Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)

(Under Maharashtra Act No. XXIX of 2014)

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Course Structure and Detailed Syllabus

For

M. Tech Cyber Security

In line with New Education Policy 2020 guidelines
(Effective from Academic Year 2024-25)

Dr. Babasaheb Ambedkar Technological University
M. Tech Cyber Security
In line with New Education Policy 2020 guidelines
(Effective from AY 2024-25)

	Course Code	Course Title	L	T	P	Cr	Categorization
SEM- I	MTCSBS101	Applied Mathematics-Number Theory Concepts	3	1	-	4	BS
	MTCSPC102	Research Methodology and IPR	3	-	-	3	PCC
	MTCSPC103	Cloud Security	3	-	-	3	PCC
	MTCSPC104	Information Security and Privacy-Policies and Standards	3	-	-	3	PCC
	MTCSPE105	Program Elective-I	3	1	-	4	PEC
	MTCSPE106	Program Elective-II	3	1	-	4	PEC
	MTCSPC107L	Cloud Security Laboratory	-	-	2	1	PCC
	MTCSAU108	YOGA for Stress Management	-	-	2	-	Audit Course
		Total	**18**	**2**	**8**	**22**	
SEM- II	MTCSPC201	Applied Cryptography	3	1	-	4	PCC
	MTCSPC202	Cyber Forensics and Cyber Laws	3	1	-	4	PCC
	MTCSPE203	Program Elective-III	3	1	-	4	PEC
	MTCSOE204	Open Elective I	3	-	-	3	OE
	MTCSPC205L	Offensive Security Laboratory	-	-	2	1	PCC
	MTCSMP206	Mini Project with Seminar	-	-	2	1	ELC
	MTCSAE207	IKS Bucket#	3	-	-	3	AEC/VEC/IKS
	MTSCAU208	Disaster Management	-	-	2	-	Audit Course
		Total	**15**	**3**	**6**	**20**	
SEM- III	MTCSOE301	Open Elective II	3	-	-	3	OE
	MTCSMD302	Multidisciplinary Minor	3	-	-	3	MD M
	MTCSSE303	Seminar II	-	-	4	2	ELC
	MTCSPR304	Project I	-	-	-	10	ELC
		Total	**6**	**2**	**4**	**18**	
SEM-IV	MTCSPR401	Project II	-	-	-	20	ELC
		Total				**20**	

Note:
1. *Students can complete 40% of the courses from SWAYAM /NPTEL/Coursera/ from Institutes with MoU signed by university.*
2. *Existing passing rules will be applicable.*

Credit Distribution				
SEM I	**SEM II**	**SEM III**	**SEM IV**	**Total**
22	**20**	**18**	**20**	**80**

Abbreviations: PCC (Programme Core Course), PEC (Programme Elective Course), ELC (Experiential Learning Courses), OE (Open Elective), AEC (Ability Enhancement Courses), VEC (Value Education Courses), IKS (Indian Knowledge System), MD M (Multidisciplinary Minor).

	Program Elective -I
A)	Secured Software Architecture and Design
B)	Cyber Security Incident Response Management
C)	Mobile Application Security
D)	Coding and Information Theory
E)	Cryptographic Protocols and Standards

	Program Elective -II
A)	Security Assessment and Verification
B)	Database Security
C)	Software Metrics and Quality Assurance
D)	Operating System Security
E)	Cognitive Security

	Program Elective -III
A)	Cyber Security Essentials
B)	Ethical Hacking and Digital Forensics
C)	Intrusion Detection System
D)	Block Chain & Cyber Security
E)	Malware Analysis and Network Security

	Open Elective I
A)	New Labour Codes of India
B)	Urban Utilities Planning: Water Supply, Sanitation and Drainage
C)	Environment and Development
D)	Entrepreneurship
E)	Research Methodology

Open Elective II
A) Student Psychology
B) Business To Business Marketing (B2B)
C) Organizational Behavior
D) Principles Of Economics
E) Intellectual Property & Rights
F) Introduction to Public Administration

Multidisciplinary Minor
A) Design Of Mechatronic Systems
B) Ethical Hacking
C) Sustainable Power Generation Systems
D) Components and Applications of Internet of Things
E) Linear Algebra
F) Artificial Intelligence and Machine Learning

IKS Bucket

Indian Knowledge System (IKS)
A) Indian Knowledge System (IKS): Concepts and Applications in Engineering
B) Indian Knowledge System(IKS): Humanities and Social Sciences

SEMESTER I

| MTCSBS101 | Applied Mathematics-Number Theory Concepts | Credits 04 |

Teaching Hours/Week (L:T:P)   3:1:0

Course Objectives:

This course will enable students to:

1. Have an insight into statistical methods.
2. Apply the concept of probability distribution of discrete and continuous random variables.
3. Apply the concept of various graphs and Vector Spaces.
4. Analyze the statistical data for testing of hypothesis and to draw the conclusions.

Course outcomes:

The students will be able to

1. CO1: Apply probability formulations for new predictions with discrete and continuous RV's.
2. CO2: Solve the vector spaces and related topics arising in magnification and rotation of images.
3. CO3: demonstrate knowledge and critical understanding of the well-established principles within Number Theory;
4. CO4: Apply the statistical tools in multi variable distributions.
5. CO5: Summarize the Numerical and Statistical tools using programming

Unit -I

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.

Introduction: Understanding of Vector spaces, graph theory, Statistical models & their applications in Engineering, Economics and Statistics.

Linear Algebra-I

Vector Spaces: Vector spaces; subspaces Linearly independent and dependent vectors, Basis and dimension, coordinate vectors-Illustrative examples. Linear transformations, Representation of transformations by matrices.   (08 Hrs.)

Unit-II

Linear Algebra-II

Computation of Eigen values and Eigen vectors of real symmetric matrices-Jacobi and Given's method. Orthogonal vectors and orthogonal basis. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition. .   (08 Hrs.)

Unit-III

Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non linear).   (08 Hrs.)

Unit-IV

Number Theory: Divisibility, GCD, Euclidean algorithm, Congruences, Linear Congruences, The Chinese Remainder theorem, Solving Polynomials, Linear Diophantine Equation, System of Linear Congruences, Euler's Theorem, Wilson Theorem and Fermat's little theorem

(08 Hrs.)

Unit-V

Probability Theory: Random variable (discrete and continuous), Probability mass function (pmf), Probability density function (pdf), Mathematical expectation, Sampling theory: testing of hypothesis by *t*-test, z- test.   (08 Hrs.)

Textbooks:

1. David C.Lay, Steven R.Lay and J.J.McDonald, "Linear Algebra and its Applications",
5th Edition, Pearson Education Ltd., 2015.
2. T.Veerarajan, "Probability, Statistics and Random Process", 3rdEdition, Tata Mc- Graw Hill Co., 2016.
3. Neal Coblitz, "A Course in Number Theory and Cryptography", Springer Verlag, Second edition.
References:
1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. John Vince, "Foundation Mathematics for Computer Science", Springer International Publishing, Switzerland, 2015.
3. Burton, David M. Elementary number theory. Second edition. W. C. Brown Publishers, Dubuque, IA, 1989.

MTCSPC102	Research Methodology and Intellectual Property Rights	Credits 03

Teaching Hours/Week (L: T: P)   3:0:0
Course Objectives:
This course will enable students to:
1. Give an overview of the research methodology and explain the technique of defining a research problem.
2. Explain the functions of the literature review in research and carry out a literature search, its review and develop theoretical and conceptual frameworks.
3. Explain various research designs, sampling designs, and also different methods of data collections.
4. Understand hypothesis and chi- square test.
5. Develop the art of interpretation and the art of writing different research reports.
6. Explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.

Course Outcomes: The student will be able to:
1. CO1: Understand the concepts of research methodology, research problem and literature review.
2. CO2: Understand various forms of the intellectual property rights, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.
3. CO3: Analyze various research designs, sampling designs, measurement and scaling techniques and different methods of data collections.
4. CO4: Apply several parametric tests of hypotheses.
5. CO5: Develop the art of interpretation and writing research reports

Unit-I
Introduction: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. **Defining the Research Problem**: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

(8 Hrs.)

Unit-II

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. **Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. (8 Hrs.)

Unit-III

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

(8 Hours)

Unit-IV

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, and Cautions in Using Chi Square Tests. (8 Hours)

Unit-V

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organization (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property. Recap / Summary of the Course (8 Hours)

Textbooks :

1. C.R. Kothari, Gaurav Garg, "Research methodology: Methods and Techniques", New Age International, 4th Edition, 2018.

2. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners", SAGE Publications Ltd., 4th Edition, 2014.

3. The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, September 2013.

References:

1. Trochim , Research Methods: the concise knowledge base , Atomic Dog Publishing, 2005.

2. Fink A, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009.

3. Panneerselvam R, Research Methodology, Prentice Hall of India, New Delhi, 2004

MTCSPC103	Cloud Security	Credits 03

Course Objectives:

This course will enable students to:

1. To summarize the concepts of secure architecture design patterns.
2. To investigate software vulnerabilities and its impacts on attacks.
3. To illustrate tools used in secured designing
4. To apply the policies, security standards on software architectures.

Course Outcomes: The students will be able to:

1. CO1: Generalize the Data Centre operations, encryption methods and deployment details
2. CO2: Demonstrate the growth of Cloud computing, architecture and different modules of implementation.
3. CO3: Provide recommendations for using and managing the customer's identity and choose the type of virtualization to be used.
4. CO4: Evaluate the different types of cloud solutions among IaaS, PaaS, SaaS.

Unit-I

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective. Cloud Computing Architectural Framework: Cloud Benefits, Business scenarios, Cloud Computing Evolution, cloud vocabulary, Essential Characteristics of Cloud Computing, Cloud deployment models, Cloud Service Models, Multi- Tenancy, Approaches to create a barrier between the Tenants, cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, Security for Cloud Computing, How Security Gets Integrated.

(8 Hours)

Unit-2

Compliance and Audit: Cloud customer responsibilities, Compliance and Audit Security Recommendations. Portability and Interoperability: Changing providers reasons, Changing providers expectations, Recommendations all cloud solutions, IaaS Cloud Solutions, PaaS Cloud Solutions, SaaS Cloud Solutions.   (8 Hours)

Unit- 3

Traditional Security, Business Continuity, Disaster Recovery, Risk of insider abuse, Security baseline, Customers actions, Contract, Documentation, Recovery Time Objectives (RTOs), Customers responsibility, Vendor Security Process (VSP).   (8 Hours)

Unit-4

Data Center Operations: Data Center Operations, Security challenge, Implement Five Principal Characteristics of Cloud Computing, Data center Security Recommendations. Encryption and Key Management: Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards, Recommendations.   (8 Hours)

Unit-5

Identity and Access Management: Identity and Access Management in the cloud, Identity and Access Management functions, Identity and Access Management (IAM) Model, Identity Federation, Identity Provisioning Recommendations, Authentication for SaaS and Paas customers, Authentication for IaaS customers, Introducing Identity Services, Enterprise Architecture with IDaaS ,IDaaS Security Recommendations. Virtualization: Hardware Virtualization, Software Virtualization, Memory Virtualization, Storage Virtualization, Data Virtualization, Network Virtualization, Virtualization Security Recommendations. (8 Hours)

Textbooks:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy, An enterprise Perspective on Risks and Compliance, Oreilly Media, 2009.
2. References:
3. Vic (J.R.) Winkler, Securing the Cloud, Cloud Computer Security Techniques and Tactics, Syngress, 2011.

MTCSPC107L	Cloud Security Laboratory	Credit 02

Course Objectives:

This course will enable students to:

1. To provide skills for designing and analyzing cloud Concepts.
2. To enable students to work on various cloud platforms.
3. To provide skills to work towards solution of real-life problems

Course Outcomes: The students will be able to:

CO1: Demonstrate how secure communication between various cloud platforms/applications.

CO2: Implement various security techniques.

List of Experiments

1. AWS Security, Identity & Compliance
2. Managing User Identities with Long Term Credentials in AWS IAM
3. Managing Access using IAM User Groups & Roles
4. Using IAM Policies to Define and Manage Permissions
5. Knowledge Check: Overview of AWS Identity and Access Management (IAM)
6. Implementing Cross-Account Access Using IAM
7. Securing AWS Organizations with Service Control Policies (SCPs)

Web References:

1. Cloud Academy Security Labs Details: https://cloudacademy.com/learning-paths/aws-security-services-42/
2. Udemy Certification on AWS security fundamentals: https://www.udemy.com/course/aws-hands-on-labs-2020-step-by-step-for-beginners-new/?utm_source=adwords&utm_medium=udemyads&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_77882236223_._ad_533093955804_._kw__._de_c_._dm__._pl__._ti_dsa-1007766171032_._li_9062044_._pd__._&matchtype=&gclid=Cj0KCQiA1sucBhDgARIsAFoytUtbiwTaUqvVRLrS0glkHq0HrOBbBayvYat0B6_p35i5MeOUdfA9ZuMaAiPPEALw_wcB

MTCSPC104   Information Security and Privacy Policies and Standards   Credits 03

Course Objectives:
This course will enable students to:
1. Understand the polices established IT governance.
2. Audit vulnerabilities based on the IT security standards
3. Analyze business case studies for IT security.
4. Explain managing of security models using information security standards.

Course Outcomes: The students will be able to:
CO1: Write policy document for securing network connection and interfaces.
CO2: Explain the standards, guidelines, Procedures, and key roles of the organization.
CO3: Write, monitor, and review policy document

Unit- 1
Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective. **Introduction to Information Security Policies:** About Policies, why Policies are Important, When policies should be developed, How Policy should be developed, Policy needs, Identify what and from whom it is being protected, Data security consideration, Backups, Archival storage and disposal of data, Intellectual Property rights and Policies, Incident Response and Forensics, Management Responsibilities, Role of Information Security Department, Security Management and Law Enforcement, Security awareness training and support. (8 Hours)

Unit - 2
Policy Definitions, Standards, Guidelines, Procedures with examples, Policy Key elements, Policy format and Basic Policy Components, Policy content considerations, Program Policy Examples, Business Goal Vs Security Goals, Computer Security Objectives, Mission statement Format, Examples, Key roles in Organization, Business Objectives, Standards: International Standards. (8 Hours)

Unit- 3
Writing The Security Policies: Computer location and Facility construction, Contingency Planning, Periodic System and Network Configuration Audits, Authentication and Network Security, Addressing and Architecture, Access Control, Login Security, Passwords, User Interface, Telecommuting and Remote Access, Internet Security Policies, Administrative and User Responsibilities, WWW Policies, Application Responsibilities, E-mail Security Policies. (8 Hrs.)

