University of Engineering & Management, Kolkata

University of Engineering & Management, Jaipur

Institute of Engineering & Management, Kolkata

B.Tech in Computer Science and Engineering

Admission Year: 2022

COURSE STRUCTURE

Semester VIII (Fourth Year) Curriculum								
Sl. No	**Type of course**	**Course Code**	**Course Name**	**Hours per week**				**Credit Points**
				Lecture	**Tutorial**	**Practical**	**Sessional**	
Theory Papers								
1	Professional Elective Courses	PECS801	Elective-IV	3	0	0	0	3
2	Open Elective Courses	OECS801	Open Elective-II	3	0	0	0	3
3	Open Elective Courses	OECS802	Open Elective-III	3	0	0	0	3
4	Humanities & Social Sciences including Management course	ESP801	Essential Studies for Professionals – VIII (CS)	2	0	0	0	0.5
Total				**11**	**0**	**0**	**0**	**9.5**
Sessional Papers								
1	Humanities & Social Sciences including Management course	SDP881	Skill Development for Professionals - VIII	0	0	0	2	0.5
2	Project	PRJCS881	Project – III	0	0	0	12	6

3	Grand Viva	PCCCS881	Grand Viva-Voce	0	0	0	0	2
4	Internship	INP881	Internship - II	0	0	0	0	4
Total				**0**	**0**	**0**	**14**	**12.5**

Mandatory Requirements								
Sl. No	**Type of course**	**Course Code**	**Course Name**	**Hours per week**				**Score/Credit /Count**
1	Co-curricular & Extra Curricular Activities	MAR	Mandatory Additional Requirements (Score)	-	-	-	-	-
2	Honours	MOOCs	Massive Open Online Course (Credit)	-	-	-	-	-
3	Certification	IFC	Industry and Foreign Certification (Count)	-	-	-	-	-
4	Co-curricular & Extra Curricular Activities	SAR	Skills As Additional Requirement	-	-	-	-	-
Total				**11**	**0**	**0**	**14**	**22**

Professional Elective

Recommended Professional Elective Courses					
Sl. No.	**Semester**	**Choice-1 (A) Track: Network & Security**	**Choice-2 (B) Track: Artificial Intelligence & Data Science**	**Choice-3 (C) Track: Theory & Systems**	**Choice-4 (D) Track: Applications**
PE-4	Sem-8	Data Encryption and Compression (PECS801A)	Advanced AI (PECS801B)	Real Time Operating Systems (PECS801C)	Human Computer Interaction (PECS801D)

Open Elective

Recommended Open Elective Courses			
Sl. No.	**Semester**	**Option-1**	**Option-2**
OE-2	Sem-8	Soft Skills and Interpersonal Communication (OECS801A)	History of Science and Engineering (OECS801B)
OE-3	Sem-8	Cyber Law and IPR (OECS802A)	Introduction to Philosophical Thoughts (OECS802B)

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Department of Computer Science and Engineering
DETAILED SYLLABUS

Course Code- PECS801A
Course Title – Data Encryption and Compression
Credit – 3
Category – Professional Core Course
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – Linear Algebra, Computer Networks, Cryptography and Network Security

Course Outcomes:

CO1	**Students will understand lossless & lossy compression principles, modeling techniques, Huffman, arithmetic dictionary-based coding.**
CO2	**Students will learn audio compression fundamentals including psychoacoustic models, companding, MP3 st**
CO3	**Students will analyze image compression approaches including PCM, DPCM, JPEG, motion estimation, MP H.264.**
CO4	**Students will be able to understand cryptographic algorithms, message integrity techniques, authentication malware defenses, digital certificates, Kerberos and SSL.**

Study Material	Coursera	NPTEL	Linkedin Learning	Infosys Springb

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Lossless & Lossy Text Compression**	Lossless compression, Lossy compression Measure of performance Modeling and coding Types of models Coding techniques Minimum variance Huffman encoding	***International Academia:*** **MIT OpenCourseWare – Data Compression:** https://ocw.mit.edu/courses/6-241j-dynamic-programming-and-stochastic-control-spring-2011/	8	1 Implement Huffman coding and decoding. 2 Implement Adaptive Huffman coding. 3 Implement Arithmetic coding.

