SEMESTER – VII

19N701 EMBEDDED SYSTEMS

3 0 0 3

INTRODUCTION: Fundamental Components of Embedded Systems - Architecture of Embedded Systems - Embedded Design Life Cycle - Development Environment - Validation - Host and Target Testing - Debugging tool (9)

MEMORY AND INTERRUPTS: Types of Memory - Memory Access Procedure - Memory Management techniques - Memory Testing - Common Memory problems - Interrupts - Interrupt Service Routines (9)

COMMUNICATION INTERFACES AND PROTOCOLS: Interfacing Buses - Serial Interfaces - RS232/UART - UART Programming - RS422/RS485 - I2C Interface - SPI Interface - I2C/SPI Programming - USB (9)

REAL TIME OPERATING SYSTEMS: Real-Time Concepts - Task Management - Task Scheduling - Classification of Scheduling Algorithms - Clock Driven Scheduling - Event Driven Scheduling - Resource Sharing - Priority Inheritance Protocol - Priority Ceiling Protocol - Commercial RTOS (9)

CASE STUDY: Requirement Engineering -Requirements for a Smart Card reader system - Development of Automatic Vending Machine - Protocol converter - Development of a navigation system - Simultaneous Localization and Mapping (SLAM) for autonomous vehicles (9)

Total L: 45

TEXT BOOKS:

1. Arnold S Berger, “Embedded Systems Design - An Introduction to Processes, Tools and Techniques”, Elsevier, New Delhi, 2011
2. Prasad K V K K, “Embedded/Real-Time Systems: Concepts, Design and Programming - The Ultimate Reference”, Himal Impressions, New Delhi, 2003

REFERENCES:

1.Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 3rd Edition, Tata McGraw Hill, 2017
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, First Edition, Pearson, 2009
3.Sriram V Iyer and Pankaj Gupta, “Embedded Real-time Systems Programming”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

19N710 EMBEDDED SYSTEMS LABORATORY

0 0 4 2

1. Introduction to Development Tools and Environment
2. Programming - Basics of Embedded C
3. Interfacing Keyboard and LCD Display
4. UART Serial Port Programming
5. Communication Interface using I2C and SPI
6. RTOS Programming Environment
7. RTOS - Creating Multiple Tasks
8. RTOS - Inter-Task Communication
9. RTOS - Task Synchronization
10. Automatic Vending Machine

Total P: 60

REFERENCES:

1.Michael J Pont, “Embedded C”, Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA, 2002.
2. Michael Barr and Anthony Massa, “Programming Embedded Systems with C and GNU Development Tools”, Second Edition, O’Reilly Media, 2006.
3.Jean J Labrosse, “MicroC OS II: The Real Time Kernel”, Second Edition, CRC Press, 2002.

19N720 PROJECT WORK I

0 0 4 2

The project I involves the following:

- Identification of Real-World Problem
- System Requirement Analysis and Specification
- Developing a Model and Solution for the Identified Problem
- Consolidated Report Preparation and Presentation

Total P:60

SEMESTER – VIII

19N820 PROJECT WORK II

0 0 8 4

The Project work II involves

- Preparing a project - brief proposal including
- Problem Identification
- A statement of system / process specifications proposed to be developed
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
- Time Line of activities
- Presentation highlighting the
- Design based on functional requirements
- Implementation
- Testing and Validation
- Results and future work
- Consolidated report based on standards

Total P: 120

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS:
Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal Communication Activities

(9)

FOCUS ON SOFT SKILLS:
Etiquette ─Work Place etiquette ─ Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques

(14)

TECHNICAL WRITING:
Technical Writing Principles
Style and Mechanics
Technical Definitions – Physical, Functional and Process Descriptions
Technical Report Writing
Preparing Instructions and Manuals
Interpretation of Technical Data

(15)

BUSINESS CORRESPONDENCE:
Writing Emails
Preparing Resumes
Memos
Technical and Business Proposals

(7)

TECHNICAL COMMUNICATION:
Seminars
Process Description and Group Discussions
Use of Visual Aids

(15)

Total P: 60

TEXT BOOKS:

1. Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology., Coimbatore, 2019.

REFERENCES:

1. Jeff Butterfield "Soft Skills for Everyone", Cengage Learning., New Delhi, 2013
2. Jean Naterop B and Rod Revell "Telephoning in English", Cambridge University Press., Cambridge, 2011
3. David A Mc Murrey and Joanne Buckley "Handbook for Technical Writing", Cengage Learning., New Delhi, 2011
4. Simon Sweeney "English for Business Communication", Cambridge University Press., New Delhi, 2012

19G002 GERMAN- LEVEL A1.1

0 0 4 2

GUTEN TAG!:
1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic
3. Grammar: W ─ Questions, Verbs & Personal pronouns I. (10)

FREUNDE, KOLLEGEN UND ICH:
1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural (10)

IN DER STADT:
1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
2. Vocabulary: related to the topic
4. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs (12)
5.

