West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Computer Science & Engineering [CSE], Computer Science & Technology [CST], Computer Software Technology [CSWT] & Information Technology [IT]

Part-III (5th Semester)

Revised 2022

West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

Semester V

Sl. No	Category	Code No.	Course Title	Hours per wee			Total contact hrs/ week	Credits
				L	T	P		
1.	Program core course	COPC301	Microprocessor & Microcontroller (based on 8086 & 8051)	3	0	0	3	3
2.	Program core course	COPC303	IoT	3	1	0	3	4
3.	Program Elective Course-1	COPE304 / ***	Program Elective-1 (any one) i) Mobile Computing ii) Advanced Computer Network	3	1	0	4	4
4.	Program Elective course-2	COPE305 / ***	Program Elective-2 (any one) i) Theory of Automata ii) Fundamentals of AI	3	1	0	4	4
5.	Program Elective course-3	COPE306/ ***	Program Elective-3 (any one) 1) Computer Graphics 2) Digital Image Processing	3	1	0	4	4
6.	Program core course		Microprocessor & Microcontroller Lab using simulator/debug	0	0	2	2	1
7.	Summer Internship-II (4 to 6 weeks)	SI301	Summer Intern-ship-2					1
8.	Major Project	PR302		0	0	4	4	^
	Total Credits							**21**

*** Will be mentioned by the subject name.

^1 credit is carried forward from the Vth semester major project evaluation.

Course Title: MICROPROCESSOR & MICROCONTROLLER	
Course Code	COPC301
Number of Credits :2	3 (L: 3, T: 0, P: 0)
Prerequisites	Basic knowledge of Digital Electronics, Computer Organization
Course Category	PC
Course code: CST	**Semester: FIFTH**
Duration: 15 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week Total Contact Hours: 45 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc: 10 Marks End Semester Examination: 60 Marks

Course Objectives

- **Students will learn working principle of microprocessor and microcontroller and the basic differences among them.**
- **To understand the internal architecture of 8086 and 8051.**
- **To understand the addressing modes and instruction set of 8086 and 8051.**
- **To understand assembly language.**
- **To learn how to write down the programs by using instructions.**
- **To learn the interfacing IO and other devices with 8086**

Course Content:

Contents (Theory)	Hrs./Unit	Module
UNIT 1: Introduction to Microprocessor Architecture of 8086	10	A

- **Introduction and evolution of Microprocessors**
- **Internal Architecture of 8086 and pin diagram**
- **Register Organization of 8086**
- **Introduction to 80286, 80386, 80486 and Pentium (brief description about architectural advancements only).**
- **Memory Organization and Segmentation of 8086**
- **Minimum and Maximum mode operations of 8086**
- **8086 Control signal interfacing , Read and write cycle timing diagrams.**

**** Some portions has already been covered in 4th sem.**

UNIT 2: Programming and Interrupt structure	**6**	A

- **Instruction sets of 8086**
- **Addressing modes**
- **Assembly language and Assembler directives**
- **Interrupts of 8086.**

UNIT 3: Interfacing with 8086	12	B

- **8255 PPI:**
  - **Internal Architecture of 8255**
  - **Modes of operation in details with example.**
  - **Interfacing A to D converters and Interfacing D to A converters (just concept)**
  - **Stepper motor interfacing**
  - **Architecture and interfacing of 8251 USART**
  - **Architecture and interfacing of 8254 Timer/counter**
  - **Architecture and interfacing of DMA controller (8257)**
  - **Architecture 8259 Programmable Interrupt Controller (8259), Command words and operating modes of 8259**

UNIT 4: Introduction to 8051 Microcontroller	10	C

- **Basic difference between Micro-processor and Microcontroller**
- **Overview of 8051 Microcontroller**
- **Internal Architecture of 8051**
- **Memory Organization in details (RAM and ROM).**
- **SFRs of 8051**

UNIT 5: 8051 interfacing and programming	7	C

- **I/O ports and Interrupts**
- **Timers and Counters**
- **Serial Communication**
- **Instruction set and Addressing modes.**

Course outcomes

After the successful completion of the course the student should be able to:

- **understand the Microprocessor capability in general and explore the evaluation of microprocessors.**
- **understand the addressing modes of Microprocessors**
- **understand the Microcontroller capability and its usage.**
- **write down programs of Microprocessors and Microcontrollers.**
- **interface Microprocessors and Microcontrollers with other electronic devices**
- **understand the interrupt system of both.**

