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream: Filtering Streams, Counting Distinct ElementsinaStream,EstimatingMoments,CountingOnenessinaWindow,Decaying Window, Real time Analytics Platform(RTAP) Applications, Case Studies, RealTimeSentimentAnalysis,StockMarketPredictions.	7
4	**Framework, Technologies, Tools And Visualization** MapReduce: Hadoop, Hive, MapR, Sharding, NoSQL Databases: S3, Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Inter-actionTechniques;SystemsandAnalyticsApplications,AnalyticsusingStatistical packages,IndustrychallengesandapplicationofAnalytics.	6

Course Outcomes:

After completion of course, students would be able to:	
1.	Apply the Big Data statistics to a given data set.
2.	Use various analytical methods studied in the course
3.	Analyze data in real applications and design efficient mining techniques
4.	Analyze various applications on tools like MapReduce, Hadoop, and S3.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Analytics in Practice, by Soumendra Mohanty, Tata McGraw hill Education	2011
2.	Agile Analytics: A value Driven approach to Business intelligence and Data Warehousing, by Kenw. Collier, Pearson Education	2012

MOOCs on this course are available at:
1) Introduction to Big Data - https://www.edx.org/course/introduction-big-data

Course Name	:	Pattern Recognition and Computer Vision
Course Code	:	ISM5401
Credits	:	1.5
L T P	:	2 0 2
Segment	:	4-6

Total No. of lectures: 14
Total No. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	The course will introduce students to the fundamentals of image formation and major ideas, methods, and techniques of computer vision and pattern recognition.
2.	This course aims to develop an appreciation for various issues in the design of computer vision and object recognition systems and provide the student with programming experience from implementing computer vision and object recognition applications.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Pattern Recognition:** Introduction, Bayes Decision Theory, Linear Classifiers, Non-linear classifiers, Feature Selection, Dimensionality Reduction, Additional Features AndTemplate Matching, Clustering	7
2	**Computer Vision:** Cameras: Pinhole camera, Perspective projection, Affine projection, Geometric camera models: Elements of analytical Euclidean geometry, Cameraparameters and the perspective projection, Affine cameras and affine projection equations, Geometric camera calibration: Least squares parameter estimation - Linear approach to cameracalibration.	7

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Project Work: 1. Object recognition and tracking 2. VideoSurveillance 3. Medical ImageProcessing	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Apply the fundamental concepts related to pattern analysis, featureextraction and visual geometric modelling.
2.	Analyze and interpret the visible world around us.
3.	Contribute to research and further developments in the field of pattern recognition andcomputer vision applications ranging from biometrics, medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	D.A. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice-Hall,	2003
2.	C.H. Chen and P.S.P. Wang (Editors), Handbook of Pattern Recognition and Computer Vision, World Scientific,	2005
3.	L.G. Shapiro and G. Stockman, Computer Vision, Prentice-Hall,	2001
4.	R. Schalkoff, Pattern Recognition Statistical, Structural & NeuralApproaches, John Wiley,	1992

Course Name	:	**Information Warfare**
Course Code	:	**ISM5402**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**4-6**