GUTEN APPETIT! :
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs

(13)

TAG FŸR TAG/ZEIT MIT FREUNDEN:
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone
2. Vocabulary: related to the topic
3. Grammar: Time related prepositions, Possessive articles, Modal verbs (15)

Total P: 60

TEXT BOOKS:
1. Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt Gmbh., München,2013
2. Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:
1. Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt Gmbh., München, 2013
2. Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4. Christiane Lemcke und Lutz Rohrmann "'Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

19G003 FRENCH LANGUAGE LEVEL 1

0 0 4 2

PARTS OF SPEECH:
1. inviter et répondre à une invitation, Pronoms sujets
2. L'article définis, l'article indéfinis
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes

(12)

ELEMENTS OF GRAMMAR:
1. Exprimer l'ordre et l'obligation demander et commander
2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne
3. pas, l'article contracté
4. verbe pronominaux
5. prepositions

(12)

SENTENCE STRUCTURE:
1. Raconter et reporter-donner son avis
2. Futur simple, pronom complètement d'objet direct, passé composé
3. plusieurs région de France, imparfait, pronom y/en, imparfait

(12)

TENSES AND NUMBERS:
1. Demander l'autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport

(12)

DISCOURSE:
1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter d'système éducation de France
3. parler de la technologie de l'information

(12)

Total P: 60

TEXT BOOKS:
1. Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI,2012
2. Myrna Bell Rochester "Easy French Step By Step", MCGrawhill Companies.,USA, 2008

REFERENCES:
1. Michael D. Oates "Entre Amis: An Interactive Approach", Houghton Mifflin., 2005 , 5th
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", .,
3. Simone Renaud, Dominique van Hooff "En bonne forme", .,

19G004 BASIC JAPANESE

0 0 4 2

JAPANESE PEOPLE AND CULTURE:
1. Basic greetings and responses
2. Basic script–Method ofwriting hiragana and katakana –Combination sounds and simple words 3. Self introductions:—Hajimemashite‖ -Demonstratives —Kore‖,—Sore‖,—Are‖–Demonstrative —Kono‖,—Sono‖,—Ano‖ 4. Possessive noun particle —no‖ –Japanese apartments: Greeting your neighbor

(12)

PATICLE "NI (AT)" FOR TIME:
1. kara (from) ~ made(until) – Particle —to (and)‖
2. Time periods: Days of the week, months, time of day –Verbs (Present / future and pasttense) 3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle —e‖.

(12)

LIKES AND DISLIKES:
1. Potential verbs (wakarimasu and dekimasu) – —Kara (~ because)‖
2. Adverbs –Asking some one out over the phone-Verbs denoting presence
4. Introduction to Adjectives (na and ii type) -Verb groups – I, II and III – Exercises to group verbs- Please do (te kudasai)
5. Present continuous tenses (te imasu) – Shall I? (~ mashou ka) – Describing a natural phenomenon (It is raining)

(12)

DIFFERENT USAGES OF ADJECTIVES:
1. Comparison –Likes and dislikes –Going to a trip- Need and desire (ga hoshii) – Wanting to…(Tabeti desu)- Going for a certain purpose (mi –ni ikimasu)
2. Choosing from a menu-Adjectives (—i‖ and —na‖ type) – Adjectives (Positive and negative useage) (12)

ROLE PLAYS IN JAPANESE:
1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party (12)

Total P: 60

TEXT BOOKS:
1. Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", . International publisher – 3A Corporation., Tokyo, 2012

REFERENCES:
1. Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I -Workbook", 1999
2. Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", 2014
3. Minna No Nihongo "Translation & Grammatical Notes In English Ele

PROFESSIONAL ELECTIVES

19N001 ADVANCED DATA STRUCTURES

3 0 0 3

AMORTIZED ANALYSIS AND SETS: Amortization - Methods - Applications. Sets: Disjoint Sets - Dynamic Set Operations - Van Emde Boas Trees. (9)

HEAP STRUCTURES: Min - Max Heaps - Deaps - Leftist Heaps - Binomial Heaps - Fibonacci Heaps. (8)

SEARCH TREES: Red-Black Tree - AA Tree - Interval Tree - Splay Trees. (7)

MULTIDIMENSIONAL STRUCTURES K - D Trees - Point Quad Trees - MX- Quad Trees - R - Trees - TV Trees. (9)

RANDOMIZATION: Random Number Generators - Skip Lists - Primality Testing - Treaps. - Probabilistic analysis and Randomization. (12)

Total L: 45

TEXT BOOKS:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press, Massachusetts 2009.
2. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", University Press, New Delhi, 2013.

REFERENCES:

1. Subrahmanian V S, "Principles of Multimedia Database Systems", Morgan Kaufman, USA, 2001.
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2006.
3. Peter Brass, "Advanced Data Structures", Cambridge University Press, USA, 2008.
4. Venkatesan R and Lovelyn Rose S, "Data Structures", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2015.

19N002 APPROXIMATION ALGORITHMS

3 0 0 3

INTRODUCTION AND COMBINATORIAL ALGORITHMS: Definitions - Performance ratios - vertex cover problem - Lower bounding - Greedy set cover problem - Layering - Application to shortest superstring (9)

LINEAR PROGRAMMING DUALITY AND ROUNDING: LP-Duality theorem - Min-max relations and LP-Duality - LP-rounding for set cover problem - randomized rounding - Primal-Dual method for set cover problem (9)

CUTS AND LP RELAXATIONS: Multicut and Integer Multicommodity - Primal-dual scheme for Multicut - Multiway Cut - Randomized rounding algorithm for multiway cut - Multicut in General Graphs - Sum multicommodity flow - LP rounding-based algorithm (9)

SEMIDEFINITE PROGRAMMING: Strict quadratic and vector programs - Properties of positive semidefinite matrices Semidefinite programming problem - Randomized rounding algorithm - Improving the guarantee for MAX-2SAT (9)

HARDNESS OF APPROXIMATION: Reduction, graphs, and hardness factors - PCP theorem - hardness of MAX- 3SAT - Hardness of set cover (9)

Total L: 45

TEXT BOOKS:

1. Vijay V. Vazirani, "Approximation Algorithms", Springer Nature (SIE), Berlin, 2010.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, England, 2009.