		Extended Huffman coding, Adaptive Huffman coding Arithmetic coding Dictionary-based coding (LZ77, LZ78, LZW) Run-Length Encoding	**Stanford – Data Compression Resources:** https://web.stanford.edu/class/ee398a/ **IEEE Data Compression Community:** https://ieeexplore.ieee.org/browse/conferences/title **Industry Tools:** MATLAB, zlib, gzip, 7-Zip algorithms		4 Implement LZ77 and LZ78 compression. 5 Compare compression ratios of RLE, LZW and Huffman.
2	**Audio Coding & Psychoacoustic Modeling**	Digital audio basics Frequency masking and temporal masking Lossy audio compression μ-law and A-law companding MP3 audio standard	***International Academia:*** **MIT OCW – Digital Signal Processing:** https://ocw.mit.edu/courses/6-341-discrete-time-signal-processing-fall-2005/ **AES (Audio Engineering Society):** https://aes.org **Industry Mapping:** Audacity, FFmpeg, MP3 encoders	6	6 Implement μ-law and A-law companding. 7 Frequency masking simulation in MATLAB/Python. 8 Generate and compress audio using MP3 tools (FFmpeg).

3	**Image Coding Principles**	PCM, DPCM JPEG standard Intra-frame coding Motion estimation and compensation Introduction to MPEG-2 Introduction to H.264 encoder & decoder	**MIT OpenCourseWare – Digital Image Processing:** https://ocw.mit.edu/courses/6-450-principles-of-digital-communication-i-fall-2006/ **Stanford – Image & Video Compression:** https://stanford.edu/class/ee398b/ **Industry Tools:** OpenCV, MATLAB, FFmpeg, H.264 encoders	8	9.Implement JPEG DCT-based compression. 10 Implement DPCM for grayscale images. 11 Motion estimation using block matching techniques. 12 Encode & decode videos using MPEG-2 / H.264 tools.
4	**Cryptography & Information Security**	Security goals Cryptography: Monoalphabetic and polyalphabetic ciphers Substitution & transposition ciphers Stream vs block cipher Symmetric vs asymmetric cipher AES, DES, RSA, Diffie–Hellman Steganography Cryptanalysis Message integrity & authentication MAC, Hash functions, HMAC Digital Signature Algorithm	***International Academia:*** **MIT OCW – Computer Systems Security:** https://ocw.mit.edu/courses/6-858-computer-systems-security-fall-2014/ **Stanford – Applied Cryptography:** https://crypto.stanford.edu/ **Industry Mapping:** Kali Linux, Wireshark, OpenSSL, Splunk, Cisco Security	14	Implement classical ciphers. Implement AES and DES algorithms. RSA key generation and encryption. Perform hashing using SHA algorithms. Implement HMAC. Build a simple firewall rule set. IDS simulation using Snort. Implement SSL communication in a client-server program.

		Malware, Intruders Intrusion Detection Systems Firewalls, Antivirus techniques Digital Immune Systems Biometric authentication Ethical hacking Kerberos Digital certificates SSL			

Textbooks:

1. **Data Compression and Cryptography** – J. S. Katre, Pravin Goyal, TechKnowledge Publications
2. **Data Compression: The Complete Reference (3rd Ed.)** – David Salomon, Springer

Reference books:

1. **Data Compression: Methods and Theory** – James A. Storer

Course Name: Advanced Artificial Intelligence
Course Code: PECS801B
Credit – 3
Category – Professional Core Course
Semester – VIII
L:T:P:S – 3:0:0:0

Course Objectives

- To deepen understanding of symbolic logic, resolution principles, and their applications in AI.
- To explore fuzzy logic and advanced fuzzy systems for decision-making under uncertainty.
- To examine heuristic search techniques, focusing on A* search and its admissibility proof.
- To introduce generative AI models, their theoretical underpinnings, and applications in artificial intelligence.