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	The course aims at gaining an understanding of the threats to information resources, including military and economic espionage,communicationseavesdropping,computerbreak-ins and disruption of information flow.
2.	To learnaboutcyberspacelaw,informationwarfareandthemilitary,andintelligenceintheinformationage.
3.	The course will also inculcate the knowledge of computer crime, police and forensic methods, and the legal requirements for collectingevidence among students.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Theory of Information warfare:** History of Information warfare, Definition and types of Information warfare, Nature of information warfare, Types of IW: Command and Control Warfare, Intelligence-Based Warfare, Electronic Warfare, Psychological Warfare, Hacker Warfare, Economic Information Warfare, and Cyber warfare.	5
2	**Intelligence Gathering & Psyops:** Information sources, types of Intelligences e.g. SIGINT, HUMINT, OSINT etc. tools for gathering intelligences, destruction and modification of data, distortion andfabricationofinformation,forgery,controlanddisruptionofinformationflow, CellularIntercepts,LawenforcementWiretaps,ForeignIntelligenceIntercepts,AI based Security. Perception management &Psyops	4
3	**Anatomy of Cyber War:** Malware and Cyber War, Attacks Considered to Be Illustrative of Real Cyber War, Low Intensity, Asymmetric, Persistent, Economic Attacks, Such As Spam, Kinetic Attacks On High Value Internet Choke Points Threats to information resources,includingmilitaryandeconomicespionage,communicationseavesdropping, computer break-ins, Terrorism and Internet, Ten Information Management Trends	5
4	**Case Studies:** Use of IO operations e.g. Gulf war, RAND reports on Information Operations Snowden Revelation: PRISM, SIGINT, INQTEL. Perception Management: TRUMP, BREXIT election campaign, Facebook Cambridge Analytica Scam, Abdullah X and other perception propagating bots	7

Course Outcomes:

	After completion of course, students would be able to:
1.	Design information operations and information warfare in the context of psychological strategy
2.	Use information as a tool of statecraft and as a weapon of war; and
3.	Analyze potential adversaries, in this realm and help devise and execute conformity with an overall psychological strategy and carrying out psychops

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Cyber warfare and cyber terrorism, By Lech Janczewski, AndrewM. Colarik	2007
2.	Cyberwar and Information Warfare by Daniel Venture,	2013
3.	Inside Cyber Warfare, Mapping the Cyber Underworld, By JeffreyCarr, O'Reilly Media, December	2009
4.	Cyber War: The Next Threat to National Security and What toDo About It, Richard A. Clarke, Robert Knake,	2010
5.	Information Warfare and Security by Dorothy Elizabeth RoblingDenning,	1999

Course Name	:	**Advanced Programming in Python, R, Weka**
Course Code	:	**ISM5403**
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:
1.	This course will make students proficientinadvancedprogrammingandscriptingpackages, inculcatetheabilitiestoimplementrealworldproblems and tobuilddataanalysisandvisualizationabilitiesinordertoeffectivelybringouttheresults.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Beyond the Basics:** Loops, String Formatting, Modules, Libraries, Packages,Reading and writing from files. **Data Analysis:** Using the following packing Pandas, Numpy, Scipy **Data Visualization:** Matplotlib	5
2	**Basics of R Programming:** Vectors, Matrices, Dataframe, Getting help and loading packages, Control Structures, Loop Functions and Debugging. **Data Analysis with R:** Summary statistics, Graphics in R, Probability and Distribution, Data entry and exporting data.	5
3	**WEKA:** Classification, Prediction, Rule Mining on Real world Applications usingWEKA	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	• Hands-ononpythonlibrariesliketensorflow,Keras,etc • Data analysis withR • Implementation of various machine learning algorithms on different datasets like: UCI machine learning and KaggleDatasets.	14

Course Outcomes:

After completion of course, students would be able to:
1.	Apply the concepts of programming and scripting packages
2.	Implement and automate the real world problems
3.	Interpret, analyze and visualize the results effectively.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Introduction to Programming in Python: An Interdisciplinary Approach, 1e (English, Paperback, Sedgewick)	2015
2.	Data Analysis with R: Tony Fischetti	2015
3.	Data Mining with WEKA: University of Waikato	

Course Name	:	**Advanced Biometrics**
Course Code	:	**ISM5404**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:	
1.	This course will provide scientific foundations needed for the design, implementation, and evaluation of large scalebiometricidentificationsystemsusingMultimodalBiometrics.
2.	It will also give an insightofsecurityaspectsofabiometricsystem.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Multimodal Biometrics:** Multimodal biometric systems, Design Issues, Fusion Techniques, Normalization Techniques, Case studies.	4
2	**Biometric Security Models:** Introduction to various biometric security models, Attack levels and available re- medial solutions.	5
3	**Adversarial Machine Learning:** Adversary Machine Learning Model: Adversary goals; knowledge; capability, Proactive-Reactive security aspects, Machine Learning Attack Scenarios, Case Study: Machine Learning based Cyber Forensic Biometric Systems.	5