Reference Books

1. Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
2. Ray and Burchandi, “Advanced Microprocessors and Interfacing”, Tata McGraw–Hill.
3. Kenneth J Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, Thomson Publishers, 2nd Edition.
4. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18, - Muhammad Ali Mazidi, RolindD.Mckinay , Danny causey -Pearson Publisher
5. Microprocessor ans microcontroller, Krishna Kant, PHI

West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

Course Title :	**Internet of Things**
Course Code	COPC303
Number of Credits :4	4 (L: 3, T: 1, P: 0)
Prerequisites	NIL
Course Category	PC
Course code : CST	Semester : FIFTH
Duration : 15 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme
Theory : - 4 hrs/week	Continuous Internal Assessment : 20 Marks
Lectures:- 3hrs/week **Tutorial: 1 hr/week**	Attendance-10 Marks
Total Contact Hours:60 Hours	Viva/Presentation/Assignment /Quiz etc : - 10 Marks
Practical : NIL	End Semester Examination : 60 Marks
Aim:	Develop basic concepts of IoT and its applications

Course Objectives:

The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. It's becoming the Internet of Things (IoT). The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things.

Course Content:

Contents (Theory)	Hrs	Marks	Module
UNIT 1: IoT	**10**	10	A

- **What is the IoT and why is it important? Elements of an IoT ecosystem,**
- **Technology drivers, Business drivers,**
- **Trends and implications,**
- **Overview of Governance,**
- **Privacy and Security Issues.**
- **Sensing**
- **Actuation**

UNIT 2: IoT PROTOCOLS	**14**	**14**	A

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT 3: IOT ARCHITECTURE	**10**	**10**	B
IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.			
UNIT 4: WEB OF THINGS	**10**	**10**	B
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.			
UNIT 5: Arduino	**6**	**6**	C
Introduction to Arduino programming, Integration of Sensors/Actuators to Arduino			
UNIT 6: IoT APPLICATIONS	**10**	**10**	C
IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.			

Reference Books:

1. IoT Fundamentals, 1e, Hanes, Pearson Education
2. Enterprise IoT, Slama, SPD
3. Internet of Things, Ramgir, Pearson Education
4. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
6. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22

Course outcomes:

Students will have good understanding of various aspect of IoT, know some tools and have basic implementation skills

Unit No.	Unit Title	Group	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Unit 1	A	4	4	2	10
2.	Unit 2	A	4	4	6	14
3.	Unit 3	B	4	2	4	10
4.	Unit 4	B	6	2	2	10
5.	Unit 5	C	2	2	2	06
6.	Unit 5	C	2	4	4	10
	Total		**22**	**18**	**20**	**60**

Legends: R = Remember; U = Understand; A = Apply and above levels(Bloom's revised taxonomy)

West Bengal State Council of Technical & Vocational Education and Skill Development
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Course Title :	MOBILE COMPUTING
Course Code	COPE304/1
Number of Credits :4	4 (L: 3, T: 1, P: 0)
Prerequisites	NIL
Course Category	PC
Course code : CST	Semester : FIFTH
Duration : 15 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme
Theory : - 4 hrs/week	Continuous Internal Assessment : 20 Marks
Lectures:-3hrs/week **Tutorial: 1 hr/week**	Attendance-10 Marks
Total Contact Hours:60 Hours	Viva/Presentation/Assignment /Quiz etc : - 10 Marks
Practical : NIL	End Semester Examination : 60 Marks
Aim:	Develop basic concept of Mobile Computing and its applications

Course Objectives:

1. **To acquire some basic knowledge of Mobile Communications**
2. **To get exposed to Mobile computing and Wireless Networks.**
3. **To learn concepts of Mobile IP and Mobile Ad-Hoc Networks.**
4. **To study the Mobile Computing Operating systems and Mobile Computing Application Environment.**
5. **To understand the relation between Mobile Computing and E-commerce**

Course Content:

Contents (Theory)	Hrs	Marks	Module
UNIT 1: Basics of Mobile Communications	**10**	10	A

- **Mobile handsets**
- **Wireless Communications and Server Applications**
- **Cell phone System**
- **Types of Telecommunication Networks**
- **Components of wireless communication system**
- **Architecture of mobile telecommunication system**
- **Wireless networking standards**
- **Wireless LANs and Wireless LAN Architecture**
- **Applications of WLANs and Advantages of WLANs over wired LANs**
- **Bluetooth Technology and Protocol stack of Bluetooth.**