Unit - 4
Privacy & Online Rights - Privacy as Confidentiality, Data Confidentiality Cryptography-based access control, Obfuscation-based inference control , Metadata Confidentiality , Privacy as Control ,Support for privacy settings configuration , Support for privacy policy negotiation ,Support for privacy policy interpretability , Privacy as Transparency , Feedback-based transparency , Audit-based transparency, Privacy Technologies and Democratic Values, Privacy technologies as support for democratic political systems , Censorship resistance and freedom of speech ,Privacy Engineering (8 Hours)

Unit – 5
The Information Security Blueprint: The ISO 27000 Series, NIST Security Models, IETF Security Architecture Baselining and Best Business Practices, Design of Security Architecture   (8 hours)

Textbooks:
1. Scott Barman, Writing Information Security Policies, Sams Publishing 2002.
2. CyBoK, The Cyber Security Book of Knowledge, Oct 2019.
3. Michael E. Whitman, Principles of Information Security, Fourth Edition, Cengage Learning, 2012.

References:
1. Thomas R Peltier, Justin Peltier, Information Security Fundamentals, John Backley CRC Press, 2005.
2. Harold F. Tipton and Micki Krause, Information Security Management Handbook Auerbach publications, 5th Edition, 2005.

MTCSPE105A **Program Elective –I Secured Software Architecture and Design Credits 04**

Course Objectives:

This course will enable students to:

1. To summarize the concepts of secure architecture design patterns.
2. To investigate software vulnerabilities and its impacts on attacks.
3. To illustrate tools used in secured designing
4. To apply the policies, security standards on software architectures.

Course Outcomes:

The students will be able to:

CO1: Identify the components targeted for each zone.

CO2: Map site zones with level of security

CO3: Design the secured sites based on tools & techniques

Unit – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective. Architecture and Security: Architecture Reviews, Software Process, Reviews and the Software Development Cycle, Software Process and Architecture Models, Software Process and Security, Architecture Review of System, Security Assessments, Security Architecture Basics, Architecture Patterns in Security. (8 Hours)

Unit – 2

Low-Level Architecture: Code Review, importance of code review, Buffer Overflow Exploits, Countermeasures Against Buffer Overflow Attacks, patterns applicable, Security and Perl, Bytecode Verification in Java-Good Coding Practices Lead to Secure Code, Cryptography, Trusted Code, Secure Communications. (8 Hours)

Unit – 3

Mid-Level Architecture: Middleware Security, Middleware and Security, The Assumption of Infallibility, The Common Object Request Broker Architecture, The OMG CORBA Security Standard, Vendor Implementations of CORBA Security, CORBA Security Levels, Secure Interoperability, Application, Unaware Security, Application, Aware Security, Application Implications, Web Security, Application and OS Security, Database Security. (8 Hours)

Unit– 4

High-Level Architecture: Security Components, Secure Single Sign-On- Public-Key Infrastructures, Firewalls, Intrusion Detection Systems, LDAP and X.500 Directories, Kerberos, Distributed Computing Environment, The Secure Shell, or SSH, The Distributed Sandbox, Security and Other Architectural Goals, Metrics for Non-Functional Goals, Force Diagrams around Security, High Availability, Robustness, Reconstruction of Events, Ease of Use, Maintainability, Adaptability, and Evolution, Scalability, Interoperability, Performance, Portability. (8 Hours)

Unit– 5

Enterprise Security Architecture: Security as a Process, Security Data, Enterprise Security as a Data Management Problem, Tools for Data Management, David Isenberg and the "Stupid Network", Extensible Markup Language, The XML Security Services Signaling Layer, XML and Security Standards, The Security Pattern Catalog Revisited, XML-Enabled Security Data-HGP: A Case Study in Data Management, Business Cases and Security, Building Business Cases for Security G Case study: Building secure OS for Linux: Linux security modules, security enhanced Linux. . (8 Hours)

Textbooks:

1. Jay Ramachandran, Designing Security Architecture Solutions, Wiley Computer Publishing, 2010.

References:

1. Markus Schumacher, Security Patterns: Integrating Security and Systems Engineering, Wiley Software Pattern Series, 2010

MTCSPE105B Program Elective –I Cyber Security Incident Response Management   Credits 04

Course Objectives:

This course will enable students to:

1. To understands cyber incident response and its components.

2. To plan for incident response readiness and managing the operational aspects of the incident response team.

3. To organize an incident response team in a manner that ensures good handling of incidents while also making sure staff burnout is avoided.

Course Outcomes:

The students will be able to:

CO1: Describe the main phases of incident response.

CO2: Identify different kinds of attacks methods to counter their effects

CO3: Describe the application of such techniques to real situations and the connection with incident response.

Unit – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.

Introduction: Definitions of incident response and forensic analysis, relation of incident response to the rest of cybersecurity operations, incident response phases - preparation, identification, containment, eradication, recovery, follow-up, indicators of compromise (IOC), forensic analysis as an incident response tool and as support for cybercrime investigations, cybersecurity forensics principles.   (8 Hours)

Unit – 3

Containment: Damage limitation, network segment isolation, system isolation, forensic backup and imaging, use of write blockers, temporary fixes, malware spread limitation. **Eradication:** Actual removal and restoration of affected systems, removal of attack artifacts, scanning of other systems to ensure complete eradication, use of IOCs on other systems and local networks, cooperation with forensic analysis to understand the attack fully. (8 Hours)

Unit – 4

Recovery: Test and validate systems before putting back into production, monitoring of system behavior, ensuring that another incident will not be created by the recovery process. **Follow-up:**

Documenting lessons learned, preparatory activities for similar future incidents, technical training, and process improvement. (8 Hours)

Unit – 5
Advanced computer network defense: vulnerability and threat management, threat intelligence and situational awareness, tools and processes, frameworks (ATT&CK, Cyber Kill Chain, etc.), threat hunting, information sharing Planning and running incident response team exercises.

Textbooks:
1. Ten Strategies of a World-Class Cybersecurity Operations Center, Carson Zimmermann, The MITRE Corporation, 2014. Free e-book available from https://www.mitre.org/publications/all/ten-strategies-of-a-world-class-cybersecurity-operations-center
2. Jason T. Luttgens and Matthew Pepe, "Incident Response & Computer Forensics, Third Edition"

References:
1. Don Murdoch, "Blue Team Handbook: Incident Response Edition: A condensed field guide for the Cyber Security Incident Responder".
2. Leighton Johnson, "Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response"

MTCSPE105C	Program Elective –I	Mobile Application Security	Credits 04

Course Objectives:
This course will enable students to:
1. To learn about securing wireless networks
2. To Identify and analyze various the security issues in wireless mobile communication
3. To learn various issues of application-level security in wireless environment and its related solution.

Course Outcomes:
The students will be able to:
CO1: Identify the requirement of security and various issues at wireless and mobile network.
CO2: Analyze the threats in wireless environment including device, networks and servers.
CO3: Distinguish the attacks at various protocols in wireless network and differentiate the solution required for them.
CO4: Assess the security requirement for mobile adhoc environment, ubiquitous environment.

Unit – 1
Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective. **Security Issues in Mobile Communication**: Mobile Communication History, Security Wired Vs Wireless, Security Issues in Wireless and Mobile Communications (8 Hours)

Unit – 2
Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks - Application of WLANs, Wireless Threats, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications. (8 Hours)

Unit– 3
Application-Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM,GPRS and UMTS security for applications, 3G security for applications (8 Hours)

Unit– 4
Application-Level Security in Ubiquitous Networks: Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC (8 Hours)

Unit – 5

Application Level Security in Heterogeneous Wireless Networks: Heterogeneous Wireless network architecture, Heterogeneous network application in disaster management, Security problems and solutions in heterogeneous wireless networks. (8 Hours)

Textbooks:
1. Pallapa Venkataram, Satish Babu, Wireless and Mobile Network Security, First Edition, Tata McGraw Hill, 2010.
2. Hakima Chaouchi, Maryline Laurent-Maknavicius, Wireless and Mobile Network Security Security Basics, Security in On-the-shelf and Emerging Technologies, Wiley, 2009.

References:
1. Tara M. Swaminathan and Charles R. Eldon, Wireless Security and Privacy- Best Practices and Design Techniques, Addison Wesley, 2002.

| MTCSPE105D Program Elective –I Coding and Information Theory | Credits 04 |

COURSE OBJECTIVES:
1. Covers information theory and coding within the context of modern digital communications applications.

2. To help students in quantify the notion of information in a mathematically and intuitively sound way.

3. Explaining how this quantitative measure of information may be used in order to build efficient solutions to multitudinous engineering problems

COURSE OUTCOMES: By the end of the course students will
1. Learn various coding methods.

2. Learn various error control methods.

SYLLABUS
Unit I
Source Coding - Introduction to information theory, uncertainty and information, average mutual information and entropy, source coding theorem, Shannon-fano coding, Huffman coding, Arithmetic coding, Lempel-Ziv algorithm, run-length encoding and rate distortion function.
Unit II
Channel capacity and coding - channel models, channel capacity, channel coding, information capacity theorem, random selection of codes. Error control coding: linear block codes and their properties, decoding of linear block code, perfect codes, hamming codes, optimal linear codes and MDScodes.
Unit III
Cyclic codes - polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, burst error correction, fire codes, golay codes, CRC codes, circuit implementation of cyclic codes. BCH codes: minimal polynomials, generator polynomial for BCH codes, decoding of BCH codes, Reed-Solomon codes and nested codes.
Unit IV
Convolutional codes - tree codes and trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, generation function, matrix description of convolutional codes, Viterbi decoding of convolutional codes, distance bounds for convolutional codes, turbo codes and turbo decoding.
Unit V

Trellis Coded Modulation - concept of coded modulation, mapping by set partitioning, ungerboeck's TCM design rules, TCM decoder, Performance evaluation for Additive White Gaussian Noise (AWGN) channel, TCM for fading channels.

REFERENCES:

1. Lin S. and D. J. Costello, "Error Control Coding — Fundamentals and Applications", Second Edition, Pearson Education Inc., NJ., USA, 2004.

2. Shu Lin and Daniel J. Costello, "Error Control Coding", Second Edition, Prentice Hall, 1983.

3. E. R. Berlekamp, "Algebraic Coding Theory", McGraw-Hill, New York, 1968.

3. R. E. Blahut, "Algebraic Codes for Data Transmission", Cambridge University Press Cambridge, UK, 2003.

4. Ranjan Bose, "Information theory, coding and cryptography", Tata McGraw Hill, 2002.

5. Viterbi, "Information theory and coding", McGraw Hill, 1982.

6. John G. Proakis, "Digital Communications", 2nd Edition, McGraw Hill, 1989

MTCSPE105E	Program Elective –I Cryptographic Protocols and Standards	Credits 04

COURSE OBJECTIVES:
1. To provide learners with the concepts of symmetric and asymmetric cipher models.
2. To enable learners to understand fundamental concepts of authentication.

COURSE OUTCOMES: At the end of the course, students will be able
1. To explain classical encryption techniques.
2. To demonstrate encryption techniques and key exchange methods.
3. To differentiate between types of cryptosystems.
4. To compare various authentication techniques and signature schemes.

Syllabus

Unit I
Introduction to concepts of security, Cryptographic goals, Classical encryption techniques: Shift cipher, Substitution cipher,Vigenere cipher, Hill cipher, Permutation cipher, Stream ciphers, LFSR, Cryptanalysis of Vigenere cipher and LFSR.

Unit II
Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, Feistel cipher, Data Encryption Standard, 3- DES, Advanced Encryption Standard and Modes of operation, IDEA

Unit III
Hash Functions and Data Integrity: Classification and framework, Cryptographic hash functions, message authentication code, Hash based MAC, Case study: SHA 256. Introduction to Public Key Cryptography: Integer factorization problem, Discrete logarithm problem.

Unit IV
Public key cryptosystems- RSA cryptosystem, Attacks on RSA, Diffie-Hellman Key agreement scheme, ElGamal cryptosystem,

Unit V
Elliptic curve cryptography. Signature schemes: RSA signature, Digital Signature Algorithm, ECDSA. X.509 certification standard.

REFERENCES:
1. William Stallings, Cryptography and Network Security, Pearson Education, 2014.
2. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill. 2010.

3. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network security", 2nd edition, Pearson India Education Services.
4. Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC Press, 1996.
5. Abhijith Das and C.E. VeniMadha van, "Public-key Cryptography, Theory and Practice", Pearson Education, 2009.

MTCSPE106A	Program Elective –II	Security Assessment and Verification	Credits 04

Course outcomes: At the end of the course the student will be able to:
CO1: Illustrate the roles information security and its management
CO2: Select appropriate techniques to tackle and solve problems in the discipline of information security assessment
CO3: Design an information security and validation system

Unit-1
Evolution of information security: information assets, security standards, organizational impacts, security certifications, elements of information security program, need for security assessment, security assessment process.
Unit- 2
Security assessment planning: Business drivers, scope definition, consultant's perspective, Client's perspective, Development of project plan. Initial information gathering, Initial preparation, analysis of gathered information.
Unit- 3
Business process evaluation, Technology evaluation, Risk analysis, Risk mitigation.
Unit- 4
Security Risk assessment project management, Security risk assessment approaches and methods.
Unit- 5
Information security standards, Information security Legislation, Formal security verification, Security verification with SSL.

Textbook/ Textbooks
1. Sudhanshu Kairab , A practical assessment guide to security, CRC press, 2005.
2. Douglas J. Landoll, A Security Handbook risk assessment, Auerbach publications, 2006.