REFERENCES:

3. David P. Williamson, David P. Shmoys, "The Design of Approximation Algorithms", Cambridge University Press, England, 2011.
4. Ellis Horrowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 1st Edition, Galgotia Publications, New Delhi, 2010.
5. Bernd Gärtner, Jiri Matousek, "Approximation Algorithms and Semidefinite Programming", Springer, Berlin, 2012.
6. Christos H. Papadimitriou, Kenneth Steiglitz, "Combinatorial Optimization: Algorithms and Complexity", 1st Edition, Dover Publications, New York, 2013.

19N003 AUGMENTED REALITY

3 0 0 3

INTRODUCTION TO IMMERSIVE TECHNOLOGIES AND GEOMETRY OF VIRTUAL WORLDS: Introduction to Immersive Technologies - Reality, Virtuality and Immersion - VR, AR, MR: similarities and differences - Current trends and state of the art in immersive technologies, developing platforms and consumer devices - Geometric modelling - Matrix algebra and 2D rotations - 3D rotations and yaw, pitch, and roll – Quaternions - Converting and multiplying rotations - Homogeneous transforms - Eye transforms - Canonical view transform. (9)

TRACKING FOR AUGMENTED REALITY & VIRTUAL REALITY: Overview - Orientation tracking - Tilt drift correction - Yaw drift correction - Camera tracking - Perspective n-point problem – Filtering - Motion tracking and navigation - Navigation and Manipulation Interfaces. (9)

VISUAL RENDERING: Visual Rendering - Overview - Shading models – Rasterization - Pixel shading - Distortion shading - Post-rendering image warp - Rendering Architecture - 3D rendering for Immersive Environments. (9)

HUMAN PERCEPTION FOR AUGMENTED REALITY & VIRTUAL REALITY: Interfaces - Overview – Locomotion – Manipulation - System control - Social interaction –Human Perception and Cognition - User Centered Design - User Experience - Ethical Code of Conduct - VR Health and Safety Issues. (9)

APPLICATIONS OF VR: Applications of VR in Medical applications, Military applications - Robotics applications - Robot Programming and Robot Teleoperation - Big Data Visualization - VR Technology in Film & TV Production - Demonstration of Digital Entertainment by VR - VR Technology in Physical Exercises and Games. (9)

Total L: 45

TEXT BOOKS:

1. Kent Norman (Ed), Wiley Handbook of Human Computer Interaction, Wiley 2017.
2. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016.

REFERENCES:

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016.
2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2006.
5. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)", Addison-Wesley publisher, 1st Edition, 2016.

19N004 BLOCKCHAIN TECHNOLOGY

3 0 0 3

INTRODUCTION: Distributed System, P2P system, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, issues, Distributed Ledger Technology- Private, public and permissioned ledgers - Cryptographic primitives- public key cryptography- Digital Signature Algorithm -Hashing- Blockchain evolution- Structure of blockchain – Life of Blockchain application - consensus – Byzantine General problem and Fault Tolerance. (11)

BITCOIN AND CRYPTOCURRENCY: Block Hash - structure of block – syntax, structures, and validation - transaction life cycle- transaction types – Hash computation and Merkle Hash Tree -Bit coin and importance- Creation of coins– Bitcoin P2P Network-, Bitcoin protocols - Mining strategy and rewards – PoW and PoS – Difficulty, hash rate– Wallets- Double spending – forking- Token, Coinbase (12)

ETHEREUM: Distributed applications (Dapps), Smart contracts, Ethereum Virtual Machines, Ethereum high level design, Ethereum addresses, Ethereum accounts, Transactions, Currency, Gas, Tokens, Decentralized autonomous organizations(DAOs), Bitcoin vs Ethereum – Trie- Solidity programming – writing smart contracts – remix IDE – TestNet- sample exercises - issues in solidity programming (12)

HYPERLEDGER: Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric. (5)

APPLICATIONS: Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, Cross border payments - AI applications - swarm learning (5)

Total L: 45

TEXT BOOKS:

1. Imran Bashir,' Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks', Packt Publishing Limited 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. 'Bitcoin and cryptocurrency technologies: a comprehensive introduction', Princeton University Press, 2016

REFERENCES:

1. Bina Ramamurthy,' Block Chain in Action', Manning Publications, 1st edition, 2020
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
4. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

19N005 COMPILER DESIGN

3 0 0 3

INTRODUCTION TO COMPILERS: Translators - Compilation and Interpretation - The Phases of Compiler – Errors Encountered in Different Phases - The Grouping of Phases - Compiler Construction Tools - JIT. (7)

LEXICAL ANALYSIS: Need and Role of Lexical Analyzer - Input Buffering - Lexical Errors - Expressing Tokens by Regular Expression - Finite Automata: NFA- DFA - Converting NFA to DFA - Minimization of DFA- Converting Regular Expression to DFA. LEX Tool: Structure of LEX Program – Design of Lexical Analyzer for a Sample Language. (9)

SYNTAX ANALYSIS: Need and Role of the Parser - Context Free Grammars - Top-Down Parsing: Recursive Descent Parser - Predictive Parser. Bottom-Up Parsers: Shift Reduce Parser - LR Parser - LR (0) Item - Construction of SLR Parsing Table - CLR Parser - LALR Parser. Error Handling and Recovery in Syntax Analyzer – YACC Tool: Structure of YACC Program – Design of a Syntax Analyzer for a Sample Language. (10)

INTERMEDIATE CODE GENERATION: Benefits- Intermediate Languages - Generation of Three Address Code – Declarations - Assignment Statements - Arrays - Boolean Expressions - Backpatching - Flow of Control Statements – Procedure calls. (9)