Syllabus (Topics)	**Mapping with Industry & Academia**	**Contact Hours**	**Assignment Questions**	**References + External Resources**

Module 1: Logic and Resolution in AI Predicate & Propositional Logic, WFF, Clausal Form, Skolemization, Unification, Resolution Refutation, Linear & Input Resolution, Subsumption, and Iterative Deepening.	Industry: Automated reasoning, formal verification, logic programming. Academia: NPTEL Logic for CS, MIT OCW Logic.	9	Convert WFF to clausal form; Implement unification; Apply resolution for theorem proving.	Russell & Norvig – Artificial Intelligence: A Modern Approach. **NPTEL:** https://nptel.ac.in/courses/106/104/106104028/ **MIT OCW Logic:** https://ocw.mit.edu/courses/24-241-logic-i-fall-2005/
Module 2: Fuzzy Logic and Advanced Fuzzy Systems Fuzzy sets, membership functions, Mamdani/Sugeno systems, Defuzzification, Fuzzy clustering, Type-2 fuzzy sets, Applications in control, vision, prediction.	Industry: Control systems, robotics, medical diagnosis. Academia: NPTEL Soft Computing, MIT OCW AI research topics.	9	Design a Mamdani-type inference system; Apply defuzzification techniques; Implement fuzzy clustering.	Zadeh – Fuzzy Sets. NPTEL Soft Computing: https://nptel.ac.in/courses/106/106/106106134/ MIT AI Topics: https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/

Module 3: Advanced Heuristic and A* Search Algorithms Heuristics, Evaluation functions, A*, Admissibility & Consistency proofs, Optimality, Applications in planning, robotics, game AI.	Industry: Robotics navigation, game AI, optimization. Academia: NPTEL AI Search, MIT OCW AI.	9	Implement A* algorithm; Prove admissibility of heuristics; Apply A* for pathfinding.	Russell & Norvig – AI: A Modern Approach. **NPTEL AI Search:** https://nptel.ac.in/courses/106/105/106105078/ **MIT OCW AI:** https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/
Module 4: Generative AI and Applications in Artificial Intelligence Generative AI overview, GAN architecture, VAE theory, Latent space, Diffusion models, Advanced generative learning, Ethics & Bias.	Industry: Image synthesis, data augmentation, creative AI, analytics. Academia: NPTEL Deep Learning, MIT OCW Generative Models.	9	Implement a simple GAN; Train a VAE encoder-decoder; Analyse ethical issues in generative AI.	Goodfellow et al. – GANs. **NPTEL Deep Learning:** https://nptel.ac.in/courses/106/106/106106184/ **MIT Generative Models:** https://ocw.mit.edu/courses/6-819-advances-in-computer-vision-fall-2018/

Books

1. Russell, S., & Norvig, P. (2010). "Artificial Intelligence: A Modern Approach." *Pearson.*
2. Zadeh, L. A. (1965). "Fuzzy Sets." *Information and Control*.
3. Goodfellow, I., et al. (2014). "Generative Adversarial Nets." Proceedings of the 2014 Conference on Neural Information Processing Systems.

Course Code- PECS801C
Course Title – Real Time Operating Systems
Credit – 3
Category – Professional Elective Course
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – Operating Systems

Course Outcomes:

CO1	**Students will be able to explain the fundamental concepts and characteristics of real-time systems.**
CO2	**Students will be able to distinguish between various real-time task models and scheduling requirements.**
CO3	**Students will be able to analyze and design solutions for resource sharing and dependency issues in real-tim using protocols such as Priority Inheritance, Priority Ceiling, and Stack Resource Policy.**
CO4	**Students will be able to evaluate and compare scheduling strategies and architectural considerations in mul and distributed real-time systems, and examine the features of commercial RTOS such as VxWorks, QNX, a FreeRTOS.**