MTCSPE106B	Program Elective –II	Database Security	Credits 04

Course outcomes: At the end of the course the student will be able to:
CO1: Carry out a risk analysis for a large database
CO2: Implement identification and authentication procedures, fine-grained access control and data encryption techniques
CO3: Set up accounts with privileges and roles
CO4: Audit accounts and the database system
Unit -1

Introduction: Introduction to Databases, Security Problems in Databases Security Controls Conclusions. Security Models 1: Introduction, Access Matrix Model, Take-Grant Model, Acten Model, PN Model, Hartson and Hsiao's Model, Fernandez's Model, Bussolati and Martella's Model for Distributed databases.

Unit - 2

Security Models 2: Bell and LaPadula's Model, Biba's Model, Dion's Model, Sea View Model, Jajodia and Sandhu's Model, The Lattice Model for the Flow Control conclusion.Security Mechanisms: Introduction, User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms, Isolation, Security Functionalities in Some Operating Systems, Trusted Computer System, Evaluation Criteria.

Unit- 3

Security Software Design: Introduction, A Methodological Approach to Security, Software Design, Secure Operating System Design, Secure DBMS Design, Security Packages, Database Security Design.

Unit- 4

Statistical Database Protection & Intrusion Detection Systems: Introduction, Statistics, Concepts and Definitions, Types of Attacks, Inference Controls, evaluation Criteria for Control Comparison, Introduction IDES System, RETISS System, ASES System Discovery.

Unit- 5

Models For The Protection Of New Generation Database Systems 1: Introduction, A Model for the Protection of Frame Based Systems, A Model for the Protection of Object-Oriented Systems, SORION Model for the Protection of Object-Oriented Databases. Models For The Protection Of New Generation Database Systems 2: A Model for the Protection of New Generation Database Systems, the Orion Model, Jajodia and Kogan's Model, A Model for the Protection of Active Databases Conclusions.

Textbook/ Textbooks

1. Hassan A. Afyoun, Database Security and Auditing, CENGAGE Learning, 2009.
2. Castano, Database Security, Pearson Education

References:
1. Alfred Basta, Melissa Zgola, Database security, CENGAGE learning

| MTCSPE106C | Program Elective –II | Software Metrics & Quality Assurance | Credits 04 |

Course outcomes: At the end of the course the student will be able to:

CO1: Identify and apply various software metrics, which determines the quality level of software

CO2: Identify and evaluate the quality level of internal and external attributes of the software product

CO3: Compare and Pick out the right reliability model for evaluating the software

CO4: Evaluate the reliability of any given software product

CO5: Design new metrics and reliability models for evaluating the quality level of the software based on the requirement

Unit-1

What Is Software Quality: Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management and Summary. **Fundamentals Of Measurement Theory:** Definition, Operational Definition, And Measurement, Level Of Measurement, Some Basic Measures, Reliability And Validity, Measurement Errors, Be Careful With

Correlation, Criteria For Causality, Summary. **Software Quality Metrics Overview:** Product Quality Metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples For Metrics Programs, Collecting Software Engineering Data.

Unit -2

Applying The Seven Basic Quality Tools In Software Development: Ishikawa's Seven Basic Tools, Checklist, Pareo Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause and Effect Diagram. **The Rayleigh Model:** Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity.

Unit – 3

Complexity Metrics And Models: Lines Of Code, Halstead's Software Science, Cyclomatic Complexity Syntactic Metrics, An Example Of Module Design Metrics In Practice .**Metric And Lessons Learned For Object Oriented Projects:** Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object oriented Projects.

Unit-4

Availability Metrics: Definition And Measurement Of System Availability, Reliability Availability And Defect Rate, Collecting Customer Outage Data For Quality Improvement, In Process Metrics For Outage And Availability .**Conducting Software Project Assessment :**Audit Ad Assessment , Software Process Maturity Assessment And Software Project Assessment , Software Process Assessment A Preponed Software Project Assessment Method.

Unit -5

Dos And Don'ts Of Software Process Improvement : Measuring Process Maturity, Measuring Process Capability, Staged Versus Continuous Debating Religion, Measuring Levels Is Not Enough, Establishing The Alignment Principle , Take Time Getting Faster, Keep it Simple Or Face Decomplexification, Measuring The Value Of Process Improvement, Measuring Process Compliance, Celebrate The Journey Not Just The Destination. **Using Function Point Metrics to Measure Software Process Improvement: Software** Process Improvement Sequences, Process Improvement Economies, Measuring Process Improvement at Activity Levels

Textbooks:

1. Stephen H Khan, Metrics and Models in Software Quality Engineering, Pearson 2nd edition, 2013.

References:

1. Norman E-Fentor and Share Lawrence Pflieger, Software Metrics, International Thomson Computer Press 1997.
2. S.A.Kelkar, Software quality and Testing Market,. PHI Learning, Pvt, Ltd 2012
3. Watts S Humphrey, Managing the Software Inc,. Process Pearson Education, 2008.
4. Mike Konrad and Sandy, CMMI Pearson Education (Singapore), 2003.

MTCSPE106D	Program Elective –II	Operating System Security	Credits

Course outcomes:

At the end of the course the student will be able to:

CO1: Gain the knowledge of fundamental concepts and mechanisms for enforcing security in OS.

CO2: Analyze how to build a secure OS by exploring the early work in OS.

CO3: Identify and compare different formal security goals and variety of security models proposed for development of secure operating systems.

CO4: Interpret architectures of various secure OS and retrofitting security feature on existing commercial OS's.

CO5: Shows variety of approaches applied to the development & extension services for securing operating systems.

Unit -1

Introduction: Secure OS, Security Goals, Trust Model, Threat Model, Access Control. Fundamentals: Protection system, Lampson's Access Matrix, Mandatory protection system.

Unit- 2

Multics: Fundamentals, multics protection system models, multics reference model, multics security, multics vulnerability analysis.

Unit- 3

Security in ordinary operating system: UNIX security, windows security Verifiable security goals: Information flow, information flow secrecy, models, information flow integrity model, the challenges of trusted, process, covert channels.

Unit 4

Security Kernels: The Security Kernels, secure communications, processor Scomp, Gemini secure OS, Securing commercial OS, Retrofitting security into a commercial OS, History Retrofitting commercial OS, Commercial era, microkernel era, UNIX era- IX, domain and type enforcement.

Unit - 5

Case study: Solaris Extensions Trusted extensions, access control, Solaris compatibility, trusted extensions, mediations process rights management, role based access control, trusted extensions, networking trusted extensions, multilevel services, trusted extensions administration.

Case study: Building secure OS for Linux: Linux security modules, security enhanced Linux.

Textbooks:

1. Trent Jaeger, Operating system security, Morgan & Claypool Publishers, 2008.
2. Michael Palmer, Guide to Operating system Security, Thomson, 2009.

MTCSPE106E	Program Elective –II	Cognitive Security	Credits 04

Course Outcomes: At the end of this course, students are able to:

CO1: Correlate the AI and solutions to modern problem.

CO2: Decide when to use which type of AI technique.

Unit-1

Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

Unit-2

Emotion Recognition using human face and body language, AI based system to predict the diseases early, Smart Investment analysis, AI in Sales and Customer Support.

Unit-3

Robotic Processes Automation for supply chain management.
Unit-4
AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology &Security using AI.
Unit-5
Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Block chain and AI.

Textbooks:
1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.
3. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, 2018.
4. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, 2017.

MTCSAU108	YOGA for Stress Management	Audit

Course Objectives:
    1.Understand the physiological and psychological aspects of stress and its impact on overall well-being.
    2.Learn and practice specific yoga postures, breathing exercises, and relaxation techniques to alleviate stress.
    3.Explore the connection between mindfulness, meditation, and stress reduction, fostering mental clarity.
    4.Discover holistic practices that promote better sleep, nutrition, and overall lifestyle habits for stress management.
    5.Develop practical skills to manage stress in daily life, enhancing resilience and promoting emotional balance.

Course Outcomes:
    1.Recognize the signs and sources of stress, understanding its effects on mental and physical well-being.
    2.Master a variety of yoga techniques, including postures, breathing, and meditation, to effectively manage stress.
    3.Acquire relaxation strategies that promote calmness, reduce anxiety, and enhance overall mental clarity.
    4.Incorporate healthy habits inspired by yoga principles to foster better sleep, nutrition, and self-care routines.
    5.Develop practical skills to navigate and cope with stress, enhancing emotional balance and promoting a more harmonious life.

UNIT I
Introduction to Yoga for Stress Management - 1 Introduction to Yoga for Stress Management - 2 Stress according to Western perspective
Stress Eastern Perspective
Developmental process: Western and Eastern Perspective Stress Hazards and Yoga

UNIT II
Meeting the challenges of Stress - 1 Meeting the challenges of Stress - 2 Introduction to Stress Physiology

Stress, Appetite and Dietary management- Modern and Yogic perspective
Sleep and Stress: understanding the relationship for effective management of stress

UNIT III

Stress Assessment methods- a valuable tool toward stress management
Role of Yoga in prevention and management of stress related disorders – a summary of research evidence
Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 1 Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 2 Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 3

UNIT IV

Concept of stress and its management - perspectives from Bhagavad Gita - Part 1 Concept of stress and its management - perspectives from Bhagavad Gita - Part 2 Concept of stress and its management - perspectives from Bhagavad Gita - Part 3

UNIT V

Bio-Psycho-Socio-Spiritual model of stress management Yoga practices for Stress Management Breathing practices – 1 Hands in and out breathing, Hands stretch breathing, Ankle stretch breathing Breathing practices – 2Dog Breathing, Rabbit breathing, Tiger breathing, Sashankasana breathing Breathing practices – 3
Bhujangasana breathing, Ardha Shalabhasana breathing (alternate legs), Straight leg raising (alternate legs), Straight leg raising (both legs), Sethubandhasana lumbarstretch, Instant Relaxation Technique (IRT)Loosening Practices – 1
Shoulder Rotation, Side bending, standing twist, Hip rotation, Thigh strengthening Loosening practices – 2 Chakki chalan, Bhunamasana Chalana, Alternative toe touching Loosening practices – 3 Side leg raising, Pavana muktasana kriya: Wind releasing pose movements, Quick Relaxation Technique (QRT)

UNIT VI

Asana practices – 1
Tadasana, Ardhakati Chakrasana, Ardha Chakrasana, Trikonasana, Vrikshasana Asana practices – 2 Vakarasana, Janu Sirshasana, Ushtrasana, Sashankasana, Asana practices – 3 Ardhamatseyndrasana, Paschimottanasana, Poorvottanasana, Gomukhasana Asana practices – 4 Makarasana, Bhujangasana, Salambha Shalabahasana, Dhanurasana Asana practices – 5 Setubandhasana, Sarvangasana, Mastyasana, Deep Relaxation Technique (DRT) Soorya Namaskar Pranayama – 1
Kapalbhati kriya and Sectional Breathing Pranayama – 2 Nadishuddhi Pranayama Pranayama – 3 Bhramari, Sheetali, Sitkari and Ujjayi Om Meditation
Cyclic Meditation Integrated Yoga Module I Integrated Yoga Module II Integrated Yoga Module III

Textbooks / References:
1. H R Nagendra and R Nagarathna. Yoga for Promotion of Positive Health. Swami Vivekananda Yoga Prakashana. 2011.
2. Contrada, R., & Baum, A. (Eds.). The handbook of stress science: Biology, psychology, and health. Springer Publishing Company. 2010
3. Al'Absi, M. (Ed.). Stress and addiction: Biological and psychological mechanisms. Elsevier. 2011.
4. Van den Bergh, O. Principles, and practice of stress management. Guilford Publications. 2021.

5. Swami Muktibodhananda, Hatha Yoga Pradipika, Bihar Scool of Yoga, 1998
6. Swami Satyananda Saraswati, Four Chapters on Freedom, Bihar Scool of Yoga, 1975
7. Swami Tapasyananda, Srimad Bhagavat Gita, Sri Ramakrishna Math, 2012

SEMESTER II

MTCSPC201	Applied Cryptography	Credits 04

Course Objectives:
This course will enable students to:
1. Explain standard algorithms used to provide confidentiality, integrity and authenticity.
2. Distinguish key distribution and management schemes.
3. Deploy encryption techniques to secure data in transit across data networks
4. Implement security applications in the field of Information technology.

Course Outcomes:
The students will be able to:
CO1: Apply the OSI security architecture and classical encryption techniques for simple applications.
CO2: Compare various cryptographic techniques.
CO3: Analyze the vulnerabilities in any computing system.
CO4: Evaluate security mechanisms using rigorous approaches, including theoretical.

Unit – 1
Introduction: Significance and Scope of the course, Importance of the course in societal, political, and economic growth of the nation. Impact of the course on societal and ethical issues and career perspective.
Overview of Cryptography: Introduction, Information security and cryptography, Basic terminology and concepts, Symmetric key encryption, Digital signatures, Public-key cryptography, Hash functions, Protocols and mechanisms, Key establishment, management, and certification, Pseudorandom numbers and sequences, Classes of attacks and security models. (8 Hours)

Unit – 2
Symmetric & Asymmetric Cryptography: Classical encryption techniques, Block cipher design principles and modes of operation, Data encryption standard, Evaluation criteria for AES, AES cipher, Principles of public key cryptosystems, The RSA algorithm, Key management – Diffie Hellman Key exchange, Elliptic curve arithmetic-Elliptic curve cryptography. (8 Hours)

Unit – 3
Mathematical Background: Probability theory, Information theory, Complexity theory, Number theory, Abstract algebra, Finite fields, The integer factorization problem, The RSA problem, The Diffie-Hellman problem, Composite moduli.
Number Theory: Introduction to number theory, Overview of modular arithmetic, discrete logarithms, and primality/factoring, Euclid's algorithm, Finite fields, Prime numbers, Fermat's and Euler's theorem- Testing for primality, A quick introduction to groups, rings, integral domain and fields. (8 Hours)

Unit – 4

Geometric Extensions: Fields, Characteristic of a field, prime fields, Arithmetic of polynomials over fields. Field extensions, Galois group of a field extensions, Fixed field and Galois extensions. Minimum polynomial, Construction of fields with the help of an irreducible polynomial. Splitting field of a polynomial, Separable polynomial and Separable extensions. Construction of finite fields and their structure. Enumeration of irreducible polynomials over finite fields. Fundamental theorem of Galois Theory. Cyclotomic extensions, Geometric constructions and Galois theory of Equations (Statement only of Abel Ruffini), Solving Cubic and Bi-quadratic polynomials using radicals.   (8 Hours)

Unit – 5

Quantum Cryptography and Quantum Teleportation: Heisenberg uncertainty principle, polarization states of photons, quantum cryptography using polarized photons, local vs. nonlocal interactions, entanglements, EPR paradox, Bell's theorem, Bell basis, teleportation of a single qubit theory and experiments.   (8 Hours)

Textbooks:
> 1.   Alfred J. Menezes, Paul C. vanorschot and Scott A. Vanstone, "Handbook of Applied Cryptography" CRC Press.
> 2.   Neal Koblitz, A Course in Number Theory and Cryptology, Springer 1987.
> 3.   William Stallings, Cryptography and Network Security Principles and Practice, 6th edition, 2019.