RUN-TIME ENVIRONMENT, CODE OPTIMIZATION AND GENERATION: Source Language Issues – Storage Organization - Storage Allocation - Symbol Tables. Principal Sources of Optimization - Optimization of Basic Blocks - Global Optimization - Global Data Flow Analysis - Issues in Design of A Code Generator - A Simple Code Generator Algorithm. (10)

Total L: 45

TEXT BOOKS:

1. Alfred V Aho, Monica Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers - Principles, Techniques and Tools", Essex Pearson, Harlow, 2014
2. V Raghavan, “Principles of Compiler Design”, 2nd Edition, TMH, 2016

REFERENCES:

1. Dick Grone, Henri E Bal, Ceriel J H Jacobs, Koen G Langendoen, "Modern Compiler Design", John Wiley & Sons, USA,2000.
2. O.G. Kakde, "Compiler Design", 5th Edition, An Imprint of Laxmi Publications Pvt. Ltd., 2015
3. Sudha Sadasivam G, "Compiler Design", Scitech Publications (India) Private Limited, Chennai, 2010.
4. Dhamdhere D M, "Compiler Construction Principles & Practice", Macmillan India Limited, New Delhi, 1997.

19N006 COMPUTER VISION AND IMAGE PROCESSING

3 0 0 3

IMAGE REPRESENTATION: Digital images – Digital Image formats - Problems in digital image – 3D structure from 2D Images – Pixels and Neighborhoods – Applying masks to Images – Binary image morphology – Region properties – Region adjacency Graphs – Thresholding Grayscale image – Histograms for Threshold selection. (9)

IMAGE FILTERING AND ENHANCEMENT: Grey level mapping – Removal of small image regions – Image smoothing – Median filtering – Determining edges using differencing masks – Gaussian filtering and LOG edge detection – Canny edge detector – Mask and matched filters - Color: RGB basics for color – Color histogram – Color segmentation - Shading - Texture: Texels and Statistics – Texel based texture description - Texture segmentation. (9)

MOTION SEQUENCING AND IMAGE SEGMENTATION: Motion phenomena and applications – Image subtraction – Computing motion vectors – Computing paths of moving points – Detecting changes in video - Segmentation: Identifying regions – Representing regions – Identifying contours – Fitting models to segments – Segmentation using Motion Coherence. (9)

3D SENSING AND OBJECT COMPUTATION: Representation of 2D data – representation of Points – Affine mapping functions – Perceiving 3D from 2D images – Perspective imaging model – Depth perception from stereo – General stereo configuration – 3D affine transformation – camera model – Best affine calibration matrix – 3D object reconstruction. (9)

CASE STUDY: Veggie Vision: A system for checking out vegetables – Identification humans via the Iris of an Eye – Advanced Driver Assistance systems (ADAS) using multi sensors and cameras. (9)

Total L: 45

TEXT BOOKS:

1.Linda G. Shapiro, George C. Stockman, “Computer Vision” Pearson Prentice Hall, 2011
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.

REFERENCES:

1. E. R. Davies, "Computer & Machine Vision", 4th Edition, Academic Press, 2012.
2. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
3. Mark Nixon, Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2012.
4. Simon J. D. Prince , "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

19N007 CLOUD COMPUTING

3 0 0 3

INTRODUCTION TO CLOUD COMPUTING: The Vision of Cloud Computing - Defining a Cloud - A Cloud Computing Reference Model - Characteristics and Benefits - Challenges Ahead - Historical Developments - Types of Clouds - Building Cloud Computing Environments - Computing Platforms and Technologies. (9)

VIRTUALIZATION: Introduction - Hypervisors - Main Categories of Virtualization: Full - Para - Application Server - Application - Network - Storage – Service - Benefits of Virtualization - Cost of Virtualization - Virtualization Drawbacks – Case Study: GCP - Creation of virtual machines- Google Kubernetes Engine (9)

CLOUD COMPUTING ARCHITECTURE AND SERVICE MANAGEMENT: Economics of the Cloud - Storage as a Service - Database as a Service - Information as a Service - Process as a Service - Application as a Service - Platform as a Service - Integration as a Service - Security as a Service - Management as a Service - Testing as a Service - Infrastructure as a Service (9)

CLOUD APPLICATIONS: Scientific Applications - Gene Expression Data Analysis for Cancer Diagnosis - Business and Consumer Applications - Social Networking - Media Applications. (9)

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE TASKS IN CLOUD: AI Platform - Case study: Train and deploy a TensorFlow model to AI Platform in GCP, Cloud Speech API – Case study: Create an API key - Create a Speech API request - Call the Speech API request, Reinforcement Learning - Case study: fundamental concepts of Reinforcement Learning in GCP. (9)

Total L: 45

TEXT BOOKS:

1. Rajkumar Buyya , Christian Vecchiola, Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill Education Private Limited, New Delhi, 2017.
2. Ted Hunter, Steven Porter, Legorie Rajan PS, “Building Google Cloud Platform Solutions: Develop scalable applications from scratch and make them globally available in almost any language”, Packt Publishing Limited, ISBN: 1838647430, March 2019

REFERENCES:

1. Ekaba Bisong, “Building Machine Learning and Deep Learning Models on Google Cloud Platform”, Apress, ISBN: 978-1-4842-4470-8, 2019.
2. KC Tung, “Learn TensorFlow Enterprise: Build, manage, and scale machine learning workloads seamlessly using Google's TensorFlow Enterprise”, Packt Publishing, 2020.
3. Anand Deshpande, Manish Kumar, Vikram Chaudhari, “Hands-On Artificial Intelligence on Google Cloud Platform: Build intelligent applications powered by TensorFlow, Cloud AutoML, BigQuery, and Dialogflow”, ISBN-13: 978-1789538465, Packt Publishing, 2020.
4. Diane Barrett and Gregory Kipper, “Virtualization and Forensics: A Digital Forensic Investigators Guide to Virtual Environment”, Elsevier, USA, 2010.
5. David S Linthicium, “Cloud Computing and SOA Convergence in Your Enterprise”, Pearson, USA, 2010.