Study Material	Coursera	NPTEL	Linkedin Learning	Infosys Springb

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Textbook Mapping
1	**Fundamentals of Real-Time Systems**	Introduction to Real-Time Systems: Characteristics of real-time systems, Hard vs soft real-time tasks, Real-time system models, Real-time operating system requirements.	***International Academia:*** (MIT Open Courseware): *https://web.mit.edu/16.070/www/year2001/RTOS27.pdf* ***AICTE-prescribed syllabus:*** *https://onlinecourses.nptel.ac.in/noc22_cs104/preview* ***Industry Mapping:*** *VxWorks, QNX, FreeRTOS, ThreadX*	4	**Textbook-1** Chapters: 1 **Textbook-2** Chapters: 1, 2
2	**Real-Time Scheduling**	Real-Time Task Scheduling: Clock-driven and event-driven scheduling, Aperiodic, periodic, and sporadic tasks. Performance metrics: latency, jitter, response time. Introduction to uniprocessor scheduling,	***International Academia:*** (MIT Open Courseware):	8	**Textbook-1** Chapters: 2 **Textbook-2** Chapters: 3

		Rate Monotonic Scheduling (RMS), Earliest Deadline First (EDF).	*https://web.mit.edu/16.070/www/year2001/RTOS27.pdf* ***AICTE-prescribed syllabus:*** *https://onlinecourses.nptel.ac.in/noc22_cs104/preview* ***Industry Mapping:*** *VxWorks, QNX, FreeRTOS, ThreadX3*		
3	**Multiprocessor RT Scheduling and Resource Management**	Scheduling in Multiprocessor and Distributed Systems: Partitioned vs global scheduling, Load balancing and task migration, Real-time scheduling in distributed architectures, Fault tolerance strategies. Handling Resource Sharing and Dependencies: Resource Access Protocols (RAP), Priority Inheritance Protocol (PIP), Priority Ceiling Protocol (PCP), Stack resource policy, Dependency handling among tasks, Deadlock avoidance and detection.	***International Academia:*** (MIT Open Courseware): *https://web.mit.edu/16.070/www/year2001/RTOS27.pdf* ***AICTE-prescribed syllabus:*** *https://onlinecourses.nptel.ac.in/noc22_cs104/preview* ***Industry Mapping:*** *VxWorks, QNX, FreeRTOS, ThreadX*	14	**Textbook-1** Chapters: 3, 4
4	**Commercial RTOS**	Characteristics of commercial RTOS, Case studies: VxWorks, QNX, RTLinux, FreeRTOS, Micrium µC/OS. RTOS kernel architecture, Task management, interprocess communication (IPC)	***International Academia:*** (MIT Open Courseware): *https://web.mit.edu/16.070/www/year2001/RTOS27.pdf* ***AICTE-prescribed syllabus:***	10	**Textbook-1** Chapters: 5

			https://onlinecourses.nptel.ac.in/noc22_cs104/preview ***Industry Mapping:*** *VxWorks, QNX, FreeRTOS, ThreadX*		

Textbooks:

1. Rajib Mall, Real-Time Systems: Theory and Practice, Pearson Education, 2007.
2. C. M. Krishna, Kang G. Shin, Real-Time Systems, McGraw-Hill, 2010.

Reference books:

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2009.
2. 4. Philip A. Laplante, Seppo J. Ovaska, Real-Time Systems Design and Analysis, Wiley, 2012.

Online Resources:
https://onlinecourses.nptel.ac.in/noc22_cs104/preview

Course Code- PECS801D
Course Title – Human Computer Interaction
Credit – 3
Category – Professional Core Course
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – Basic knowledge of Software Engineering and Python

Course Outcomes:

CO1	Understand the basics of interactive system design, usability, and GUI prototyping tools.
CO2	Apply cognitive models and laws to analyze human performance in interactive systems.
CO3	Evaluate user interfaces using design guidelines, principles, and usability evaluation methods.
CO4	Develop interactive GUI applications using Python Tkinter and AI-based design tools.