References:
> 1.   Damien Vergnaud and Michel Abdalla, Applied Cryptography and Network Security, 7th International Conference, ACNS 2009, Paris-Rocquencourt, France, June 2-5, 2009, Proceedings.
> 2.   B. Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", 2nd Edition, John Wiley & Sons, 1995.
> 3.   Mihir Bellare and Phillip Rogaway, "Introduction to Modern Cryptography", 2005.

MTCSPC202	Cyber Forensics and Cyber Laws	Credits 04

Course Objectives:
This course will enable students to:
1. Gain knowledge of the various aspects of cyber security and law aspects.
2. Understand effective mechanisms for forensics applications
3. Identify issues in detection and investigation of Cyber Crime.
4. Learn various acts related to cyber security world.

Course Outcomes:
The student will be able to
CO1: Demonstrate cyber security cybercrime and forensics.
CO2: Illustrate evidence collection and legal challenges
CO3: Analyze the cybercrime with the support tools and methods.
CO4: Examine possible research opportunities and challenges within the cyber laws and security.

Unit – 1

Introduction: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.   (8 Hours)

Unit – 2

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops (8 Hours)

Unit – 3

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).(8 Hours)

Unit – 4

Understanding Computer Forensics: Introduction, Historical Background of Cyber-forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber-forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti-forensics. (8 Hours)

Unit – 5

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual

Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License. (8 Hours)

Textbooks

1. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt Ltd 2013.

2. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, Introduction to information security and cyber laws, Dream tech Press 2015.

References:

5. Thomas J. Mowbray, Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, John Wiley & Sons.

MTCSPE203A   Program Elective-III   Cyber Security Essentials   Credits 04

Course Objectives:
This course will enable students to:
1. Gain knowledge of the various aspects of network architecture and protocols, Network performance
2. Understand effective communication mechanisms
3. Students will learn about the issues in 802.11 LANs
4. Learn various congestion control algorithms.

Course Outcomes:
The student will be able to
CO1: Apply various protocols to develop applications using the sockets API.
CO2: Demonstrate effective communication mechanisms in computer networks
CO3: Analyze the concepts and issues in Mobile and Wireless Networks.
CO4: Examine possible research opportunities and challenges within the network application and security

Unit – 1
Introduction: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait ,Sliding Window, Concurrent Logical Channels.   (8 Hours)

Unit – 2
Internetworking I: Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP.   (8 Hours)

Unit-3
Security Essentials:
Network Security: Internet Architecture, Network Protocols and Vulnerability, Application-Layer Security- Public Key Infrastructure, DNS Security Extensions, Hyper Text Transfer Protocol Secure (HTTPS), Network Time Protocol (NTP) Security, Transport-Layer Security- Handshake, Key-Derivation, Data-Transfer, Quick UDP Internet Connections (QUIC), Network Layer Security - IP Masquerading, IPv6 Security- Routing Protocol Security, Border Gateway Protocol (BGP) Security   (8 Hours)

Unit– 4
Cryptographic Building Blocks, Principles of Ciphers, Symmetric-Key Ciphers, Public-Key Ciphers, Authenticators, key Pre-distribution, Pre-distribution of Public Keys, Pre-distribution of Symmetric Keys, Authentication Protocols, Originality and Timeliness Techniques   (8 Hours)

Unit – 5

Authentication and others: Public-Key Authentication Protocols, Symmetric-Key Authentication Protocols, Diffie-Hellman Key Agreement, Example Systems, Pretty Good Privacy (PGP),Secure Shell (SSH), Transport Layer Security (TLS, SSL, HTTPS),IP Security (IPsec), Wireless Security (802.11i),Firewalls, Strengths and Weaknesses of Firewalls

(8 Hours)

Textbooks

1. Larry Peterson and Bruce S Davis "Computer Networks: A System Approach", 5 Edition, Elsevier 2014.
2. CyBoK, The Cyber Security Book of Knowledge, Oct 2019.

References:

1. Uyless Black, "Computer Networks, Protocols, Standards and Interfaces" 2nd Edition PHI.
2. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture", 6th Edition, PHI – 2014.
3. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4th Edition – Tata McGraw-Hill.
4. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e, Pearson Education, 2012.

MTCSPE203B   Program Elective-III   Ethical Hacking and Digital Forensics Credits 04

Unit -1
Introduction: Objective, scope and outcome of the course
Unit -2
Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks - Privacy attacks.
Unit -3
TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models. Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming.
Unit -4
Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process. Architecture strategies for computer fraud prevention – Protection of Web sites – Intrusion detection system – NIDS, HIDS – Penetrating testing process – Web Services – Reducing transaction risks.
Unit -5
Key Fraud Indicator selection process customized taxonomies – Key fraud signature selection process –Accounting Forensics – Computer Forensics – Journaling and it requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and Novelty detection.

TEXT BOOK
1 Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications Taylor & Francis Group, 2008.
2 Ankit Fadia " Ethical Hacking" 2nd Edition Macmillan India Ltd, 2006

MTCSPE203C   Program Elective-III   Intrusion Detection System   Credits 04

Unit -1
Introduction: Objective, scope and outcome of the course.
Unit -2

History of Intrusion detection, Audit, Concept and definition , Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

Unit -3 Intrusion Prevention Systems, Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques Responses requirement of responses, types of responses mapping responses to policy Vulnerability analysis, credential analysis non-credential analysis.

Unit-4 Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

Unit- 5 Working with Snort Rules, Rule Headers, Rule Options, and the Snort Configuration File etc. Plug-ins, Preprocessors and Output Modules, Using Snort with My SQL. 05 6 Using ACID and Snort Snarf with Snort, Agent development for intrusion detection, Architecture models of IDs and IPs.

TEXT BOOK

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.
2. Christopher Kruegel,Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
3. Carl Endorf, Eugene Schultz and Jim Mellander "Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
4. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
5. T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment". 6th Edition, KhannaPublihsers, 2012.

MTCSPE203D	Program Elective-III Block Chain & Cyber Security	Credits 04

Unit-1

Introduction: Objective, scope and outcome of the course. Introduction Block chain: History, Definition, Types of Block chain, Hash Functions, Properties of Hash Function, Digital Signature, Working of Block chain, Issues and needs of Block chain, Benefits and Challenges of Block chain, features of Block chain, Block chain Network and Nodes, Peerto-Peer Network

Unit-2

Block chain Architecture: Mining Mechanism, Life cycle of Block chain, Merkle Patricia Tree, Gas Limit, Transaction Fees, Anonymity, Reward, Chain policy, Applications of Block chain, Fork and its Types, Generic elements of Block chain, Cryptography in Block chain, Nash Equilibrium, Prisner's Dilemma, ZeroSum Games.

Unit-3

Introduction to Cybercrime and Laws: Definition and Origins of Cybercrime, information Security, Who are Cybercriminals? Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cyber-cafe and Cybercrimes, Bot-nets, Attack Vector, The Indian IT ACT 2000 and amendments

Unit- 4

Tools and Methods used in Cybercrime : Introduction, Proxy Server and Anonymizers, Password Cracking, Key-loggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow. Phishing and Identity Theft: Introduction, Phishing - Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics

Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Unit -5

Network Defense tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs. Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System.

TEXT BOOK

1 Dejey Nurugan: Cyber forensics, Oxford University Press

2 Jennifer L. Bayuk: Cyber Security, Policy Guide Book, Wiley Publisher

3 Nina Godbole: Cyber Security, Wiley Publisher, Latest Edition

4 Hands-On Cyber security with Block chain by Rajneesh Gupta, Packt Publication, June 2018, ISBN9781788990189.

MTCSPE203E Program Elective-III   Malware Analysis and Network Security Credits

Unit I

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks,

Unit II

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism

Unit III

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

Unit IV

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection, YARA rule based detection Unit V Android Malware Analysis: Android architecture, App development cycle, APK Tool, APK Inspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies,

Unit V

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies,

Books recommended:

1. "Practical Malware Analysis" by Michael Sikorski and Andrew Honig
2. "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition by Reverend Bill Blunden
3. "Rootkits: Subverting the Windows Kernel" by Jamie Butler and Greg Hoglund

4. "Practical Reverse Engineering" by Dang, Gazet, Bachaalany
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015
6. Android Malware and Analysis by Dunham Ken, CRC Press

MTCSPC205L	**Offensive Security Laboratory**	**Credits 02**

Course Objectives:
This course will enable students to:
1. To provide skills for designing and analyzing IOT Concepts.
2. To enable students to work on various IOT sensor.
3. To provide skills to work towards solution of real-life problems
Course Outcomes: The students will be able to:
CO1: Familiarization with cyber kill-chain (Reconnaissance, Scanning and Enumeration, Exploitation, Privilege escalation, Maintaining access etc)
CO2: Understanding the usage of industry standard tools used as a part of the VAPT process such as Metasploit, nmap, Nessus.
CO3: Ability to perform pentest a target and generate a report based on the test.

List of Experiments-PART A

1. Cyber-kill chain: Reconnaissance and Information Gathering : OSINT, Breached credentials, Subdomain brute forcing, Directory scanning.
2. Scanning and Enumeration : Scanning and exploiting open ports and services, Scanning for potential exploits in public vulnerability databases.
3. Exploitation Basics : Metasploit, Gaining access to machines using vulnerabilities, Custom exploitation scripts, Password brute forcing, Password spraying.
4. Active Directory : LLMNR poisoning, SMB relays, IPv6 DNS takeovers, pass-the-hash/pass-the- password, token impersonation, kerberoasting, GPP attacks, golden ticket attacks.
5. Maintaining access : Reverse shell, file transfer. Web Application Penetration Testing. Automated Vulnerability scanners: Nessus, NMap, Metasploit, Acunetix.
6. Report Writing : Statements of Work, Rules of Engagement, Non-Disclosure Agreements, and Master Service Agreements

Textbooks:
1. Bugcrowd, "The Ultimate Guide to Penetration Testing", 2020 edition
2. HackerOne, "Web hacking 101"

MTCSOE204A	New Labour Codes of India	Credits 03

Course Objectives:
1. Gain a clear understanding of the key Labour Codes, namely the Code on Wages, Code on Social Security, Code on Occupational Safety, Health, and Working Conditions, and the Industrial Relations Code.
2. Explore the legal structure and scope of each Labour Code, understanding their applicability to different categories of workers and industries.
3. Examine the provisions related to wages, including wage definitions, payment structures, deductions, and methods for calculating wages
4. Analyse the components of social security as outlined in the Code on Social Security, including provident funds, health insurance, maternity benefits, and pensions.
5. Explore the mechanisms for resolving disputes and conflicts between employers and employees, including the role of labour courts, tribunals, and the appellate process.

Course Outcomes:
1. Understand the historical context and reasons behind the overhaul of labour laws in India.
2. Analyze the economic, social, and administrative motivations driving the implementation of the new labour codes.
3. Evaluate the impact of the new Industrial Relations Code on trade unions, collective bargaining, and dispute resolution mechanisms.
4. Analyze the potential effects of these provisions on both workers and employers.
5. Speculate on the possible evolution of labour practices and employer-employee relations in response to these codes.

UNIT I
History of Labour Laws
Introduction, Government Policies, History of Labour Laws in the Country, History: Previous Social Legislations in India, National Labour Commission Reports

UNIT II
Trade Unions
Evolution of Trade Unions in India, Constitutional Freedom to Form Association and Unions, International Labour Organization on Trade Unions, Trade Union – Definition, Registration, Cancellation, Management of Funds, Trade Union – Recognition, Immunities.

UNIT III
Strikes & Layoffs
Industrial Dispute – Introduction, Definitions, Resolution of Industrial Disputes, Concept of Workmen, Contract of service, Contract for service, Strike, Lock-out, Retrenchment, Closure of Undertakings, Industrial Employment (Standing Orders), Disciplinary Action and Procedures**.**

UNIT IV
Payment of Wages
The Code on Wages 2019 – An Introduction, Minimum Wages, Floor Wages, Central and State Advisory Board, Payment of Wages, Deductions & Recovery, Fines, Equal Remuneration, Bonus, Minimum Wage Fixing Convention, 1970, Protection of Wages Convention, 1949, Equal Remuneration Convention, 1951: International Instruments on Equality of Pay, Protection of Workers' Claims (Employer's Insolvency) Convention, 1992, Discrimination (Employment and Occupation) Convention, 1992

UNIT V
Social security & Insurance
Employees State Insurance, Different Benefits under the ESI Scheme, Employee's Provident Fund, Gratuity, Maternity Benefit, Social Security in case of Building and other Construction Workers, Social Security for Unorganized sector and Platform workers, Bonded Labour System Abolition and Regulation, Child Labour Prohibition, Plantation Labour.

UNIT VI
Factories & various types of workers
The Meaning of Factory, Manufacturing Process, Approval and Licensing of Factories, Role of Inspector-cum-facilitator and Other Authorities, Social Security Fund, Offences and Penalties, Contract Labour and Proposed ILO Convention, Inter-State Migrant Workers**,** Mines Workers, Beedi and Cigar Workers (Kerala & West Bengal Legislations), Audio- Visual workers, Cine-workers and Dock workers, The Effective Abolition of Child Labour (ILO: C029, C105, C138 & C182), The Governance Convention of ILO Labour Standards.