19N008 EVOLUTIONARY COMPUTING ALGORITHMS

3 0 0 3

INTRODUCTION: Challenges in Solving Complex Problems - Evolutionary algorithms: Principles, Historical development, Features, Classification and Components, Advantages, Applications. (8)

HEURISTIC SEARCH: Problem representation as search - Generate and Test - Breadth First Search - Depth First Search - Hill Climbing: Principles, Local and Global maxima, Ridges, Plateau - Steepest Ascent - Simulated annealing: Annealing schedule, Parameter Selection. (8)

GENETIC ALGORITHM: Biological Background - Simple Genetic Algorithm (SGA) - Representation types - Recombination Types - Mutation types - GA Algorithm - Schema Theorem - Variations of GA: Adaptive GA, Real Coded GA - Differential Evolution: Principles, Mutation, Crossover, Selection. (9)

SWARM INTELLIGENCE: Particle Swarm Optimization: Swarms, Operating principles, PSO Algorithm, Neighborhood Topologies - Variations of PSO: Binary, weighted - Ant Colony Optimization: Ant foraging behavior, Theoretical Considerations, ACO Algorithm, Variations of ACO: Elitist Ant System (EAS), MinMax Ant System (MMAS) and Rank Based Ant Colony System (RANKAS). (10)

MULTI-OBJECTIVE OPTIMIZATION AND MEMETIC ALGORITHMS: Multi-Objective Principles - Classical Methods - Challenges - Evolutionary algorithms for multi-objective optimization - Multimodal function optimization - Non-Dominated Sorting Genetic Algorithm (NSGA): Non-elitist, elitist - Controlled elitism in NSGA - Memetic Algorithms: Need - Template - Design Issues - Considerations for Discrete and Combinatorial Optimization problems. (10)

Total L: 45

TEXT BOOKS:

1. Eiben A E and Smith J E, “Introduction to Evolutionary Computing”, Second edition, Springer, Heidelberg, 2015.

2. Rich E and Knight K, “Artificial Intelligence”, Tata McGraw Hill Education Private Limited, India, 2011.

REFERENCES:

1. Deb K, “Multi-Objective Optimization Using Evolutionary Algorithms”, Wiley-Blackwell, USA, 2008.
2. Kennedy J and Eberhart R C, “Swarm Intelligence”, Morgan Kaufmann Publishers, USA,2001.
3. Dorigo M and Stutzle T, “Ant Colony optimization”, Prentice Hall of India, New Delhi, 2005.
4. DeJong KA, “Evolutionary Computation: A Unified Approach”, Prentice Hall of India, New Delhi, 2006.

19N009 GRAPH THEORY

3 0 0 3

INTRODUCTION: Review on Definition and Basic Terminologies of Graphs – Representations of Graphs – Walks in Graphs and Digraphs- Subgraphs-Vertex Degrees - Path and Cycles - Regular and Bipartite Graphs- Representations of graphs – adjacency and incidence lists – adjacency and incidence matrices -Graph Traversals-Applications: Four Cubes Problem- Social Networks. (9)

EULERIAN AND HAMILTONIAN GRAPHS: Exploring and Travelling – Eulerian Graphs – Konigsberg bridge problem - Hamiltonian Graphs – Applications: Dominoes – Chinese Postman Problem - Travelling salesman problem (8)

PATHS AND CONNECTIVITY: Connected Graphs and Digraphs-Menger’s Theorem for Graphs-Applications: Reliable Telecommunication Networks. Network flows and applications- Flows and cuts in Networks, Maximum-flow problem, flows and connectivity– applications (10)

VERTEX-COLORING: Vertex-coloring - chromatic number of a graph, vertex coloring algorithms – sequential vertex coloring, largest degree first algorithm, applications - scheduling problem, fast register allocation for computer programming. (10)

MATCHING AND FACTORS: Matching, Perfect matching, Tutte’s 1-factor theorem, weighted Bipartite matching, Hall’s theorem. (8)

Total L: 45

TEXTBOOKS:

1. Jonathan L. Gross and Jay Yellen, Graph Theory and its Applications, CRC Press, New York, 2016.
2. Douglas B West, Graph Theory, Prentice Hall, New Delhi, 2017.

REFERENCES:

1. Bondy J.A. and Murty U.S.R., Graph Theory, Springer, London, 2016.
2. Narsingh Deo, Graph Theory with Applications to Engineering And Computer Science, Prentice Hall, New Delhi 2017.
3. Joan M Aldous and Robin J Wilson, “Graphs and Applications- An Introductory Approach, Springer-Verlag”, New York, 2014.
4. Reinhard Diestel,” Graph Theory”, Springer-Verlag, Berlin Heidelberg, 2012.
5. Willian Kocay, Donald L. Kreher, Graphs, Algorithms, and Optimization, CRC Press, 2013.