Study Material	**Coursera**	**NPTEL**	**Linkedin Learning**	**Infosys Springb**

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction to interactive system design	Introduction, Historical evolution of the field, Concept of usability definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques, GUI design Tool: Figma	***International Academia:*** MIT OpenCourseWare: https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/	8	Hands-on GUI Design with the help of Figma

			AICTE-prescribed syllabus: *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:*** *Figma*		
2	Cognitive architecture, and model-based Design and evaluation	Introduction to cognitive architecture and types, relevance of cognitive architecture in interactive system design, Model Human Processor (MHP) Introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and HickHyman's law	***International Academia:*** MIT OpenCourseWare: https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/ ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:***	10	Case studies on model based design
3	Design guidelines and dialog design in HCI	Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and (classical) Petri Nets in dialog design	***International Academia:*** MIT OpenCourseWare: https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/ ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:***	8	Case studies on dialog design

4	GUI Design using Python & AI Tools	GUI & Event-Driven Programming, Basics of Tkinter, Creating Windows, Mainloop, Geometry Settings, Tkinter Widgets: Label, Entry, Button, Text, Frame, Radio button, Checkbox, Listbox, Combobox, Messagebox, Layout Management, Variables & Event Handling, Menus & Advanced design with AI tools.	***International Academia:*** MIT OpenCourseWare: https://ocw.mit.edu/courses/6-831-user-interface-design-and-implementation-spring-2011/ ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:*** *Python Tkinter*	10	Hands-on interactive GUI development using python Tkinter library and latest available AI tools

Textbooks:

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
2. Rao N. Core Python Programming, 3ed, Wiley, 2021.

Reference books:

1. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.

Online Resources:

https://nptel.ac.in/courses/106103115

Course Code- OECS801A
Course Title –Soft Skills and Interpersonal Communication
Credit – 3
Category – Open Elective
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – NA

Course Outcomes:

CO1	**Awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality.**
CO2	**Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.**
CO3	**Actively participate in group discussion / meetings / interviews and develop leadership skills.**
CO4	**Become more effective individual through goal/target setting, self-motivation**

	and practicing creative thinking facilitating an all-round development of personality.

Study Material https://drive.google.com/file/d/1Pm2OQiirexIHWUeaExQjTW8VLmDi2BQE/view?usp=sharing	**Coursera** https://www.coursera.org/programs/iem-uem-program-2024-2dvv9/specializations/people-and-soft-skills-for-professional-success?source=search	**NPTEL** https://onlinecourses.nptel.ac.in/noc20_hs60/preview	**Linkedin Learning** https://www.linkedin.com/learning/paths/professional-soft-skills-learning-pathway?u=229219690	**Infosys Springboard 5G** -

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	**Soft Skills: Introduction**	1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. 2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinking and Attitude;	***International Academia:*** (MIT Open Courseware): https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/ ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:*** *NA*	8	1. Conduct a self-assessment of your soft skills using any standard rubric and submit your score summary. 2. Prepare a one-page personal SWOT analysis and list three SMART goals based on it.	**Textbook-1** Chapter: 1,2.5

		Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.				
2	**Interpersonal Communication**	1. Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. 2. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.	***International Academia:*** (MIT Open Courseware): https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/ ***AICTE-prescribed syllabus:*** https://aicte.gov.in/index.php/education/model-syllabus ***Industry Mapping:*** *NA*	8	1.Prepare and deliver a 2-minute speech using any one public speaking strategy discussed in class. 2. Observe a peer conversation and write one line each on how assertion, persuasion, and negotiation were used.	**Textbook-1** Chapters: 6,7

3	**Team Skills**	1. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. 2. Non-Verbal Communication: Importance and Elements; Body Language. 3. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.	***International Academia:*** (MIT Open Courseware): *https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/* ***AICTE-prescribed syllabus: https://aicte.gov.in/index.php/education/model-syllabus Industry Mapping:*** *NA*	14	1. Watch a professional speaker and note two body language elements that made the delivery effective. 2. Participate in a small group task and write one line on how teamwork contributed to task completion.	**Textbook-1** Chapters: 8,10
4	**Professional Skills**	1. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 2. Presentation Skills:	***International Academia:*** (MIT Open Courseware): https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/ ***AICTE-prescribed syllabus:*** https://aicte.gov.in/index.php/education/model-syllabus ***Industry Mapping:*** *NA*	6	1.Set a one-line time management goal using any method (Pomodoro, ABC analysis, 2.Observe a formal interaction and list two etiquette mistakes or	**Textbook-1** Chapters: 11,12,13,14

		Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. 4. Time Management – Concept, Essentials, Tips. 5. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.			strengths in one line each. to-do list).	