Textbooks / References:
1. Labour Law (Taxman)
2. E-book of the Ministry of Labour and Employment - https://labour.gov.in/e-book-1
3. Reading material prepared by the Course Co-ordinator.
4. Avtar Singh and Harpreet Kaur, Introduction to Labour and Industrial Laws, 2nd ed., Lexis Nexis Butterworths Wadhwa.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
New Labour Codes of India	Prof. KD Raju	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc23_lw05/preview

MTCSOE20B   Urban Utilities Planning: Water Supply, Sanitation and Drainage redits 03

Course Objectives:
1. To develop a clear understanding of the significance of water supply, sanitation, and drainage systems in urban areas.
2. To explore different sources of water supply for urban areas, including surface water, groundwater, and treated wastewater.
3. To delve into various sanitation systems, such as sewerage networks, on-site sanitation solutions, and wastewater treatment plants.

4. To learn about hydraulic calculations, pipe sizing, pump station design, and related technical aspects.

Course Outcomes:
1. Students should be able to demonstrate a clear understanding of the fundamental concepts related to water supply, sanitation, and drainage systems in urban settings.
2. Students should be capable of applying design principles to develop efficient and sustainable water supply, sanitation, and drainage systems that meet the needs of urban populations while considering factors such as population growth, climate change, and land use.
3. Students should be able to outline strategies for the effective management, operation, and maintenance of water supply, sanitation, and drainage infrastructure to ensure long-term sustainability and functionality.

UNIT I
Urban Utilities
Urban utilities planning: Introduction, Urban Water Supply, Collection of water.

UNIT II
Water Storage & Distribution
Pumping and storage, Water supply Distribution system and Plans, Water Quality, testing, treatment, and cost.

UNIT III
Sanitation
Sanitation and Drainage Fundamentals, Water carriage system, Sewer design,

UNIT IV
Sewage treatment
Sewer appurtenances and master plans, Sewage treatment, drainage, and recharge

Textbooks / References:
1. Water Supply Engineering, S. K. Garg (18th ed.), Khanna Publishers.
2. Water Supply and Sanitary Engineering, G. S. Birdie & J. S. Birdie (8th ed.), Dhanpat Rai Publishing Company, New Delhi.
3. Stormwater drainage manual Planning, Design and Management, Drainage services department, Government of the Hong Kong Special Administrative Region.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Urban Utilities Planning: Water Supply, Sanitation and Drainage	Prof. Debapratim Pandit	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc23_ar08/preview

MTCSOE204C	Environment and Development	Credits 03

Course Objectives:
1. To help students comprehend the complex interconnections between environmental factors and development processes, highlighting how they can either support or impede each other.
2. To identify and analyze key environmental challenges arising from development activities, such as pollution, resource depletion, deforestation, loss of biodiversity and climate change.
3. To study the effect of climate change on environment.
4. To analyze real-world case studies of both successful and unsuccessful attempts to integrate environmental considerations into development projects and policies

Course Outcomes:
1. Demonstrate a deep understanding of the complex interrelationships between environmental factors and socioeconomic development, including how they influence and shape each other.
2. Identify and critically analyze key environmental challenges resulting from development activities, and evaluate their impacts on ecosystems, natural resources, and human well-being.

UNIT I
Environmental movement
Introduction: Development, economic growth and sustainable development, Basic ecosystem ecology, Environmentalism, Environmental Movement, Environmentalism in the global south,

UNIT II
Social ecology
Approaches to environment: Ecofeminism, Feminist political ecology, Marxism and ecology, Debates on environmental ethics: Deep ecology, Gandhi and ecology, social ecology.

UNIT III
Impact of Religion on environment
Religion, environment, and conservation: Religion, environment and historical roots of ecological crisis, Biodiversity conservation ethics in Buddhism and Hinduism, Christian religion in the age of ecological crisis

UNIT IV
Natural Resources & development
Natural resource management, Common property vs. private property, Livelihoods, forests, and conservation, Displacement, dispossession, and development: Conservation-induced displacement, Environment impact assessment and national rehabilitation & resettlement policy, Dispossession, and land acquisition.

UNIT V
Gender & Development, Climate change
Development theory and gendered approach to development, Gender, environment & sustainable development.

Environment and climate change: Climate change interventions and policy framework, Eastern Himalayas, and climate change.

UNIT VI
Belief and local knowledge of environment
Belief and knowledge systems, biodiversity conservation and sustainability: Ecological knowledge, biodiversity conservation and sustainability, Traditional religion and conservation of nature in Northeast India: Case study
Local knowledge in the environment-development discourse: Indigenous knowledge, environment and development, Relevance of indigenous knowledge: case study

Textbooks / References:
1. Arnold, David, and Guha, Ramchandra, (eds.), 1997. Nature, Culture and Imperialism, New Delhi: Oxford University Press.
2. Baviskar, Amita. 1997. In the Belly of the River: Tribal Conflicts over Development in the Narmada Valley, OUP, Delhi.
3. Barnhill, David Landis & Roger S. Gottlieb. (eds.) 2001. Deep Ecology and World Religions: New Essays on Sacred Grounds. State Univ. of New York Press, Albany.
4. Bicker, Alan, Paul Sillitoe and Johan Pottier. 2004. Development and Local Knowledge: New Approaches to Issues in Natural Resources Management, Conservation and Agriculture. Routledge, London & New York.
5. Esteva, G. 1997. _Development' in W. Sachs, ed., The Development Dictionary, Orient Longman, pp. 8-34.
6. Gadgil, Madhav and Guha, Ramchandra. 1995. Ecology and Equity: The use and Abuse of Nature in Contemporary India, New Delhi: Oxford University.
7. Gottlieb, Roger S. 2004. This Sacred Earth: Religion, Nature, Environment. Routledge, New York, and London.
8. Merchant, Carolyn. 1994. Ecology: Key Concepts in Critical Theory, Humanities Press, New Jersey.
9. Ramakrishnan, P.S. 1992. Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from North-Eastern India, Man and the Biosphere Series, Volume 10, UNESCO.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Environment and Development	Prof. Ngamjahao Kipgen	IIT Guwahati	https://onlinecourses.nptel.ac.in /noc21_hs83/preview

MTCSOE204D	**Entrepreneurship**	**Credits 03**

Course Objectives:
1. To understand the role of entrepreneurs in driving innovation and economic growth.
2. Guide students through the process of developing a comprehensive business plan, including market research, financial projections, competitive analysis, and risk assessment.
3. Provide students with essential financial literacy skills, including budgeting, financial forecasting, and understanding different funding options such as bootstrapping, loans, venture capital, and angel investment.

4. Guide students through the process of developing, prototyping, and refining their products or services to meet customer needs and expectations.

Course Outcomes:
1. Students will be able to generate innovative business ideas by identifying market gaps, customer needs, and emerging trends.
2. Students will be capable of developing comprehensive business plans that encompass market research, financial projections, and strategic goals.
3. Students will gain skills in budgeting, financial forecasting, and managing financial resources for their entrepreneurial ventures.
4. Students will be able to identify and manage potential risks associated with entrepreneurship, including financial, operational, and market risks.

UNIT I
Entrepreneurial Journey, Entrepreneurial Discovery, Ideation and Prototyping,

UNIT II
Testing, Validation and Commercialisation, Disruption as a Success Driver

UNIT III
Technological Innovation and Entrepreneurship – 1, Technological Innovation and Entrepreneurship – 2, Raising Financial Resources.

UNIT IV
Education and Entrepreneurship, Beyond Founders and Founder-Families, India as a Start-up Nation

UNIT V
National Entrepreneurial Culture, Entrepreneurial Thermodynamics,

UNIT VI
Entrepreneurship and Employment, Start-up Case Studies

Textbooks / References:
1. Zero to One: Notes on Startups, or How the Build the Future by Peter Thiel.
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries.
3. India as Global Start-up Hub: Mission with Passion by C B Rao.
4. Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future by Ashlee Vance.
5. Steve Jobs by Walter Isaacson.
6. Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker.
7. The Innovator's Solution: Creating and Sustaining Successful Growth by Clayton M Christensen.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Entrepreneurship	Prof. C Bhaktavatsala Rao	IIT Madras	https://onlinecourses.nptel.ac.in /noc20_mg35/preview

MTCSOE204E	Research Methodology	Credits 03

Course Objectives:
1. To develop a research orientation among the scholars and to acquaint them with fundamentals of research methods.
2. To develop understanding of the basic framework of research process.
3. To identify various sources of information for literature review and data collection.
4. To understand the components of scholarly writing and evaluate its quality.

Course Outcomes:
1. Learner will learn the meaning, objective, motivation, and type of research
2. Learner will be able to formulate their research work with the help of literature review
3. Learner will be able to develop an understanding of various research design and techniques
4. Learner will have overview knowledge of modelling and simulation of research work
5. Learner will be able to collect the statistical data with different methods related to research work
6. Learner will be able to write their own research work with ethics and non-plagiarized way.

UNIT I
Philosophy of Science (subjective versus objective, materialism versus idealism, causality, etc.) Logical Reasoning (inductive logic, deductive logix, syllogistic logic)

UNIT II
History of development of science and the influence of philosophy, What Scientists Actually Do

UNIT III
Forming a Hypothesis, Techniques of Scientific Measurement

UNIT IV
Testing of hypothesis, Methods of Theoretical Research

UNIT V
The Art of Scientific Communication, Presentation in Seminars and Conferences, Sponsored Research, Ethical Conduct in Science

Textbooks / References:
1. Soumitro Banerjee, Research Methodology for Natural Sciences, IISc Press, 2022.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Research Methodology	Prof. Soumitro Banerjee	IISER Kolkata	https://onlinecourses.nptel.ac.in/noc22_ge08/preview

MTSCMP206	Mini-Project	Credits 02

The mini project shall be based on the recent trends in the industry, research and open problems from the industry and society. This may include mathematical analysis, modelling, simulation, and hardware implementation of the problem identified. The mini project shall be of the student's choice and approved by the guide. The student has to submit the report of the work carried out in the prescribed format signed by the guide and head of the department/institute.

MTCSAE207A
Indian Knowledge System (IKS): Concepts and Applications in Engineering
Credits 03

Course Objectives:
1. Introduce students to the foundational concepts, philosophies, and components of Indian knowledge systems, including ancient scriptures, philosophies, and traditional practices.
2. Introduce students to Vedic mathematical principles and computational techniques from ancient Indian texts, demonstrating their practical use in engineering calculations.
3. Explore the potential benefits of incorporating yogic and meditative practices into engineering to enhance focus, creativity, and overall well-being.
4. Study architectural concepts from Indian traditions and evaluate how they can inform modern urban planning and sustainable architecture.
5. Encourage students to draw inspiration from IKS to develop innovative engineering solutions that align with ancient wisdom while meeting contemporary needs.

Course Outcomes:
1. Gain a comprehensive understanding of the philosophical, scientific, and technological aspects of Indian Knowledge Systems and their historical development.
2. Understand the philosophical underpinnings of IKS, including concepts like dharma, karma, and holistic thinking, and explore their relevance to engineering.
3. Understand Vedic mathematical principles and computational methods, and their potential relevance in solving modern engineering problems.
4. Investigate the connections between yoga, meditation, and stress management, and their potential impact on mental well-being in engineering contexts.
5. Reflect on the ethical, cultural, and social dimensions of integrating IKS concepts into engineering practices and applications.

UNIT I
Indian Knowledge System – An Introduction & Vedic Corpus
What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS,
Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.

UNIT II
Number system & Mathematics
Number systems in India - Historical evidence, Salient aspects of Indian Mathematics, Bhūta-Saṃkhyā system, Kaṭapayādi system, Measurements for time, distance, and weight, Piṅgala and the Binary system.

Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry, Trigonometry, Binary mathematics, and combinatorial problems in Chandaḥ Śāstra, Magic squares in India

UNIT III
Engineering Technology: Metal & Other applications
Wootz Steel: The rise and fall of a great Indian technology, The Indian S & T heritage, Mining and ore extraction, Metals and metalworking technology, Iron and steel in India, lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components.

Irrigation systems and practices in South India, literary sources for science and technology, Physical structures in India, irrigation and water management, dyes and painting technology, the art of making perfumes, Surgical techniques, shipbuilding, sixty-four art forms (64 Kalās) status of Indigenous S & T.

UNIT IV
Town Planning and Architecture:
Perspective of Arthaśāstra on town planning, Vāstu-śāstra – The science of architecture eight limbs of Vāstu, town planning, temples in India: Marvelous stone architecture for eternity, temple architecture in India, Iconography.

UNIT V
Knowledge Framework and classifications:
Indian scheme of knowledge, The knowledge triangle, Prameya – A vaiśeṣikan approach to physical reality, Dravyas – the constituents of the physical reality, Attributes – the properties of substances and Action – the driver of conjunction and disjunction, Sāmānya, viśeṣa, samavāya, Pramāṇa – the means of valid knowledge, Saṃśaya – ambiguities in existing knowledge, Framework for establishing valid knowledge, Deductive or inductive logic framework, Potential fallacies in the reasoning process, Siddhānta: established tenets in a field of study.

UNIT VI
Linguistics
Introduction to Linguistics, Aṣṭādhyāyī, Phonetics, word generation, computational aspects, Mnemonics, Recursive operations, Rule based operations, Sentence formation verbs and prefixes, role of Sanskrit in natural language processing.

Textbooks / References:
1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), ―Introduction to Indian Knowledge System: Concepts and Applications‖, PHI Learning Private Ltd. Delhi.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Indian Knowledge	Prof. B. Mahadevan, Dr. Vinayak Rajat	(IIMB), Chanakya	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

System (IKS): Concepts and Applications in Engineering	Bhat, Dr. R Venkata Raghavan	University, Bangalore	

MTCSAE207B
Indian Knowledge System (IKS): Humanities and Social Sciences
Credits 03

Course Objectives:
1. Introduce students to the diverse range of Indian philosophical, cultural, and social knowledge systems that have evolved over millennia.
2. Encourage students to critically compare Indian knowledge systems with other global philosophies and social theories, fostering a nuanced understanding.
3. Study Vedic texts, ancient scriptures, and philosophical treatises to understand the core ideas and insights that inform Indian knowledge systems.
4. Investigate the intersections of spirituality, psychology, and well-being in Indian knowledge systems, exploring practices like meditation, yoga, and mindfulness.
5. Study the role of language, symbols, and communication in Indian knowledge systems, including Sanskrit as a language of knowledge transmission.