19N010 HUMAN COMPUTER INTERACTION

3 0 0 3

HCI FOUNDATION: The Human - The Computer - The Interaction - Paradigms for Interaction. (8)

USABILITY ENGINEERING: Definition - UI Generations - Evaluation - Lifecycle - Classification of Users - Prototyping - Usability Testing Stages. (9)

GUIDELINES IN HCI: Principles to Support Usability - HCI Golden Rules - Shneiderman’s Eight Golden Rules - Norman’s Model of Interaction. (8)

DESIGN PROCESS: UI Design Process - Task Oriented Design - Object Oriented Design - CSCW UI Design - Case Studies. (10)

WEB AND MOBILE U>: Principles for Web and Mobile UI - Web UI Patterns - Mobile User Characteristics - Mobile Devices: Taxonomy - Anatomy - Mobile Design Principles - Mobile UI Design Patterns. (10)

Total L :45

TEXT BOOKS:

1. Dix A, Finlay J, Abowd G D and Beale R, “Human Computer Interaction”, Third Edition, Pearson Education, USA, 2018.
2. Linda Mcaulay, “HCI for Software Designers”, International Thompson Computer Press, USA, 2005.

REFERENCES:

1. NPTEL, “HCI”, http://www.nptel.ac.in/syllabus/106103115/
2. Bill Scott and Theresa Neil, “Designing Web Interfaces”, O’Reilly, 2011
3. Barbara Ballaer, “Designing the Mobile User Experience”, Wiley, USA, 2015.

4. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs, “Designing the User Interface: Strategies for effective HCI”, Pearson, USA, 2015.

19N011 INFORMATION RETRIEVAL

3 0 0 3

INTRODUCTION: Boolean retrieval - IR problem - Inverted index - Processing Boolean queries - Extended Boolean model and ranked retrieval - Document delineation - Determining vocabulary of terms - Skip pointers – Search structures for dictionaries - Wildcard queries - Spelling and phonetic correction (9)

INDEX CONSTRUCTION: Blocked sort-based indexing - Single-pass in-memory indexing - Distributed indexing - Dynamic indexing - Statistical properties of terms in IR - Dictionary compression - Postings file compression (9)

VECTOR SPACE MODEL AND EVALUATION: Term frequency and weighting - Vector space model - Queries as vectors - Computing vector scores - IR system evaluation - Standard text collections - Evaluation of unranked and ranked retrieval sets (9)

PROBABILISTIC AND LANGUAGE MODELS: Probability ranking principle - Binary independence model - Appraisal of probabilistic models - Language models - Query likelihood models - Merits and demerits of language models (9)

WEB SEARCH: Web characteristics - Search user experience - Index size and estimation - Near-duplicates and shingling - Web crawler features and architecture - URL frontier - Link analysis - Web as a graph - PageRank algorithm - Hubs and authorities (9)

Total L: 45

TEXT BOOKS:

1. Manning C, Raghavan P, Schutze H, "Introduction to Information Retrieval", Cambridge University Press, New Delhi, 2008.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Addison Wesley, USA, 2011.

REFERENCES:

1. Bruce Croft W, Metzler D, Strohman T, "Search Engines: Information Retrieval in Practice", Addison Wesley, USA, 2009.
2. Gerald K, "Information Retrieval Architecture and Algorithms", Springer, Heidelberg, 2013.
3. Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press, Cambridge, USA, 2016.
4. Hang Li, "Learning to Rank for Information Retrieval and Natural Language Processing", 2nd Edition, Morgan & Claypool Publishers, USA, 2014.

19N012 NETWORK DATA ANALYTICS

3 0 0 3

GRAPH THEORY IN NETWORK ANALYSIS: Representing Networks - Graphs and Networks - Paths and Cycles - Components and Connected sub graphs - Neighborhood - Degree and Network Density - Eigenvectors and Eigen values - Degree Distributions - Cliquishness, Cohesiveness, and Clustering – Centrality (7)

NETWORK MODELS AND LINK ANALYSIS: The Small-World Phenomenon: Six Degrees of Separation - Decentralized Search - Power Laws - Rich-Get-Richer Models - The Long Tail - The Problem of Ranking - Link Analysis Using Hubs and Authorities – PageRank (8)

COMMUNITY DETECTION IN SOCIAL NETWORK: Triadic Closure - The Strength of Weak Ties - Homophily - Affiliation - Betweenness Measures and Graph Partitioning - Communities and Blocks - Methods for Identifying Community Structures - Stochastic Block Models and Communities - Maximum-Likelihood Estimation of Communities (10)

GAME THEORY IN NETWORK ANALYSIS: Introduction to game theory - Best Responses and Dominant Strategies - Nash Equilibrium - Multiple Equilibria: Coordination Games (10)

ECONOMIC NETWORK ANALYSIS: Auctions: Types of Auctions - Second-Price Auctions - Matching Markets: Bipartite Graphs and Perfect Matching - Sponsored Search Markets: Advertising Tied to Search Behavior - Advertising as a Matching Market – The VCG principle - Equilibria of the Generalized Second-Price Auction (10)

Total L: 45

TEXT BOOKS:

1. David Easley, Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge University Press, 2016.
2. Matthew O. Jackson, “Social and Economic Networks”, Princeton University Press, 2015.

REFERENCES:

1.Jure Leskovec, Anand Rajaraman, Jeff Ullman," Mining of Massive Datasets", Cambridge University Press, 2014.
2. Charu C Agarwal, "Social Networks Data Analytics", Springer, USA, 2011.
3. John Scott, Peter J. Carrington, "Sage Handbook of Social Network Analysis", SAGE Publications, 2011
4. Valente, Thomas, "Social Networks and Health: Models, Methods and Applications. New York: Oxford University Press, 2010
5. Guandong Xu and Lin Li, "Social Media Mining and Social Network Analysis: Emerging Research "IGI Global,2013.