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	• Implementation of a multimodal biometric system in MAT-LAB/Python using different biometric traits and fusionstrategies • Project work on various attacks (Spoofing, Poisoning attack) on a biometricsystem.	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Select the most appropriate biometric traits and fusion strategy for designing a multimodalbiometric system for a given application.
2.	Deploy of biometric systems for a given real world problem and analyze its securityaspects

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Anil K. Jain, Michigan State University, USA, Patrick Flynn University of Notre Dame, USA, Arun A. Ross West Virginia University, USA, Handbook of Biometrics,	2008.
2	Biggio, Battista, et al."Adversarial biometric recognition: Areviewonbiometricsystemsecurityfromtheadversarialmachine learning perspective." IEEE Signal Processing Magazine32.5	2015
3.	Articles in various journals and conference proceedings	

Course Name	:	Deep Learning
Course Code	:	ISM5405
Credits	:	1.5
L T P	:	2 0 2
Segment	:	4-6

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	The course will introduce the fundamentals of deep learning and Architecturesandoptimizationmethodsfordeepneuralnetworktraining.
2.	It will also help students implementdeeplearningmethodswithinTensor Flowandapplythemtodata

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction:** Meaning and importance of Deep Learning. Machine learning vs. Deep Learning vs. Artificial Intelligence, Deep L-Layer Neural Network, Forward Propagationin aDeepNetwork,Buildingblocksofdeepneuralnetworks,Parametersv/sHyper - parameters.	4
2	**Convolution Neural Network:** Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications	4
3	**Recurrent Neural Networks:** IntroductiontoRNNs,UnfoldedRNNs,Seq2SeqRNNs,Longshort-term memory (LSTM), RNNApplications.	4
4	**Deep Learning Applications:** Image Processing, Natural Language Processing, Speech recognition, Video Analytics	2

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	• Implementation of following deep learning algorithms in Python usingTesorFlow: ○ Convolution NeuralNetwork ○ Recurrent NeuralNetwork • ProjectworkinvolvingapplicationofDeepLearning	14

Course Outcomes:

After completion of course, students would be able to:	
1	Successfully implement, apply and test relevant learning algorithms in TensorFlow.

2	Criticallyevaluatethemethodsapplicabilityinnewcontextsandconstructnewapplications.	
3	Follow research and development in the area.	

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning.	2016
2.	Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1	2009
3.	Kalchbrenner, Nal, Edward Grefenstette, and Phil Blunsom. "Aconvolutional neural network for modelling sentences." ACL	2014

MOOCs on this course are available at:

1) Deep Learning Explained -https://www.edx.org/course/deep-learning-explained

Course Name	:	Information Retrieval from Cyber Physical Social Systems
Course Code	:	ISM5406
Credits	:	1.5
L T P	:	3 0 0
Segment	:	4-6

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	This course will allow the students to Gain an understanding of various methods for Information retrieval from sources of Cyber Physical Social Systems(CPSS)
2.	This course willcover the techniques for information categorization and filtering from the data being collected fromCPSS.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Retrieving Sensory data** Datafromsmartphoneslikecalllogs,sensordata(fromGPS,accelerometeretc.), messages,photos,locationhistory,mobilitypatternsetc,datafromwearablesensors, geospatial data	4
2	**Social media Information Retrieval** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS, Crawling from Twitter, Facebook, LinkedIn platform.	4
3	**Text Categorization and Filtering** Introduction to text classification. Naive Bayes models. Spam filtering. Vector space classification using hyperplanes, centroids, k Nearest Neighbors. Support vector machine classifiers. Kernel functions. Boosting. **Text Clustering** Clustering versus classification. Partitioning methods. k-means clustering.MixtureofGaussiansmodel.Hierarchicalagglomerativeclustering.Clusteringterms usingdocuments. **Sensor Pattern Recognition techniques** Pattern matching techniques like Dynamic Time Warping etc.	9
4	**Advanced Topics** Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval	4