UNIT 2: Mobile Computing and Wireless Network	**12**	**12**	**A**

- **Concept of Mobile Computing**
- **Comparison of Mobile Computing and Wireless Networking**
- **Mobile Computing Application**
- **Characteristics of Mobile Computing**
- **Structure of Mobile Computing Application**
- **Cellular Mobile Communication**
- **Generation of Cellular Communication Technologies**
- **Global System for Mobile communications(GSM),GSM Services, System Architecture of GSM,GSM security**
- **General Packet Radio Service(GPRS),GPRS Services, GPRS Architecture**
- **Universal Mobile Telecommunication System (UMTS),UMTS Network Architecture**
- **Software Defined Radio(SDR)**
- **Mobile phone and human body.**

UNIT 3 : Mobile IP and Mobile Ad Hoc Networks	**18**	**18**	**B**

- ✓ **Mobile IP and Packet Delivery**
- ✓ **Desirable features of Mobile IP**
- ✓ **Key mechanism used in Mobile IP and Route Optimization**
- ✓ **Dynamic Host Configuration Protocol(DHCP)**
- ✓ **Significance of DHCP**
- ✓ **Basics concepts of Ad Hoc Network setup**
- ✓ **Characteristics of Mobile Ad Hoc Networks(MANETs) and its Operational Constraints and design issues**
- ✓ **Applications of MANETs**
- ✓ **Proactive Routing protocol-DSDV**
- ✓ **Reactive Routing Protocols — DSR, AODV**
- ✓ **Hybrid routing –ZRP**
- ✓ **Multicast Routing- ODMRP**
- ✓ **Vehicular Ad Hoc Networks(VANETs), Difference of MANET and VANET**
- ✓ **Security issues in a MANET**

UNIT 4: Mobile Computing Operating systems and Mobile Computing Application Environment	**12**	**12**	**C**

- ✓ **Mobile Device Operating Systems**
- ✓ **Special Constraints & Requirements**
- ✓ **Commercial Mobile Operating Systems**
  - **Palm OS**
  - **Symbian OS**
  - **iOS**
  - **Android**
  - **BlackBerry**
  - **Windows Phone**
- ✓ **Mobile Devices as Web Clients ,**
- ✓ **HDML(Handheld Mark-up Language) ,WAP, J2ME - J2ME Configuration,**
- ✓ **Android Application Development - Software Development Kit(SDK), Features of SDK,**
- ✓ **Android Application Components, Android Software stack Structure, Advantages of Android.**

UNIT 5: Mobile Computing and E-commerce	08	08	C

- **Application of M-Commerce**
- **Business to Consumer(B2C) Applications**
- **Business to Business (B2B) Applications**
- **Structure of M-Commerce, Pros and Cons of M-Commerce**
- **Mobile Payment System and Mobile Payment Schemes**
- **Desirable properties of a Mobile Payment system**
- **Mobile Payment solutions**
- **Process of Mobile Payment**
- **Security Issues**

Reference Books:

1.Fundamentals of Mobile Computing, Prasant Kumar Pattanaik, Rajib Mall, PHI

2. Mobile Computing :Technology Applications and Service Creation, Ashok K Talukdar Hasan Ahmed & Roopa R Yavagal, McGrawHill

3. Mobile Computing, Raj Kamal, OXFORD

Course outcomes:

- **Recognize and explain wireless and Mobile Communication system and Bluetooth technology.**
- **Can describe and differentiate Mobile Computing vs Wireless Networking, GSM, GPRS, UMTS and SDR.**
- **Can explain the working of Mobile IP and Mobile Ad Hoc Networks, Vehicular Ad Hoc Network.**
- **Describe the constraints and survey of commercial mobile Operating Systems.**
- **Discuss and explain Mobile Application Development.**
- **Acquired the knowledge of different Mobile E-Commerce applications.**

Unit No.	Unit Title	Group	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Basics of Mobile Communications	A	3	4	3	10
2.	Mobile Computing and Wireless Network	A	4	4	4	12
3.	Mobile IP and Mobile Ad Hoc Networks	B	5	5	8	18
4.	Mobile Computing Operating systems and Mobile Computing Application Environment	C	6	3	3	12
5.	Mobile Computing and E-commerce	C	2	4	2	08
	Total		**20**	**20**	**20**	**60**

Legends: R = Remember; U = Understand; A = Apply and above levels(Bloom's revised taxonomy)