Textbooks:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh,McGraw Hill India, 2012.

Reference books:

1. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearson Education India, 2011
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.
3. Effective Business Communication, Kulbhushan Kumar, Khanna Publishing House, 2021.

Course Code- OECS801B
Course Title – History of Science and Engineering
Credit – 3
Category – Open Elective Course
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – Basic understanding of science and technology

Course Outcomes:

CO1	Identify major scientific milestones from ancient to modern eras
CO2	Understand contributions of major scientists and engineers.
CO3	Analyze the evolution of engineering disciplines and technological revolutions.
CO4	Evaluate how science and engineering developments shaped modern computing.

Study Material	**Coursera**	**NPTEL**	**SWAYAM**	**Linkedin Learning**

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Assignments
1	Science and Engineering- Foundation	Ancient civilizations – Egypt, Mesopotamia, India, China, Greece; early mathematics, astronomy, metallurgy.	***MIT Open Course Ware*** *https://share.google/8cyM3W7Mg89VMVI2B* ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf*	7	1. Explain contributions o Egyptian an Mesopotamian science. 2. Compar ancient Indian an Greek advancements. 3.Write short not on earl metallurgy.
2	Scientific Revolution	Renaissance science; Galileo, Newton, Kepler; scientific method; impact on engineering.	***MIT Open Course Ware*** *https://share.google/8cyM3W7Mg89VMVI2B* ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf*	7	4.Describe Galileo's experiments. 5. Explai Newton's laws i historical contex 6. Impact o scientific metho on engineering.

3	**Developments in Science and Technology in Colonial India**	Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company‘s Service. Indian Response to new Scientific Knowledge, Science and Technology in Modern India: Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites.	***MIT Open Course Ware*** *https://share.google/8cyM3W7Mg89VMVI2B* ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf*	7	7.Discuss role o early surveyors 8.Write note o CSIR formation 9.Explain India’ early spac missions.
4	Contemporary Science & Technology	AI, IoT, nanotechnology, renewable energy, Industry 4.0; ethics in science and engineering.	***MIT Open Course Ware*** *https://share.google/8cyM3W7Mg89VMVI2B* ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf*	7	10.Case study on AI ethics. 11.Explain IoT evolution. 12.Describe nanotechnology applications.

5	Industrial Revolution	Steam engine, electricity, telegraph, transportation; emergence of engineering disciplines.	***MIT Open Course Ware*** *https://share.google/8cyM3W7Mg89VMVI2B* ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf*	7	13.Explain steam engine impact. 14.Compare early transport technologies. 15.Describe rise of engineering fields.

Textbooks

1. Science and Technology in World History– McClellan & Dorn, Johns Hopkins University Press.

Reference Books

1. A History of Engineering in Classical and Medieval Times – Donald Hill.
2. The Industrial Revolution: A Very Short Introduction– Robert C. Allen.
3. India's Scientific Heritage – Bal Ram Singh.

Online Resources:

E-book: https://shorturl.at/OwkUT

Course Code- OECS802A
Course Title – Cyber Law and IPR
Credit – 3
Category – Open Elective Course
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – Fundamentals of Computer, Computer Networks

Course Outcomes:

CO1	**Students will understand fundamentals of cyber laws, cyber jurisprudence, domain name issues and global cyberspace.**
CO2	**Students will gain knowledge of Information Technology Act 2000, cybercrime types, digital signatures, and governance.**
CO3	**Students will learn the concepts and importance of Intellectual Property Rights including patents, copyright trademarks, cybersquatting, and WIPO treaties.**
CO4	**Students will understand cyber ethics, ethical issues in the digital era, AI Ethics, and Blockchain ethics.**