Course Outcomes:

After completion of course, students would be able to:	
1.	CrawldatafromCyberPhysicalSocialSystemssourceslikesocialmedia,sensors,geospatialdata etc
2.	Derive inferences from CPSS data using the techniques discussed

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Introduction to Information Retrieval Manning, Raghavan andSchutze, Cambridge University Press, draft.	2008
2.	Mining the Web, SoumenCharabarti, Morgan-Kaufmann,	2002
3.	ModernInformationRetrievalBaezaYatesandRibeiro Neto,Addison Wesley	1999
4.	A comprehensive survey by Ed Green grass	2005

Course Name	:	Data Protection Laws
Course Code	:	ISM5407
Credits	:	1.5
L T P	:	3 0 0
Segment	:	4-6

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1	This course will make students understand data privacy laws inIndia.
2	It will inculcate the knowledgeoflawsandregulationsconcerningcrossborderflowofdataprotectionandlawenforcementperspectives and will help to gain insights on data localization and processing sensitive personalinformation.
3	The students will get to knowindividual participation rights, regulation andenforcement.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Context Setting** A Digital India in a Digital World, Data Protection: Genesis and Rationale, Data Protection and the Value of Privacy, The Evolution of Privacy Principle, Comparative Approaches to Data Protection, Data Protection in India, Judicial Developments on Right to Privacy , Legislative Developments.	5
2	**Scope of Data** Territorial and personal scope, Personal data, Sensitive personal data, Entities to be defined in law, Cross-Border flow of data	4
3	**Data Localization** Introduction, Issues, Role of data transfer in trade, Digitization of Product and Service Offerings, International Practices.	3
4	**Processing** Introduction,issues,processingofsensitivepersonaldata,Internationalpractices	3
5	**Individual Participation Rights** Individual Participation Rights-1, Individual Participation Rights-2, Individual Participation Rights-3	3
6	**Regulation and Enforcement** Enforcement Models, Accountability, Adjudication Process, Remedies	3

Course Outcomes:

After completion of course, students would be able to:	
1.	Ability to apply fundamental principles of the data protection regime and information privacy.
2.	A detailed and specific knowledge of data protection issues arising in the specific contexts
3.	Ability to resolve current challenges faced by data controllers, data subjects, policy makers and regulators.
4.	Grounding in research skills and techniques in the area of data protection and

| | information privacy. | |

Reference Paper:

Sr. No.	Book Detail	Year of Publishing
1.	White Paper Of The Committee Of Experts On A Data Protection Framework For India, Justice B.N. Srikrishna	2017

OPEN ELECTIVE

Course Name	:	**Next Generation Digital Technologies - I**
Course Code	:	CIO5001
Credits	:	1.5
L T P	:	3 0 0
Segment	:	1-3

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	This course is an innovative training program covering trends in today's rapidly changing industry.
2.	The students will get to learn about several topics including Cryptocurrency, Industry 4.0, Deep web, Grid computing etc will be covered to ensure that they are on the cutting edge of the technology.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Cloud Computing** Types of cloud, applications of cloud, use of some common public cloud services (Microsoft Azure, Amazon AWS, IBM blue mix), concept of virtualization	4
2	**Big Data Analytics** Introduction to Big Data Platform, Traits of Big data, Challenges of Conventional Systems, sources, technologies, applications	4
3	**Cryptocurrency** Bit coins and cryptocurrency technology, use of block chain for cryptocurrency, success of cryptocurrency, cryptocurrency trading and wallets	3
4	**Dark Web** Introduction to dark web, deep web, crawling the data from hidden web, data pre-processing and data analysis, tor network, case studies	4
5	**Wearable Sensors** Implementationofwearablesensors,acquiringdatafromwearablesensors,applications : crowd sourcedapplications	3
6	**Case Studies:** Case studies on existing technologies and their implementation in real time environment.	3