19N013 RANDOMIZED ALGORITHMS

3 0 0 3

RANDOMIZED AND PROBABILISTIC METHODS: Randomized algorithms, Karger's mincut algorithm, Las Vegas and Monte Carlo algorithms, Computational models and Complexity classes. PROBABILISTIC METHODS: overview - maximum satisfiability - finding a large cut -Expander Graphs (12)

DEVIATION AND INEQUALITIES: Occupancy problem, Markov and Chebyshev inequalities - randomized selection - coupon collector's problem, the Chernoff bound, routing in a parallel computer - a wiring problem (10)

MARKOV CHAINS AND RANDOM WALKS: Markov Chains: Definition, Markov Chains with two states, transition probabilities, transition matrix, Chapman Kolmogorov equations, time - homogeneous chains, initial distribution, branching processes. Random walk on graphs - connectivity in undirected graphs - Expanders and Rapidly mixing random walks. (9)

APPLICATIONS: Data Structure and Graph Algorithms : Random Treaps, Primality Testing, Skip Lists - Hash tables - Fast mincut. Parallel and Distributed Algorithms: Sorting on a PRAM - Maximal Independent sets (9)

DERANDOMIZATION: The method of Conditional Probabilities - Derandomizing maxcut algorithm - Constructing pairwise independent values modulo a prime - Pairwise independent - large cut (5)

Total L: 45

TEXTBOOKS:

1. Rajeev Motwani and prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, Cambridge, 2014.
2. Micheal Mitzenmacher and Eli Upfal, "Probability & Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis", Cambridge University Press, Cambridge, 2017.

REFERENCES:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2014.
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, "Introduction to Algorithms", MIT Press, Cambridge, 2018.
3. Jon Kleinberg and Eve Tardos, "Algorithm Design", Pearson Education, 2014.
4. Noga Alon, Joel H Spencer, "The Probabilistic Method", 4th Edition, Wiley-Interscience, 2016.

19N014 RECOMMENDER SYSTEMS

3 0 0 3

INTRODUCTION: Recommender system functions- Understanding user ratings - Applications of recommendation systems- Issues with recommender systems – Recommender Systems as a Multi-Disciplinary Field. (9)

RECOMMENDATION TECHNIQUES: Collaborative Filtering: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model Based Techniques- Content-based recommendation - Knowledge based recommendation: Knowledge representation and reasoning – Overspecialization. (10)

HYBRID RECOMMENDATION SYSTEM: Opportunities for hybridization- Monolithic hybridization design- Parallelized hybridization design- Pipelined hybridization design. (10)

EVALUATING RECOMMENDER SYSTEMS: General Properties of evaluation – evaluation design – Evaluation on historical dataset – Alternate evaluation designs. (8)

SECURITY ISSUES IN RECOMMENDER SYSTEMS: Attack dimensions – Attack types – Evaluation of effectiveness and countermeasures – Privacy aspects – Case study: Personalized recommendations on the mobile internet. (8)

Total L:45

TEXTBOOKS:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press, 2011, First Edition.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer, 2011, First Edition.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer, 2013, First Edition.

19N015 SEMANTIC WEB TECHNOLOGY

3 0 0 3

SEMANTIC WEB VISION AND STRUCTURED WEB DOCUMENTS: Introduction to Semantic web - Evolution of web Semantic Web Technologies - Recommended Layered Architectures. Structured web documents- The XML Language: Structuring - Namespaces - Addressing and Querying XML Documents - Processing. (9)

DESCRIBING WEB RESOURCES: Introduction - RDF: Basic Ideas - `-Based Syntax. RDF Schema: Basic Ideas - RDF and RDF Schema in RDF Schema - An Axiomatic Semantics for RDF and RDF Schema – Querying in SPARQL (9)

ONTOLOGY ENGINEERING AND OWL: Introduction - Constructing Ontologies Manually - Reusing Existing Ontologies - Using Semi-automatic Methods - On-to-Knowledge Semantic Web Architecture –OWL Language – Ontology Examples- OWL In OWL - Future Extensions. (9)

LOGIC AND INFERENCE: Rules - Monotonic Rules: Syntax - Semantics - Representing Family Relationships. Non monotonic Rules: Syntax - Brokered Trade as an Example - Monotonic and Non monotonic Rule Markup. (9)

TOOLS AND APPLICATIONS: Development tools for semantic web- Jena Framework- Semantic Wikis-Semantic web service, Horizontal Information Products at Elsevier - Data Integration at Audi - Skill Finding at Swiss Life. (9)

Total L: 45

TEXT BOOKS:

1. Grigoris Antoniou, Frank van Harmelen, "Semantic Web Primer", MIT press, USA, 2008.
2. Michael C Daconta, Leo J Obrst, Kevin T Smit, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, USA, 2003.

REFERENCES:

1. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", CRC Press, 2009.
2. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, "Semantic Web Programming", 1st Edition, Wiley, 2009.
3. Liyang Yu, "A Developer's Guide to the Semantic Web", First, Springer, 2011.
4. Ducharme B, "Learning SPARQL", 1st Edition, O'Reilly Media, 2011.

OPEN ELECTIVES

19NO01 DESIGN THINKING

3 0 0 3

INTRODUCTION: Design thinking overview - Design Process – Principles of Design Thinking – Problems Best suited for Design Thinking – Visualization tool. **Case Study:** Problem Identification in AI (9)

EMPATHIZE: Information Gathering – Analysis – Storytelling tool- Innovation- Ideation Finding and Evaluating Ideas – Mind Mapping Tool. **Case Study:** Analysing the Identified Problem. (9)

DESIGNING PROTOTYPES: Tasks in Prototyping – Understanding Different Prototypes - Developing different prototypes – Demonstration – Prototyping Tools. **Case Study:** Prototyping the solution. (9)

TESTING AND EVALUATION: Testing Prototypes – Evaluation – Improving solution – Strategic Opportunities. **Case Study:** Evaluating the solution. (9)

APPLICATIONS: Artificial Intelligent Application - HealthCare and Science – Education- Transportation - Finance – Technology (9)

Total L: 45

TEXT BOOKS:

1. Andrew Pressman "Design Thinking A Guide to Creative Problem Solving for Everyone", Routledge Publication, 2019.
2. Muller-Roterberg "Design thinking for dummies" John Wiley & Sons,2020.