Course Outcomes:
1. Recognize the interdisciplinary nature of IKS, integrating traditional knowledge with contemporary concepts in humanities and social sciences.
2. Explore India's rich cultural heritage, including literature, art, music, dance, and rituals, and analyze their significance in shaping identity and social cohesion.
3. Explore Indian philosophical schools and their insights into consciousness, self-awareness, and psychological well-being.
4. Analyze India's cultural diversity, pluralism, and the coexistence of various belief systems, contributing to tolerance and social harmony.

UNIT I
Indian Knowledge System – An Introduction & Vedic Corpus
What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS,
Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.

UNIT II
Philosophical Systems
An introduction to philosophical systems, development of philosophy unique features of philosophy, Sāṅkhya approach of philosophy, Introduction to Yoga, tenet of Nyāya philosophy principles of Vaiśeṣika, doctrine of Pūrva-Mīmāṃsā Darśana, thesis of Vedānta and synopsis of Advaita philosophy of Viśiṣṭādvaita.

UNIT III
Wisdom through ages

Gateways of ancestral wisdoms, introduction to Purāṇa, the Purāṇic repository, Issues of interest in Purāṇas, Introduction to Itihāsas, Key messages in Itihāsas, Wisdom through Nīti-śāstras, Wisdom through Subhāṣita.

UNIT IV
Health Wellness and Psychology:

Introduction to health, Āyurveda: approach to health, Sapta-dhātavaḥ: seven-tissues, role of agni in health, tri-doṣas, Āyurveda: definition of health, Psychological aspects of health, disease management elements, Dinacaryā: daily regimen for health & wellness, Importance of sleep, Food intake methods and drugs, Approach to lead a healthy life, Indian approach to psychology, the tri guṇa system & holistic picture of the individual, the Nature of Consciousness, consciousness studies and issues

UNIT V
Linguistics:

Introduction to Linguistics, Aṣṭādhyāyī, phonetics, word generation, computational aspects, mnemonics, recursive operations, rule-based operations, sentence formation, verbs and prefixes, role of Sanskrit in natural language processing.

UNIT VI
Governance and Public Administration:

Introduction to raja dharma, Arthaśāstra: a historical perspective, Elements of a kauṭilyan state, The king & the amātya, Janapada & durga, treasury and the state economy (Kośa), danda, Mitra, the administrative setup, relevance of Arthaśāstra, public administration in Epics.

Textbooks / References:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), ―Introduction to Indian Knowledge System: Concepts and Applications‖, PHI Learning Private Ltd. Delhi.
2. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
3. Sampad and Vijay (2011). ―The Wonder that is Sanskrit‖, Sri Aurobindo Society, Puducherry.
4. Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
5. Kapoor Kapil, Singh Avadhesh (2021). ―Indian Knowledge Systems Vol – I & II‖, Indian Institute of Advanced Study, Shimla, H.P.
6. Dasgupta,S. (1975). A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi.
7. PLofker, K. (1963). Mathematics in India, Princeton University Press, New Jeresy, USA"

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Indian Knowledge System(IKS): Humanities and	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	Indian Institute of Management Bangalore	https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

Social Sciences		(IIMB), Chanakya University, Bangalore	

MTCSAU208	**Disaster Management**	**Audit**

Course Objectives:
1. Mastering strategies to manage disasters and ensure public safety during emergencies.
2. Identifying hazards, vulnerabilities, and crafting plans to reduce disaster impact.
3. Collaborative Skills: Working across disciplines to address complex disaster challenges.
4. Developing, improving, and implementing disaster management policies. Community Empowerment: Educating and engaging communities for proactive disaster readiness.

Course Outcomes:
1. Learners will be able to understand the basic concept of disaster(s) and disaster management, their significance, and types.
2. Learners will develop the analytical skills to study relationship between vulnerability, disasters, disaster prevention and risk reduction
3. Learners will gain a preliminary understanding of approaches to Disaster Risk Reduction (DRR)
4. Learners will be empowered with the awareness of institutional processes in the country for Disaster Management

UNIT I
Disaster Management: Disaster and Disaster Management – Concepts, Issues Concerned with Disaster Management.
Disaster Management: Phases of Disaster Management, Phases of Disaster Management
Types of Disasters: Bhopal Disaster: A Case Study, Types of Disasters-An Introduction, Natural Disaster, Man-made Disaster

UNIT II
Types of Disasters: Slow onset Disasters & Rapid onset Disasters, Simple and Complex, Tsunami: A Case Study Disasters, Tsunami: A Case Study, Cyclone Phallin 2013: A Case Study

UNIT III
Disaster Management in India -An Over View: Evolution of Disaster Management in India, Disaster and Disaster Management in India, National institute of Disaster Management, National Disaster Management Act 2005.

UNIT IV
Disaster Management in India -An Over View: The National Policy on Disaster Management, 2009.
Refugee Problem: National Plan on Disaster Management 2016, Refugee Problems, Impact of Disaster on the lives of Refugees.
Refugee Problem: Problems of Women and Children during disasters, Principles Of Psychosocial Care, Issues And Recovery During Emergency.

Refugee Problem: Relationship between Disasters, Development and Vulnerabilities, Relationship between Disasters, Development and Vulnerabilities.

UNIT V

Refugee Problem: Equity Issues in Disaster.
Refugee Problem: Issues of Rehabilitation and Resettlement among the Disaster Survivors, Stakeholders in Disaster Relief Management - An Introduction.
Stakeholders in Disaster Relief Management: Central Government.
Stakeholders in Disaster Relief Management: State Government, District Administration. Armed Forces.

UNIT VI

Stakeholders in Disaster Relief Management: Para-Military Forces, Fire Services.
Disaster Risk Reduction: Disaster Risk Reduction Strategies, Risk Reduction Preparedness Plans.
Disaster Risk Reduction: Action Plans and Procedures, Early Warning Systems, Components of Disaster Relief, Factors contributing to Vulnerability.
Disaster Risk Reduction: Disaster Risk Reduction - Master Planning for the Future, Capacity Building Rehabilitation measures and long-term reconstruction, Understanding Kerala Disaster 2018.

Textbooks / References:
1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopaedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopaedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur.
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
12. NIDM Publications
13. High Power Committee Report, 2001, J.C. Pant
14. Disaster Mitigation in Asia & Pacific, Asian Development Bank
15. National Disaster Management Policy, 2009, GoI
16. Disaster Preparedness Kit, American Red Cross

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Disaster Management	Naveen Kumar Nanjundan	University Of Hyderabad	https://onlinecourses.swayam2. ac.in/cec19_hs20/preview

SEMESTER III

MTCSOE301A	Student Psychology	Credits 03

Course Objectives:
1. Gain an understanding of prominent learning theories and models, enabling you to grasp the foundational concepts that influence effective teaching and learning.
2. Acquire skills to assess and appreciate diverse student characteristics, including learning styles, cultural backgrounds, and individual differences that impact learning.
3. Gain proficiency in understanding, administering, and interpreting psychological tests and inventories to assess cognitive abilities, personality traits, and emotional development in learners.
4. Examine psychological theories of motivation and cultivate the skills needed to apply motivational strategies that enhance student engagement, commitment, and achievement.
5. Investigate the stages of physical, cognitive, emotional, and social development in individuals, equipping you to design instructional methods that support comprehensive growth.
6. Acquire an understanding of NLP concepts and techniques that can be used to improve communication, establish rapport, and optimize teaching and learning experiences.

Course Outcomes:
1. Understanding of Psychological Factors: Gain a comprehensive understanding of the psychological factors that influence students' learning, behaviour, and overall well-being in educational settings.
2. Recognition of Diverse Student Needs: Develop the ability to recognize and appreciate the diverse cognitive, emotional, and social needs of students, enabling tailored support and fostering inclusive learning environments.
3. Application of Psychological Strategies: Apply psychological theories and principles to address various challenges in student development, including motivation, learning difficulties, and behavioural issues.
4. Competence in Student Assessment: Acquire skills in utilizing psychological assessment tools to evaluate students' cognitive abilities, emotional states, and learning styles, informing instructional strategies and support plans.
5. Promotion of Positive Learning Experiences: Learn to create positive and conducive learning experiences by integrating insights from student psychology, fostering engagement, motivation, and holistic growth among learners.

UNIT I
Teaching Learning Process

UNIT II
Student Characteristics, Types and Problems

UNIT III
Psychological Tests and Inventories, Student Motivation

UNIT IV
Physical and Cognitive Development

UNIT V
Emotional and Social Development

UNIT VI
Neuro-Linguistic Programming, Counselling Skills, and Summary

Textbooks / References:
1. Sharma, R.A. (2007). Training Technology. Meerut: Surya Publications.
2. Sharma, R.A. (2007). Psychology of Teaching-Learning Process. Meerut: Surya Publications.
3. B.Mukhopadhyay(1997). Motivation in Educational Management. New Delhi: Sterling Publishers.
4. Barki & Mukhopadhyay. (1995). Guidance and Counselling. New Delhi: Sterling Publishers.
5. Agochya, D. (2010). Life competencies for adolescents. New Delhi: Sage Publications.
6. Davies, I.K. (1971). Management of Learning. Berkshire: McGraw Hill.
7. Dusay. (1980). Egograms. New York: harper & Row.
8. Goleman, D. (1996). Emotional Intelligence. New York: Bantom Books.
9. Anastasi. (2016). Psychological Testing. New Delhi: Pearson Education. Psychological Tests.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Student Psychology	Dr. S. Renukadevi	NITTTR, Chennai	https://onlinecourses.swayam2.ac.in/ntr19_ed23/preview

MTCSOE301B	Business To Business Marketing (B2B)	Credits 03

Course Objectives:
1. Develop a comprehensive understanding of the unique characteristics, dynamics, and complexities that define business-to-business (B2B) marketing, including the role of intermediaries, supply chains, and collaborative relationships.
2. Learn how to segment B2B markets based on factors such as industry, company size, and purchasing behaviour. Understand the significance of effective market segmentation in tailoring marketing strategies to specific B2B customer segments.
3. Explore the elements of the B2B marketing mix, including product/service offerings, pricing strategies, distribution channels, and promotional approaches. Develop the ability to design marketing strategies that align with the unique needs and preferences of B2B customers.
4. Gain insights into relationship-building strategies in B2B contexts. Learn how to nurture long-term, mutually beneficial partnerships with B2B clients through effective communication, trust-building, and value delivery.
5. Acquire skills in B2B sales processes, negotiations, and contract management. Understand the intricacies of negotiation dynamics, procurement processes, and key decision-making factors in B2B transactions.

Course Outcomes:
1. Foundational Knowledge: Gain a strong grasp of the core concepts and theories that form the basis of B2B marketing, enabling practical application.
2. Market Analysis Expertise: Develop skills to analyse B2B markets, segment customers effectively, and make informed marketing decisions.
3. Strategic Implementation: Acquire the ability to design and execute B2B marketing strategies tailored to the unique needs of business customers.
4. Relationship Management: Learn how to build and nurture enduring relationships with B2B clients through effective communication and collaboration.
5. Sales and Negotiation Proficiency: Master the art of B2B sales, negotiation strategies, and contract management for successful transactions.

UNIT I

Introduction to B2B Marketing: Business marketing, Classifying goods for the business market, Business market customers, Market structure, Environment and Characteristics of Business Marketing, Strategic role of marketing, Commercial enterprises, Commercial and institutional customers, B2B vs B2C Marketing.
Organizational Buying and Buyer Behaviour: Organizational buyers' decision process - A Stepwise Model and A Process Flow Model, Organizational and business markets - Government as a customer - Commercial enterprises - Commercial and institutional customers, Value analysis, Buygrid framework, Strategic procurement.

UNIT II

B2B Marketing Strategy: Strategy making and strategy management process, Industrial product strategy– Managing Products for Business Markets-Managing Services for Business Markets-Managing Business Market Channels the Growth-Share Matrix, Multifactor Portfolio Matrix, The Balanced Scorecard.
B2B Marketing STP: Market Segmentation, bases for segmenting business markets, basic framework of segmentation, choosing target segments and positioning.

UNIT III

Business Marketing Communications- B2B Advertising, Digital marketing, - Trade shows, exhibitions, business meets - Managing the sales force - Deployment analysis, Direct marketing Demand forecasting: industrial market, Forecasting- meaning, importance and relevance, issues related to forecasting, forecasting measurement models, sales force forecasting, estimating segment demand, Collaborative approach to estimate demand, qualitative and quantitative forecasting methods.

UNIT IV

Product management: (existing and new) in industrial market, role of product in the industrial market, new product development, industrial product life cycle, product evaluation matrix, techniques for identifying new products QFD, perceptual mapping, reverse engineering, fish bone diagram, role of service and maintenance in industrial markets, customer experience life cycle, service quality.
Pricing: Pricing strategies; The pricing policy; Price on the Internet; Financial marketing, competitive bidding, commercial terms and conditions, role of leasing.

UNIT V

Buyer seller relationship, types of relationships, transactional and collaborative relationships, influencing industrial customers, role of service in industrial markets. CRM.

B2B marketing research, challenges in B2B research, developing a marketing information system, role of qualitative research techniques in B2B research.

UNIT VI

Business marketing channels and participants - Channel design and management decisions - B2B logistics management, types of industrial middlemen and intermediaries, marketing logistics and physical distribution.

Strategic decision making in industrial markets, strategic planning at corporate levels, allocation of resources, portfolio analysis, developing SBU'S objectives and goals, implementing and controlling marketing plan. Marketing through electronic commerce.