Study Material	Coursera	NPTEL	Linkedin Learning	Infosys Springb

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Evolution of Cyber Laws & Cyberspace**	Evolution of computer technology Emergence of cyberspace Cyber Jurisprudence Jurisprudence and law Cyberspace vs Webspace Web hosting and Web development agreements Legal & technological significance of domain names Internet as a tool for global access	***International Academia:*** **MIT OCW – Cyber Law:** https://ocw.mit.edu/search/?q=cyber+law **WIPO Academy – Intellectual Property & Cyberspace:** https://www.wipo.int/academy/ **Industry Mapping:** ICANN Guidelines, Domain Dispute Resolution (UDRP)	5	Case study on domain name dispute. Report on evolution of global cyber law frameworks.
2	**IT Act 2000, Cybercrimes & Electronic Governance**	Overview of IT Act 2000 Amendments & limitations of IT Act	***International Academia:*** **MIT OCW – Computer Systems Security:**	10	Case study on IT Act sections. Simulation of phishing attack &

		Digital signatures Cryptographic algorithms Public-key cryptography & Private-key cryptography Electronic governance Legal recognition of electronic records Cyber offences and penalties Network service provider liability Cyber Regulations Appellate Tribunal Introduction to cybercrime Forgery, Hacking, Software Piracy Computer network intrusion Categories of cybercrime: Passive & Active attacks Cyberstalking Tools & Methods used in cybercrime: • Proxy servers • Random checking • Trojan horses & Backdoors • DoS & DDoS attacks • Phishing & identity theft	https://ocw.mit.edu/courses/6-858-computer-systems-security-fall-2014/ **Stanford – Cybersecurity Courses:** https://cyber.stanford.edu/ **Industry Mapping:** CERT-In, Cisco Cybersecurity, EC-Council (CEH)		defense techniques. Demonstration of DoS attack patterns.

3	**IPR Concepts & Digital Rights**	Introduction and need for IPR Types of IPR in the digital era Patents Copyright Trademark Cyber-squatting Reverse domain hijacking Copyright in digital medium Domain name copyright disputes Electronic database protection Copyright in computer programs Copyright & WIPO treaties	**WIPO – Intellectual Property Rights Training:** https://www.wipo.int **Harvard Cyberlaw Clinic – IPR Policies:** https://clinic.cyber.harvard.edu/ **Industry Mapping:** US Patent Office (USPTO), Digital Millennium Copyright Act (DMCA)	10	Case study on copyright infringement. Analyze a WIPO domain dispute case.
4	**Ethics in Digital World**	Importance of cyber law Significance of cyber ethics Need for cyber regulations & ethics	***International Academia:*** **MIT – Ethics of Technology:** https://ethics.mit.edu **Stanford – AI Ethics Initiative:**	5	Essay on AI ethical dilemmas. Case study on Blockchain misuse & ethics.

		Ethics in information society Introduction to Artificial Intelligence Ethics • Ethical Issues in AI • Core principles of AI ethics Introduction to Blockchain Ethics	https://hai.stanford.edu/ **Industry Mapping:** IEEE AI Ethics Standards, Blockchain Council		

Textbooks:

1. *Cyber Security* – Nina Gobole & Sunit Belapune (Wiley India)
2. *Intellectual Property Rights: Protection and Management* – Nithyananda K.V., Cengage
3. *Cyber Law & Cyber Crimes* – Adv. Prashant Mali (Snow White Publications)
4. *Information Technology Law and Practice* – Vakul Sharma

Reference books:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
2. Cell for IPR Promotion and Management (http://cipam.gov.in/)

Course Code- OECS802B
Course Title – Introduction to Philosophical Thoughts
Credit – 3
Category – Open Elective
Semester – VIII
L:T:P:S – 3:0:0:0
Pre-requisite – NA

Course Outcomes:

CO1	**Understand the basic nature of Indian philosophy and key Vedic–Upanishadic concepts.**
CO2	**Explain the epistemology, metaphysics, and ethics of the Carvaka school.**
CO3	**Describe major Jain philosophical concepts and their views on bondage and liberation and analyse core Buddhist doctrines and distinguish between different Buddhist schools**
CO4	**Understand Nyaya theories of pramanas, self, liberation, and arguments for God's existence.**