REFERENCES:

1. Alyssa Gallagher and Kami Thordarson, "Design Thinking in Play: An Action Guide for Educators", ASCD Book, 2020
2. Robert Curedale, "Design Thinking Process & Methods" Design Community College, 5th Edition, 2019.
3. Brown.T, "Change by design: How design thinking transforms organizations and inspires innovation", HarperCollins,2009.
4. Harvard Business Review. "Better brainstorming" https://hbr.org/2018/03/better-brainstorming

19NO02 ETHICS OF ARTIFICIAL INTELLIGENCE

3 0 0 3

INTRODUCTION TO ETHICS OF AI: Overview of Narrow AI, General AI and Responsible AI - Laws and Regulation- Ethics of the Ethics of AI- Ethical Issues and relationship with artificial entities- Exploring the Ethical Considerations in Indian context. **Frameworks and Modes:** AI Governance by Human rights- Incompatible incentives of private sector AI - Normative Modes: Codes and Standards- Professional Norms in the Governance of AI -Legal and Regulatory Approaches for Managing AI Systems in India (9)

CONCEPTS AND ISSUES: Justice in Artificial Intelligence: Limits, Failings, and Ethics of Fairness - Accountability in computer Systems- Transparency-Responsibility and AI- Ethical Analysis and design- The future of work in the age of AI- Sentiment AIs - Autonomy –Algorithmic Governance and Law. (9)

PERSPECTIVES AND APPROACHES: Perspectives and Approaches of computer science- Social Failure modes in technology - Human centred Approach to AI Ethics: perspective from Cognitive science - Integrating ethical and economic values- Fairness through the lens of Directed Acyclic Graphs: a Statistical Modelling Perspective- Designing for other worlds- Perspectives and Approaches AI in ethics: East Asia – Middle East- Policy framework for trustworthy AI. (9)

ADDRESSING ETHICAL ISSUE IN AI: Ethical theories - purpose of AI- Ethical principles of AI –Options at the policy and organisational levels- guidance mechanisms –AI ethics stakeholders -Principles for Responsible Management of AI Systems in India (9)

NEAR FUTURE OF AI: Mass Unemployment- autonomous Weapons – Ethical Matrix –Ethics of Artificial Lover-Long term impact of super intelligence: Alignment of advanced machine learning systems- moral machines- Designing AI with Rights, Consciousness, Self-Respect, and Freedom. Applications: Transport, Defence, Healthcare, Law, Education, Robot Teaching, Social organization of work, Smart City. (9)

Total L: 45

TEXTBOOKS

1. Markus D. Dubber, Frank Pasquale, sunit Das, The Oxford Handbook of Ethics of AI, Oxford University Press, USA, 2020
2. Bernd Carsten Stahl, Artificial intelligence for a better future: An Ecosystem Perspective on the ethics of AI and Emerging digital Technologies, Springer, UK, 2021.

REFERENCES

1. S. Matthew Liao, Ethics of Artificial Intelligence, Oxford University Press, USA, 2020.
2. Virginia Dignum, Responsible Artificial Intelligence, Springer, Switzerland, 2019.
3. Steven John Thompson, Machine Law, Ethics, and Morality in the Age of Artificial Intelligence, IGI Global, USA 2021.
4. Christoph Bartneck, Christoph Lütge,Alan Wagner, Sean Welsh, An Introduction to Ethics in Robotics and AI, Springer, Switzerland 2021.
5. Niti Aayog, “Responsible AI”, Govt of India, 2021.

19NO03 INTELLECTUAL PROPERTY RIGHTS

3 0 0 3

PATENTABLE INVENTIONS: What are inventions? Why people invent —how to pitch an invention – Commercial implications of patent protecting an invention Introduction To Patents - Requirements For Patentability – Novelty, Inventive step, Industrial Application - Types of Patent Applications - Provisional And Complete Specification - Structure of Provisional And Complete Specifications - Sections And Rules of the Indian Patent Act – Non patentable Inventions (7)

TYPES OF INTELLECTUAL PROPERTY: Patents, Trademarks, Copyrights, Industrial Designs, Geographical Indication (GI), Trade Secrets, Integrated Circuit Layout Designs (SICLDR) - Process of patenting and development: Technological research, innovation, patenting, international cooperation on intellectual property, procedure for grants of patents, patenting under PCT. (8)

PATENTABILITY SEARCHING: What is patentability search – Patent information and databases- outcome of search – Limitations of patentability search – Patent search report - Practical Exercises: Prior art Searching and Reporting using open source and commercial tools – Disclosing an Invention- Comparing inventions with their closest prior arts (9)

PATENT DRAFTING: Title of the invention - Field of the invention - Background art - Objects of the invention - Patent citations and prior art in the background of the invention- Patent of addition - Divisional application - Introduction to claims - Types of claims - Significance and scope of claims Structure of claims - Drafting and interpretation of claims (12)

DEVELOPMENTS IN IPR: Scope of patent rights, licensing and transfer of technology, New developments in IPR: Administration of patent system, IPR of computer software Practical Exercise: How to draft a provision specification of your own inventive ideas? (9)

Total L: 45

TEXT BOOKS:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
2.Patent IPR Licensing- Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators, Indian Innovators Association, 2017.

REFERENCES:

1.NPTEL Online course on Patent Drafting, https://nptel.ac.in/courses/109/106/109106128
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.