Course Outcomes:

After completion of course, Students will be able to:	
1.	Intelligently use technology to develop innovative solutions
2.	Resolve openproblemsinexistingtechnologieslikehighperformancecomputing,bigdataanalytics, wearable sensors, cloud computing organization
3	Pursue research in Next Generation niche areas

Bibliography:

Sr. No.	Book Details	Year of Publication
1.	Cloud Computing: From beginning to end by Ray J Rafaels	2015
2.	Analytics in Practice, by Soumendra Mohanty, Tata Mcgraw hill Education	2011
3.	Blockchain: The Complete Step-by-step Guide to Understanding Blockchain and the Technology Behind It by Jay Isaac	2012
4.	The Dark Net: Inside the Digital Underworld , Jamie Bartlett	2015
5.	Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall/CRC Computational Science - 2010	2010

Course Name	:	**Next Generation Digital Technologies – II**
Course Code	:	CIO5002
Credits	:	1.5
L T P	:	3 0 0
Segment	:	4-6

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
1.	The goal of this course is to familiarize students with recent technologies and related issues.
2.	The technologies may be wired or wireless technologies so that the student can understand easily.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Mobile & Wireless Technologies:** Mobile IP, Wireless Networks: Wireless PANs (Sensor Networks, Bluetooth, UWB), Wireless LANs (Wi-Fi, 802.11a to n), Cellular networks: from 1 to 5G Networks,SatellitecommunicationsandDeepSpaceNetworking	6
2	**Advanced Internet Technologies:** Emergence of Social networks & Blogs, Internet telephony, Skype and other P2Psoftware's, IPTV, IP Gaming, Digital Rights Management, Web API's for e-commerce, etc., Web 2.0 andbeyond.	5
3	**Industry 4.0** Evolutionofindustry4.0,understandingcyberphysicalsystems,designprinciples andbuildingblocks,disciplinesofindustry4.0,industryexamples	2
4	**High Performance Computing Infrastructures** Parallel Architectures, Multi Cores, Graphical Processing Units, Clusters, Grid Computing, Cloud Computing.	2
5	**Case Studies:** Case studies on existing technologies and their implementation in real time environment.	6

Course Outcomes:

After completion of course, Students will have**:**	
1.	A broad knowledge of the state-of-the-art technologies.
2.	Clear Understanding of Open problems in existing technologies like wireless and mobile security, thus enhancing their potential to do research or pursue a career in this rapidly developing area.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Advancing the Next-Generation of Mobile Computing: Emerging Technologies, Ismail Khalil and Edgar R. Weippl	2012

Course Name	:	**Introduction to Information Security**
Course Code	:	**CIO5003**
Credits	:	**3**
L T P	:	**2 0 2**
Segment	:	**1-6**

Total no. of lectures: 28
Total no. of labs hrs: 28

Course Objectives:

The main objectives of this course are:	
1.	The course will incorporate the foundational understanding of Information Security, Threats and network perimeter security design principles
2.	To provide abilitiestoreviewproceduresforinstallation,troubleshootingandmonitoringofnetworkdevicesto maintain integrity, confidentiality and availability of data anddevices.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction:** Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets	2
2	**Cryptographic Protocols -** Introduction to Protocols, Communications using Symmetric Cryptography, Substitution Ciphers and Transposition Cipher, Block cipher, Stream cipher, Modes of operation, Symmetric and Asymmetric cryptography.	2
3	**Information Security Threats:** Virus,Malware,DDoSattack,Trojan,Worm,Spyware,SocialEngineering,Phishing attacks, man-in-middle attack, DNS poisoning **Vulnerabilities:** Port Scanning, Fingerprinting, Packet Sniffing, Services, Code.	4
4	**Proxy & Firewalls** WorkingofStatefulFirewall,TheConceptofState,StatefulFilteringandStateful Inspection, Fundamentals of Proxying, Pros and Cons of Proxy Firewalls, Types of Proxies, Tools forProxying	4
5	**Security Considerations** Firewalls Policy, VPN Basics, IPSec Basics, packet filter, stateful firewalls, application level firewalls.	4
6	**Network Intrusion Detection & Prevention Systems** Network Intrusion Detection Basics, the Roles of Network IDS in a Perimeter Defence,IDSSensorPlacement,IPS,IPSLimitations,NIPS,Host-BasedIntrusion Prevention Systems, TrafficMonitoring.	4
7	**Security Procedures:** Security Policy, Securing the perimeter, physical security, securing the network, securingdevices,securingapplications,OSUpdates **CommonWaysToProtect Data:** File and folder permissions, encryption, group policy. **Protocol Standards:** SSL/TLS/ SSH/ IPSEC, Kerberos, S/Key, PKI: X.509, PGP.	5

8	**Case Studies:** Methods of War gaming, Drone wars, Mitigating attacks for Electric Smart grid, Automating Security incident response.	3

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Project work related to : • Malware Detection • Packet Sniffing • Proxy Servers • Firewall policies setup • Phishing, Spamming, XSS	14
2	Practical Use of Network Security Tools, Email Header Analysis, configuration of network security equipment such as firewall, routers, IDS, Wireless Access Points	14

Course Outcomes:

	After completion of course, students would be able to:
1.	Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and designo real time scenarios
2.	Implement,monitorandmaintainasecurenetworkconsistingofenterpriselevelroutersand switches.
3.	Design and implement AAA and IPSec and firewall technologies and design network policies to securing networks
4.	Design/develop/ implement the security solution for a given application.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	W. Stallings, Network Security Essentials (3rd Edition), Prentice Hall,	2007
2.	W. R. Stevens, TCP/IP Illustrated, Vol. 1: TheProtocols, Addison-Wesley	1993
3.	D. E. Comer, Internetworking with TCP/IP, Vol.1 (4th Edition), Prentice Hall,	2000
4.	R. Oppliger, Internet and Intranet Security (2nd edition), Artech House,	2002
5.	W.R.CheswickandS.M.Bellovin,FirewallsandInternetsecurity (2nd edition), Addison-Wesley,	2003

Course Name	:	Cyber Crime and Related IT Laws
Course Code	:	
Credits	:	1.5
L T P	:	3 0 0
Segment	:	1-3

Total no. of lectures: 21

Course Objectives:

The main objectives of this course are:	
2.	To examine how the online digital world has been inflicted with new cybercrimes, implications for society and law enforcement response and investigatinghowthecomputerandelectronicdeviceshavebecomebothatargetofattackandato ol for criminalactivity

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Introduction to cyber law** Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Cyber Laws of other countries: EU GDPR, PIPEDA (Canada), etc.	5
2	**Information technology Act** Overview of IT Act, 2000, Amendments in 2008/2013 and Limitations of ITAct, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Li- ability,	5
3	**Cyber law and related Legislation** Patent Law, Trademark Law, Copyright, Software Copyright or Patented, Do- main Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant SectionsofIndianEvidenceAct,RelevantSectionsofBankersBookEvidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank ofIndiaAct,LawRelatingToEmployeesAndInternet,AlternativeDisputeRes olution, Online Dispute Resolution (ODR).	6
4	**Electronic Business and legal issues** Legal issues in Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C,E security	3
5	**Application area** Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends	2

Course Outcomes:

After completion of course, students would be able to:	
1.	Analyze various types of cybercrime and formulate procedures for real world cybercrimeInvestigations
2.	Resolve challenges posed to law enforcement agents, policy makers and prosecutors
3.	Find solutions in cybercrime investigations, evidence and applicable law for real world case studies

4.	Use and Analyze the software tools and methods currently available for finding illegal activities on computer disks and in computer networks.	
5.	Analyze the criminal activity on the Internet and propose available tools to prevent suchactivity.	