Textbooks / References:
1. Business Market Management Understanding, Creating and Delivering Value by James C. Anderson, Das Narayandas, James A. Narus and D.V.R. Seshadri Pearson, 2010 3rd edition
2. Business Marketing Management b2b By Hutt and Speh South-Western CENGAGE Learning www.cengagebrain.com 2013
3. B2B Brand Management by Kotler and Pfoertsch Springer www.springer.com 2006
4. Business Marketing: Text and Cases by Krishna K Havaldar, McGrawhill Publications, 2014 4th edition.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Business To Business Marketing (B2B)	Prof. J. K. Nayak	IIT Roorkee	Business To Business Marketing (B2B) – Course (nptel.ac.in)

MTCSOE301C	Organizational Behaviour	Credits 03

Course Objectives:
1. Explore how personality, motivation, perception, attitudes, and emotions impact employee performance and job satisfaction.
2. Study group formation, communication, decision-making, conflict resolution, and leadership's role in fostering teamwork.
3. Learn about the role of organizational culture in shaping behaviour, and develop skills to manage and align culture with goals.
4. Gain insights into leadership styles, communication, and team management for enhancing performance and satisfaction.
5. Navigate change, promote inclusivity, and address diversity-related challenges to cultivate adaptability and resilience in the workplace.

Course Outcomes:
1. Develop a grasp of how individual factors influence workplace behaviour, impacting job satisfaction and performance.

2. Acquire skills to foster productive group dynamics, facilitating better communication, decision-making, and conflict resolution.
3. Understand the role of organizational culture, and learn to manage and cultivate cultures aligned with organizational goals.
4. Gain insights into diverse leadership styles, enhancing the ability to manage teams and guide them towards success.
5. Develop the capacity to navigate change, promote diversity, and create an inclusive work environment, fostering resilience.

UNIT I
Introduction – a) defining organization, behavior and organizational behavior, b) assumptions of OB, c) principles of OB, d) levels of OB, e) scope of OB, f) OB and Human Resource Management, g) Applications of OB, h) Historical developments of OB, i) emerging concerns
Perception and Learning – a) understanding perception, b) Basic elements of perception, c) Principles of perceptual selection, d) Perceptual grouping, e) Social Perception, f) Self-perception and identity, g) attribution of causality, h) Perceptual biases in social perception, i) Implications for human resource management, j) defining learning, k) classical and operant conditioning l) learning in organizations.

UNIT II
Personality – a) Defining Personality, b) History of the concept, c) Key assumptions, d) biological and social determinants, e) Theories – Intrapsychic theory, social learning theory, self-theory, Trait, and type theories f) Related concepts (locus of control, dogmatism, authoritarianism, Machiavellianism), g) measuring personality.
Attitudes – a) Definition, b) Key elements of attitudes, c) Attitudes and related concepts (Values, opinion, belief, and ideology), e) Characteristics of attitudes, f) Attitude formation, g) Attitude measurement, h) Changing attitudes, i) Attitudes at workplace (job satisfaction, work attitude and organizational commitment), j) Prejudice and discrimination at workspace.

UNIT III
Emotions in workplace - a) Definition, b) Types of emotions, c) Related concepts (mood, temperament), d) Stress in workplace, e) General Adaptation Syndrome, f) Managing Stress, g) Psychosomatic disorders and stress h) emotional labor and emotional contagion.
Motivation – a) Definition, b) Process of motivation, c) Types of motives, d) Motivators at workplace, e) Motivation theories (Process and Content theories).

UNIT IV
Interpersonal Dynamics – a) Definition, b) Psychological Contract, c) Trust and trust building, d) Prosocial behaviour, e) Cooperation Vs Competition f) Conflict management, g) Levels and types of conflict at workplace, h) Conflict management Styles, i) Managing Negotiations
Power and Leadership - a) Defining Power, b) Sources of Power, c) Organizational politics, d) Leadership e) Managers Vs Leaders, f) Trait and Type approach to leadership g) Leadership style, h) Leadership Grid, i) Contingency Theories j) Contemporary issues

UNIT V
Team Dynamics – a) Groups and Teams, b) Types of Teams, c) Stages in group development, d) problems in team work (Free riding, social loafing, group think), e) Cross-cultural virtual teams.

Organizational culture – a) Defining culture, b) levels of culture, c) cultural dimensions, d) high and low context cultures, e) Strong and weak organizational cultures, f) Expressions of organizational culture, g) Impact of culture on individuals, h) Organizational cultural change

UNIT VI
Organization Change – a) Change in Organizations, b) Nature of the chance process, c) Types of chance, d) Impact of change, e) Managing resistance to change, f) Organizational Development interventions
Organizational Structure and Design – a) Basic dimensions of structure, b) Departmentalization, c) Organizational life cycle, d) Organizations as socio-technical systems, e) Organizational design and its impact on employees, f) Organizational boundary spanning.

Textbooks / References:
1. Behaviour in Organizations by Jerald Greenberg and Robert A. Baron, PHI learning private Ltd, New Delhi (Ninth Edition).
2. Understanding Organizational Behaviour by Udai Pareek, Oxford University Press (Third Edition).
3. ORGB by Nelson, Quick and Khandelwal, Cengage Learning New Delhi (second edition).

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Organizational Behaviour	Prof. M. P. Ganesh	IIT Hyderabad	Organizational Behaviour – Course (nptel.ac.in)

MTCSOE301D	**Principles of Economics**	**Credits 03**

Course Objectives:
1. Introduce essential economic terms and concepts for analysing real-world situations.
2. Understand market dynamics, supply and demand, and resource allocation.
3. Study national indicators, inflation, unemployment, and government policies' effects.
4. Learn to make informed choices using opportunity cost, utility, and cost analysis.
5. Explore global interdependencies, trade, exchange rates, and policy impacts.

Course Outcomes:
1. Grasp key economic principles, like supply and demand, opportunity cost, and marginal analysis, forming a foundation for economic understanding.
2. Gain insights into market structures, pricing mechanisms, and factors influencing consumer and producer behaviour.
3. Understand the role of government interventions, regulations, and fiscal/monetary policies in shaping economic outcomes.
4. Learn how societies allocate scarce resources efficiently, exploring topics like production, distribution, and factors of production.
5. Develop analytical thinking by applying economic principles to real-world scenarios, making informed personal and business decisions.

UNIT I

Principles of Economics, Thinking like an Economist; Interdependence and the gains from Trade.

UNIT II

Market forces of supply and Elasticity, Application of elasticity; supply, demand, and government policies

UNIT III

Consumer and producer surplus; cost of taxation and international trade, Externalities, and cost of production

UNIT IV

Competitive market and monopoly market, Game theory and oligopoly, measures national income, measuring cost of living

UNIT V

Production and growth; Saving, Investment and the financial system, the monetary system, Money growth and inflation

Textbooks / References:
1. N.Gregory Mankiw, Principles of Economics.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Principles Of Economics	Prof. Sabuj Kumar Mandal	IIT Madras	Principles Of Economics – Course (nptel.ac.in)

MTCSOE301E	**Intellectual Property & Rights**	**Credits 03**

Course Objectives:
1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.
3. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

Course Outcomes:
1. The students once they complete their academic projects, they get awareness of acquiring the patent.
2. They also learn to have copyright for their innovative works.
3. They also get the knowledge of plagiarism in their innovations which can be questioned legally.

UNIT I
Introduction to IPR: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Introduction to TRIPS and WTO, Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade; Secret and trade dress, Design, Layout Design, Geographical Indication, Plant. Varieties and Traditional Knowledge.

UNIT II
Patent Rights and Copy Rights— Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.

UNIT III
Copy Right—Origin, Definition &Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.

UNIT IV
Trade Marks: Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. Domain Names on cyber space.

UNIT V
Design- Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.

UNIT VI
Basic Tenents Of Information Technology Act-2000, IT Act - Introduction, E-Commerce and legal provisions, E- Governance and legal provisions, Digital signature and Electronic Signature. Cybercrimes.

Textbooks / References:
1. Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G.B. Reddy
2. Law relating to Intellectual Property, Universal Law Publishing Co, by Dr. B.L.Wadehra
3. IPR by P. Narayanan
4. Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Intellectual Property & Rights	Prof. Feroz Ali	IIT Madras	https://onlinecourses.nptel.ac.in/noc23_hs55/preview

MTCSOE301F   Introduction to Public Administration   Credits 03

Course Objectives:
1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

UNIT – I
Public Administration: Meaning Nature, Scope and Significance of Public, Administration. Difference between Public and Private Administration, Administration as an Art or Science, New Public Administration, New Public Management, E-Governance: Concept, Rationale and significance.

UNIT – II
Theories of Organization – Classical, Neo classical and Modern theory, Approaches to the study of Public Administration: Structural – functional, systems, approach, Behavioral approach, Public Choice approach, Bureaucracy: Meaning types and Weberian model of Bureaucracy.

UNIT – III
Organization: formal and informal organizations, Principles of organization – Hierarchy, Span of control, unity of command and Coordination.

UNIT IV
Concepts of Public Administration: Power, Authority, and responsibility, Decision Making: Meaning, Classification and Essentials of decision making, Process of decision making, techniques of decision making, approaches to decision making.

UNIT – V
Good Governance: Concept, characteristics, elements. Issues and Challenges, Leadership: Development of leadership, Qualities of leadership, Accountability and control –Executive, Legislative, Judicial. Citizen and Administration: Issues and problems, Methods to promote good relationship.

References/Textbooks:

1. Felix, A. Nigro and C. Nigro Modern Public Administration (New York: Lloyd Harper and Row, Latest edition)
2. John Pfiffiner and Frank Sherwood Administrative Organization (New Delhi: Prentice Hall, Latest ed.).

3. Peter F. Drucker Management: Tasks, Responsibilities, Practices (Bombay: Allied Publishers, latest ed.).
4. H. Koontz and Cyril O'Donnell Principles of Management, (Tokyo: McGraw Hill, latest ed).
5. Amitai Etzioni Modern Organizations (New Delhi: Prentice Hall, latest ed.).
6. Robert T. Golembiewsky Public Administration as a Developing Discipline (New York: Marcel, latest ed.).
7. Mohit Bhattacharya Public Administration (Calcutta: World Press, latest ed).
8. Mamta Mokta, S.S.Chauhan, S.K. Mahajan and Simmi Agnihotri Challenges in Governance(ed) Anamica Publishers,New Delhi 2011
9. C.P. Bhambri Public Administration (Theory and Practice (Meerut: Educational Publishers, latest ed.).
10. Bertram Gross The Managing of Organisations (London: Free Press, latest ed.).
11. W.M. Newman, C. Summer and E.Warren Management Concepts, behaviour & practice, edu. Publishers Meerut.
12. P. Herseay and K.H. Blanchard Management of Organisational Behaviour (New Delhi:latest ed.).
13. Nicholas Henry Public Administration and Public Affairs, (New Jersey: Prentice Hall, latest ed.).
14. Herbert G. Hicks and Ray C. Gutlet Organisations: Theory and Behaviour (New York: McGraw Hill, latest ed.).
15. Ramesh, K. Arora (ed.) Perspective in Administrative Theory (New Delhi: Associated, latest ed.).
16. S.L. Kaushik and Pardeep Sahni (eds.) Public Administration in India: Emerging Trends (Allahabad: Kitab Mehal, latest ed.).
17. J.S. Vickers and George K. YarrowPrivatization: An Economic Analysis (Cambridge: MIT Press, latest ed.).
18. David Osborne and T. Gaebler Re-inventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector (New York: Addison Wesley, latest ed.).

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Introduction to Public Administration	By Prof. Y. Pardhasaradhi	Osmania University Hyderabad.	https://onlinecourses.swayam2.ac.in/cec21_hs06/preview

MTCSMD302**A**	**Design of Mechatronic Systems**	**Credits 03**

Course Objectives:

1. Introduce students to the interdisciplinary nature of mechatronics, emphasizing the integration of mechanical engineering, electronics, control systems, and computer science.
2. Familiarize students with a variety of sensors and actuators commonly used in mechatronic systems, and explain their principles of operation and selection criteria.
3. Provide an understanding of control system theory, enabling students to design and implement closed-loop control strategies for mechatronic systems.
4. Introduce software development concepts, including programming languages, real-time operating systems, and software architecture for mechatronic applications.

5. Demonstrate techniques for integrating mechanical components, electronics, and software modules seamlessly, ensuring proper communication and synchronization.

Course Outcomes:
1. Apply knowledge to select appropriate sensors and actuators based on system requirements, considering factors such as accuracy, range, and compatibility.
2. Analyze and process sensor data using signal processing techniques, demonstrating the capability to extract meaningful information from noisy sensor measurements.
3. Proficiently program microcontrollers and embedded systems to interface with sensors, actuators, and other hardware components.
4. Integrate mechanical components and subsystems with electronics and software, ensuring seamless communication and optimal functionality.

UNIT I
Introduction: Elements of mechatronics system: Sensor, actuator, plant, and controller. Applications of mechatronics system. Systems like CDROM, scanner opened to see whats there inside and why? Integrated mechanical-electronics design philosophy. Examples of real-life systems. Smart sensor concept and utility of compliant mechanisms in mechatronics

UNIT II
Microprocessor building blocks, combinational and sequential logic elements, memory, timing, and instruction execution fundamentals with example of primitive microprocessor. Microcontrollers for mechatronics: Philosophy of programming interfaces, setting sampling time, and getting started with TIVA programming. programming different interfaces PWM, QEI etc. Mathematical modeling of mechatronic systems,

UNIT III
Modeling friction, DC motor, Lagrange formulation for system dynamics. Dynamics of 2R manipulator, Simulation using Matlab, Selection of sensors and actuators.

UNIT IV
Concept of feedback and closed loop control, mathematical representations of systems and control design in linear domain. Basics of Lyapunov theory for nonlinear control, notions of stability, Lyapunov theorems and their application

UNIT V
Trajectory tracking control development based on Lyapunov theory, Basics of sampling of a signal, and signal processing.

UNIT VI
Digital systems and filters for practical mechatronic system implementation. Research example/ case studies of development of novel mechatronics system: 3D micro-printer, Hele Shaw system for microfabrication.

Textbooks / References:
1. Devdas Shetty, Richard A. Kolk, ―Mechatronics System Design,‖ PWS Publishing company.