Study Material	**Coursera**	**NPTEL**	**LinkedIn Learning**	**Infosys Springboard 5G**
-	https://www.coursera.org/programs/iem-uem-program-2024-2dvv9/learn/philosophy?source=search	https://onlinecourses.swayam2.ac.in/nou25_hs30/preview	-	-

Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	**Nature of Indian Philosophy**	Nature of Indian Philosophy : Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna	***International Academia:*** (MIT Open Courseware): https://mitxonline.mit.edu/courses/course-v1:MITxT+24.00x/ ***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf* ***Industry Mapping:*** *NA*	8	1.Write one line identifying a common concern shared across at least two Indian philosophical traditions. 2.Choose any two concepts (Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta, Rna) and explain each in one concise line.	**Textbook-1** Chapter : 1
2	**Carvaka school**	Carvaka school : its epistemology, metaphysics and ethics. Mukti	***International Academia:*** (MIT Open Courseware): https://mitxonline.mit.edu/courses/course-v1:MITxT+24.00x/ ***AICTE-prescribed syllabus:*** https://aicte.gov.in/index.php/education/model-syllabus ***Industry Mapping:***	8	3. Write one line explaining how Cārvāka's epistemology (perception-only theory) rejects other sources of knowledge. 4.Compare Cārvāka's view of metaphysics or ethics with any other Indian school in one line and comment on its stance	**Textbook-2** Chapters: 8

					on *mukti*.	
3	Jainism & Buddhism	Jainism : Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentary ness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	***International Academia:*** (MIT Open Courseware): *https://mitxonline.mit.edu/courses/course-v1:MITxT+24.00x/* ***AICTE-prescribed syllabus:*** ***https://aicte.gov.in/index.php/education/model-syllabus*** ***Industry Mapping:*** *Wireshark, Packet Tracer, OPNET, NS3*	14	5. Explain any one Jain concept (sat, dravya, guna, paryaya, jiva, ajiva) in one line. 6. Describe anekantavada or syadvada in one line with a real-life example. 7. Compare any two Buddhist schools (Vaibhasika, Sautrantika, Yogacara, Madhyamika) in one line. 8. Write one line explaining dependent origination or the four noble truths.	**Textbook-1** Chapters: 4 , 17
4	**Nyaya**	Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence	***International Academia:*** (MIT Open Courseware): https://mitxonline.mit.edu/courses/course-v1:MITxT+24.00x/ ***AICTE-prescribed syllabus:*** https://aicte.gov.in/index.php/education/model-syllabus ***Industry Mapping:*** *Wireshark, Packet Tracer, OPNET, NS3*	6	9. Explain the four Nyāya pramāṇas (perception, inference, comparison, and verbal testimony) in detail and illustrate each with one	**Textbook-1** Chapter : 12

					practical example from daily or scientific life. 10. Write a detailed note on the Nyāya concept of the individual self (ātman), explaining its characteristics, its distinction from the body and mind, and its role in knowledge and experience. 11. Describe the Nyāya view of liberation (mokṣa), explaining the nature of bondage, the means to attain liberation, and how Nyāya's theory of knowledge contributes to freedom from suffering. 12. Discuss in detail any two Nyāya arguments for the existence of God (Īśvara), explaining the	

					reasoning behind them and evaluating their philosophical strengths or limitations.	

Textbooks:

1. C. D. Sharma – *A Critical Survey of Indian Philosophy*
2. M. Hiriyanna : *Outlines of Indian Philosophy*

Reference books:

1. S.N.Das Gupta : A History of Indian Philosophy Vol – I to V. 4.
2. S.Radhakrishnan : Indian Philosophy Vol – I & II. 5.
3. T.R.V.Murti : Central Philosophy of Buddhism.
4. J.N.Mahanty : Reason and Tradition of Indian Thought.
5. R.D.Ranade : A Constructive Survey of Upanisadic Philosophy.
6. P.T.Raju : Structural Depths of Indian Thought.
7. K.C.Bhattacharya : Studies in Philosophy Vol – 1.
8. Datta and Chatterjee : Introduction of Indian Philosophy