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Handbook of Cyber Laws, by Vakul Sharma,Macmillan.	2002
2.	Articles in various journals and conference proceedings.	

Course Name	:	**Cryptocurrency and Blockchain Technology**
Course Code	:	**CIO5004**
Credits	:	**1.5**
L T P	:	**2 0 2**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs.: 14

Course Objectives:

The main objectives of this course are:	
1.	To have a basic understanding of blockchain technology andcryptocurrency.
2.	This course will also allow the students tostudythesecurityissuesandsafeguardsrelatedtobitcointrading

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	Course Description and Blockchain, Disruption/News: Price Rise, Distinction between Blockchain vs Cryptocurrency vs Token, Definition diagram: Pillars of Blockchain, Industry Applications of Blockchain: Government, Healthcare, His- tory of Centralized Services, trusted third party: Shift from gold standard to flat currencytoHashcash/digitalcurrency(lookatBEM)/Bitcoin,Trusstlessystem, Immutability, Security, Privacy, Anti-fragility,etc.	6
2	Cryptocurrency and Markets: Cryptocurrencies - talk about Bitcoin / Ethereum,Where is the value - what are people investing in? , Methods to purchase Bit- coins/Ethereum Setting up a Wallet.	4
3	IssueswithBlockchain: SecurityandSafeguards,Protectionfromattackers,HacksOn exchanges, What is stopping adoption? , Scalability problems, Network attacks to destroy bitcoin, Legal adoption in various countries and laws.	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	Implementationofblockchainconceptandrelatedprojectsthatwillgive practical experience in real world blockchain development scenarios.	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Buildefficientblockchainmodelstocarryoutadvancedtaskswiththepracticalapproach.
2.	Evaluate the use and risks involved with Blockchain

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Blockchain: The Complete Step-by-step Guide to Understanding Blockchain and the Technology Behind It by Jay Isaac	2012
2.	Research Papers	

Course Name	:	**Advanced Programming in Python, R, Weka**
Course Code	:	
Credits	:	**1.5**
L T P	:	**3 0 0**
Segment	:	**4-6**

Total no. of lectures: 14
Total no. of lab hrs: 14

Course Objectives:

The main objectives of this course are:	
1.	This course will make students proficientinadvancedprogrammingandscriptingpackages, inculcatetheabilitiestoimplementrealworldproblems and tobuilddataanalysisandvisualizationabilitiesinordertoeffectivelybringouttheresults.

Course Contents:

Sr. No.	Course Contents	No. of Lectures
1	**Beyond the Basics:** Loops, String Formatting, Modules, Libraries, Packages, Reading and writing from files. **Data Analysis:** Using the following packing Pandas, Numpy, Scipy **Data Visualization:** Matplotlib	5
2	**Basics of R Programming:** Vectors, Matrices, Dataframe, Getting help and loading packages, Control Structures, Loop Functions and Debugging. **Data Analysis with R:** Summary statistics, Graphics in R, Probability and Distribution, Data entry and exporting data.	5
3	**WEKA:** Classification, Prediction, Rule Mining on Real world Applications usingWEKA	4

Lab Work:

Sr. No.	Lab Contents	No. of hours
1	• Hands-on on python libraries like tensor flow, Keras,etc • Data analysis with R • Implementation of various machine learning algorithms on different datasets like: UCI machine learning and KaggleDatasets.	14

Course Outcomes:

After completion of course, students would be able to:	
1.	Apply the concepts of programming and scripting packages
2.	Implement and automate the real world problems
3.	Interpret, analyze and visualize the results effectively.

Bibliography:

Sr. No.	Book Detail	Year of Publishing
1.	Introduction to Programming in Python: An Interdisciplinary Approach, 1e (English, Paperback, Sedgewick)	2015
2.	Data Analysis with R: Tony Fischetti	2015
3.	Data Mining with WEKA: University of Waikato	