2. Boukas K, Al-Sunni, Fouad M ―Mechatronic,Systems Analysis, Design and Implementation,‖ Springer,
3. Sabri Cetinkunt, ―Mechatronics with Experiments,‖ 2nd Edition, Wiley.
4. Janschek, Klaus, ―Mechatronic Systems Design,‖ Springer.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Design Of Mechatronic Systems	Prof. Prasanna Gandhi	IIT Bombay	Design Of Mechatronic Systems – Course (nptel.ac.in)

MTCSMD302**B**	**Ethical Hacking**	**Credits 03**

Course Objectives:
1. Introduce students to the concept of ethical hacking, its importance in cybersecurity, and the role of ethical hackers in identifying vulnerabilities.
2. Provide an overview of cybersecurity principles, threats, and attacks, highlighting the need for ethical hacking to strengthen defences.
3. Teach students a structured approach to hacking, including reconnaissance, scanning, gaining access, maintaining access, and covering tracks.
4. Cover essential network concepts to help students understand how networks function, including protocols, IP addressing, and network architecture.

Course Outcomes:
1. Gain a comprehensive understanding of ethical hacking concepts, methodologies, and its role in enhancing cybersecurity.
2. Acquire a solid grasp of cybersecurity principles, types of threats, and the importance of proactive defence strategies.
3. Develop proficiency in various hacking techniques, including reconnaissance, scanning, exploitation, and post-exploitation activities.
4. Perform effective vulnerability assessments on systems and networks, identifying potential security weaknesses and exposures.
5. Demonstrate the ability to conduct penetration tests, simulating real-world attacks to evaluate the strength of security measures.

UNIT I
Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.
IP addressing and routing. TCP and UDP. IP subnets. Routing protocols. IP version 6.

UNIT II
Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool**.**

UNIT III

Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.

UNIT IV

Introduction to cryptography, private-key encryption, public-key encryption. Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks, DNS, and Email security.

UNIT V

Packet sniffing using Wireshark and Burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.

UNIT VI

Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.

Textbooks / References:
1. Data and Computer Communications -- W. Stallings.
2. Data Communication and Networking -- B. A. Forouzan
3. TCP/IP Protocol Suite -- B. A. Forouzan
4. UNIX Network Programming -- W. R. Stallings
5. Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin Cryptography and Network Security: Principles and Practice -- W. Stalling

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Ethical Hacking	Prof. Indranil Sengupta	IIT Kharagpur	Ethical Hacking – Course (nptel.ac.in)

MTCSMD302**C**	**Sustainable Power Generation Systems**	**Credits 03**

Course Objectives:
1. The course content is designed to provide comprehensive knowledge of various renewable energy systems. Specifically, in this course, the design and analysis of renewable energy power plants will be discussed.
2. The concepts will be illustrated with practical examples, schematics and block diagrams wherever required. Enough numerical problems with solutions will be discussed in the course.
3. This course is specifically designed for undergraduate and postgraduate students of Energy Engineering and Technology.
4. Further, the course will be very much useful for students and researchers from varied academic backgrounds for the synthesis of novel energy conversion devices and processes.

Course Outcomes:
1. Explain the principles of sustainability in the context of power generation and understand its significance in the global energy transition.
2. Identify and describe various renewable energy sources, including solar, wind, hydro, geothermal, and biomass, and explain their potential for power generation.
3. Compare and contrast the advantages and limitations of different sustainable power generation technologies, considering factors such as efficiency, scalability, reliability, and intermittency.
4. Analyse the environmental, social, and economic impacts of both conventional and sustainable power generation methods, and evaluate their contributions to mitigating climate change and reducing pollution.

UNIT I
Introduction to power generation:
Global and Indian scenario, an overview of current technologies available for power generation, Concept of the renewable energy- based power plant
Solar Thermal Power Generation:
Fundamentals of Solar thermal energy conversion, solar thermal based power plant design and analysis (flat plate and concentrator), ORC, RC, and Stirling engine.

UNIT II
Solar Photovoltaic Power Generation:
Fundamentals of Solar photovoltaic energy conversion, Solar PV power plant design, Performance analysis of standalone and grid connected PV systems.
Wind Power Generation:
Introduction to wind turbine, classification and analysis of different components, Theory, design, and analysis of wind turbines (horizontal axis and vertical axis) and wind farms.

UNIT III
Hydro Power Generation:
Introduction to hydro power plant, overview of micro, mini and small hydro power plants, hydraulic turbines, Selection and design criteria of pumps and turbines, Brief theory, design, and analysis of hydro power plants
Biomass Power Generation:
Fundamentals of bioenergy production technologies through different routes, design, and analysis of biochemical and thermochemical reactors for clean power generation and value-added products, IGCC.

UNIT IV
Hydrogen energy and fuel cells
Importance, various routes of hydrogen generation, basic principle, and design of different types of fuel cells and their applications, prospects, IGFC
Week 8: Module-8: Geothermal Energy
Fundamentals, classification, theory, design, and analysis of geothermal power plant

UNIT V
Ocean Thermal Energy
Fundamentals, classification, theory, design, and analysis of ocean thermal power plant
Week 10: Module-10: Wave and Tidal Energy
Fundamentals, classification, theory, design, and analysis of wave and tidal power plant

UNIT VI
Energy Storage
Different modes of energy storage; design and analysis of different technologies for thermal, mechanical, and electro-chemical energy storage systems
Week 12: Module-12: Energy Economics
Cost analysis, interest, accounting rate of return, Payback, Discounted cash flow, Net present value, internal rate of return, Inflation, and life cycle analysis of energy systems.

Textbooks / References:
1. J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4th Edition, 2021.
2. G. Boyle (Editor), Renewable Energy: Power for a Sustainable Future, Oxford University press, 3rd Edition, 2012.
3. G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 4th Edition, 2013.
5. R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer, 2nd Edition, 2012.
6. P. Breeze, Hydropower, Elsevier, 1st Edition, 2018.
7. S. C. Bhattacharyya, Energy Economics Concepts, Issues, Markets and Governance, springer, 2nd Edition, 2019.
8. S.p Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Private Limited, 3rd Edition, 2010.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Sustainable Power Generation Systems	Dr. Pankaj Kalita	IIT Guwahati	Sustainable Power Generation Systems – Course (nptel.ac.in)

MTCSMD302**D**	**Components and Applications of Internet of Things**	**Credits 03**

Course Objectives:
1. The objective of this course is to learn about Basics of IoT, Components of IoT including Sensors and actuators, computing, and communication systems.
2. It will also cover IoT Protocols, Security of IoT, Cloud based design and AI/Deep learning-based analytics.

Course Outcomes:
1. Identify IoT Components: Recognize and classify key components of IoT systems, including sensors, actuators, communication protocols, and data processing units.
2. Explore IoT Communication: Understand various wireless and wired communication technologies used in IoT networks and their suitability for different application scenarios.

3. Design IoT Applications: Create IoT solutions by integrating hardware and software components, demonstrating proficiency in prototyping, programming, and data handling.
4. Analyse Data from IoT Devices: Collect, analyse, and interpret data generated by IoT devices to extract meaningful insights and support informed decision-making.

UNIT I
Basics of IoT
Introduction to Internet of things, Various sensors, and sensing techniques. Technological trends in IoT. impact of IoT on society. Review of various IoT application domain including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices.

UNIT II
Microcontroller and Interfacing Techniques for IoT Devices
Introduction to IoT and architecture layers, IoT smart devices, Typical embedded computing systems, Introduction to ARM architecture and programming method, Embedded system development: a case study, Introduction to interfacing techniques.

UNIT III
IoT Protocols & Security
Networking and basic networking hardware. Networking protocols, Interaction between software and hardware in an IoT device. IoT components and technologies to secure systems and devices.
Various security issues related to the IoT and security architectures. Hardware security threats and security vulnerabilities; protecting physical hardware

UNIT IV
Location Tracking
Introduction to device localization and tracking; different types of localization techniques: time-of-arrival (TOA) based, time-difference-of-arrival (TDOA) based, angle-of-arrival (AOA) based, received signal strength (RSS) based, Radio-Frequency Identification (RFID) based and fingerprinting based; Monte-Carlo tracking; Kalman filter based tracking; Cramer-Rao lower bound (CRLB) for device location estimator; Device diversity/heterogeneity issue in IoT networks.

UNIT V
Deep learning for IoT
This topic will focus how to build good model from the past data to predict correctly when the system is provided with a data-point. In this course mostly, supervised learning will be considered. Basics of neural network, activation functions, back-propagation, etc. will be covered. At the end some of the challenges in the context of IoT will be mentioned.

UNIT VI
IoT Applications
Smart grid: Introduction to smart grid, Integration of IoT into smart grid, Standardization activities for IoT aided smart grid, Applications of IoT aided smart grid, Architectures for IoT sided smart grid, Prototypes, Applications of big data and cloud computing, Open Issues, and challenges.

IoT-based Smart Home and Nano-grid Monitoring System
Sensor-Controller Coordination of a DC Microgrid in IoT Platform, Cyber physical system, dc microgrid, dc–dc power converter, distributed energy generator, sensor control and controller design. Low-Cost DC Nano-grid with Smart Remote Monitoring Unit, DC-DC converter modelling, closed loop control, placement of IoT devices, sensors, micro grid, solar energy, low-cost communication system design.
Introduction, objective, components of home monitoring system, control, and management, Zigbee, Wireless Sensor Network (WSN), Internet of Things (IoT).

Internet of Robotic Things (IoRT):
Introduction to stationary and mobile robots; Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IoT in robotics; Architectures for IoRT; Examples and case studies; Open issues and challenges.

Textbooks / References:
It will be provided in each of the lecture sessions.
(Refer **NPTEL** platform)

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Components And Applications of Internet of Things	Dr. Sanjoy Kumar Parida	Indian Institute of Technology Patna	https://onlinecourses.swayam2.ac.in/arp20_ap03/preview

| MTCSMD302**E** | **Linear Algebra** | **Credits 03** |

Course Objectives:
1. Understand the fundamental principles of vector spaces and matrices.
2. Develop the ability to solve systems of linear equations using various methods.
3. Learn how to analyse and manipulate linear transformations and their properties.
4. Apply linear algebra concepts to solve real-world problems in fields such as physics, engineering, and computer science.

Course Outcomes:
1. Students will demonstrate proficiency in performing matrix operations and solving linear equations in diverse mathematical contexts.
2. Students will apply linear algebra concepts to model and solve practical problems across multiple disciplines.
3. Students will analyse and interpret geometric transformations through the lens of linear transformations.
4. Students will develop critical thinking and problem-solving skills by using linear algebra as a foundation for advanced mathematical and scientific studies.

UNIT I
Vectors, vector spaces, span, linear independence, bases
Dimension, linear transformations

UNIT II
Null spaces, range, coordinate bases
Matrix multiplication, Invertibility, Isomorphisms
UNIT III
Coordinate change, products and quotients of vector spaces, duality
Review of elementary row operations, rank, determinants
UNIT IV
Eigenvalues, Eigenvectors
Diagonalization
UNIT V
Characteristic polynomials, inner products and norms
Orthogonal bases, orthognalization, orthogonal complements
Adjoints, normal and self-adjoint operators
Spectral theorem for normal and self-adjoint operators

References/Textbooks:
1. Bhattacharya P.B., Jain S.K. and Nagpaul S.R., First Course in Linear Algebra, Wiley Eastern Ltd., 1991.
2. Friedberg S.H, Insel A.J. and Spence L.E., Linear Algebra, 4th Edition, Prentice-Hall of India, New Delhi, 2004.
3. Hoffman K. and Kunze R., Linear Algebra, 2nd Edition, Prentice-Hall of India, New Delhi, 2000.
4. Kalman D., A singularly valuable decomposition; the SVD of a matrix, The College Math. Journal, Vol .27, No.1, (1996).
5. Kumaresan, S., Linear Algebra-A Geometric approach, Prentice-Hall of India, New Delhi, 2001.

6. Lay D.C., Linear Algebra and Its application, 3rd edition, Pearson Education(Singapore) Pvt. Ltd., Delhi, 2003.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Linear Algebra	Prof. Pranav Haridas	Kerala School of Mathematics	https://onlinecourses.nptel.ac.in /noc20_ma21/preview

| MTCSMD302**F** | **Artificial Intelligence and Machine Learning** | **Credits 03** |

Course Objectives:
1. Apply AI techniques to solve the given problems.
2. Implement trivial AI techniques on relatively large system
3. Explain uncertainty and Problem-solving techniques.
4. Compare various learning techniques.
Course Outcomes:
This course will enable students to
1. Identify the AI based problems.
2. Apply techniques to solve the AI problems.
3. Define learning and explain various logic inferences.
4. Discuss different learning techniques.

UNIT I

Introduction to AI and State space search, Introduction to unguided and guided search

UNIT II

Problems in search and solutions, Genetic algorithms, Neural Networks, BPNN, learning process in BPNN

UNIT III

Some other search methods and Admissibility, Planning, Game Playing

UNIT IV

Minimax and other game playing algorithms , using predicate logic for Knowledge Representation

UNIT V

Resolution and non-monotonic reasoning, Strong methods for Knowledge Representation; Fuzzy logic and CD, Scripts and Introduction to Expert systems, Developing expert systems and Machine learning

Text/Reference Books:
1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach. IIIEdition
2. E. Rich, K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGrawHill.
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hal of India.
4. G. Luger, ―Artificial Intelligence: Structures and Strategies for complex problem Solving‖, Fourth Edition, Pearson Education,2002.
5. N.P. Padhy ―Artificial Intelligence and Intelligent Systems‖, Oxford UniversityPress-2015.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Artificial Intelligence and Machine Learning	By Prof. Bhushan Trivedi	GLS University	https://onlinecourses.swayam2.ac.in/cec21_cs08/preview

MTCSSE303	**Seminar II**	**Credits 02**

The seminar shall be on the state of the art in the area of the advanced communication of student's choice approved by an authority. The student shall submit the duly certified seminar report in standard format, for satisfactory completion of the work duly signed by the concerned guide and head of the Department/Institute.

MTCSPR304	**Project I**	**Credits 10**

Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation that may include mathematical model/SRS/UML/ERD/block diagram/ PERT chart, and layout and design of the proposed

system/work. As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic.

It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal.

The student shall submit the duly certified progress report of project -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.

SEMESTER IV

MTCSPR401	**Project II**	**Credits 20**

In Project - II, the student shall complete the remaining part of the project which will consist of the simulation/ analysis/ synthesis/ implementation / fabrication of the proposed project work, work station, conducting experiments and taking results, analysis and validation of results and drawing conclusions.

It is mandatory to publish the paper on the state of the art on the chosen topic in international conference/ journal.

The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.