West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

Course Title :	**Advance Computer Networks**
Course Code	COPE304/2
Number of Credits :4	4 (L: 3, T: 1, P: 0)
Prerequisites	NIL
Course Category	PC
Course code : CST	Semester : FIFTH
Duration : 15 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme
Theory : - 4 hrs/week	Continuous Internal Assessment : 20 Marks
Lectures:-3hrs/week **Tutorial: 1 hr/week**	Attendance-10 Marks
Total Contact Hours:60 Hours	Viva/Presentation/Assignment /Quiz etc : - 10 Marks
Practical : NIL	End Semester Examination : 60 Marks
Aim:	Develop Advance Networking Concepts and its applications

Course Objectives:

Introduce Advance Networking Concepts, Theories and Tools

Course Content:

Contents (Theory)	Hrs	Marks	Module
UNIT 1:	**14**	14	A

- **Review of Networking Basics;**
- **Wireless LAN - Introduction to wireless LANs, IEEE 802.11 WAN-Architecture and Services, Physical Layer - MAC sublayer - MAC management sublayer - Other IEEE 802.11 standards**
- **Advance Topics in IPv4 – Sub-netting, Multicasting, Multicast Routing Protocols (IGMP, PIM, DVMRP);**
- **Advance Topics in TCP – flow management, congestion avoidance, protocol spoofing; IPv6**

UNIT 2:	**10**	**10**	A

- **Telecom Networks, Switching Techniques; Introduction to Frame Relay, ATM, MPLS;**
- **VSAT Communication – Star and Mesh architectures, bandwidth reservation;**
- **Wireless Networks – WiFi, WiMax, Cellular Phone Technologies – GSM, CDMA, 3G, 4G,5G**
- **DHCP-Outing in the Internet-MOSTF DVMRP,**

UNIT 3:	**10**	**10**	B

- **Storage Area Networks- Introduction to Storage Technology, Storage System Architecture**
- **Introduction to Networked Storage, Direct-Attached Storage, SCSI, NAS, IP SAN,**
- **Information Availability & Monitoring & Managing Datacentre,**
- **Securing Storage and Storage Virtualization**

UNIT 4:	**10**	**10**	B

Introduction to Network Security –

- **VLAN**
- **VPN**
- **Firewall**
- **IPS**
- **Proxy Servers**
- **Network Redundancy,**
- **Load Balancers,**
- **Caching, Storage Networks**

QoS (Quality of Service)
Network Monitoring – SNMP,RMON

UNIT 5:	**6**	**6**	C

- **Traffic Engineering Planning, WAP-WAP architecture-WAE-WTA Framework-WAP push services- WAP protocol stack, NEST Cellular Network**
- **Tuning RED for Web Traffic - Introduction, Background Work, Experimental Methods, Experimental Network**

UNIT 6:	**10**	**10**	C

Streaming protocols

Real-Time Transport Protocol **(RTP)**
Real Time Streaming Protocol **(RTSP)**
TCP Friendly Rate Control (TFRC)
Internet Route Access Protocol(RAP)
Session Initiation Protocol**(SIP)**

Reference Books:

1. Internetworking with TCP/IP - *Vol : I, II and III*, Comer / Stevens, Pearson Education
2. An Engineering Approach to Computer Networking, Keshav, Pearson Education
3. Data Communication and Networking, Forouzan, McGrawHill
4. Networking, Anderson & Benedetti, SPD
5. RFCs and Standards Documents (www.ietf.org and other standard body websites)

Course outcomes:

- Analyse wireless LAN technologies including IEEE 802.11.
- Understand internet traffic and plan traffic engineering including IP over ATM and multimedia over internet.
- Design of routing and transport layer protocols for advanced multi hop networks.
- Understanding of cryptographic algorithms for Enterprise networks.
- Understanding of Streaming protocols

West Bengal State Council of Technical & Vocational Education and Skill Development
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Unit No.	Unit Title	Group	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Unit 1	A	4	4	6	14
2.	Unit 2	A	4	4	2	10
3.	Unit 3	B	4	2	4	10
4.	Unit 4	B	6	2	2	10
5.	Unit 5	C	2	2	2	06
6.	Unit 5	C	2	4	4	10
	Total		**22**	**18**	**20**	**60**

Legends: R = Remember; U = Understand; A = Apply and above levels(Bloom's revised taxonomy)

Course Title: THEORY OF AUTOMATA	
Course Code	**COPE305/1**
Number of Credits : 4 (L: 3, T: 1, P: 0)	
Prerequisites	**Having fundamental knowledge of Computers and elementary mathematics.**
Course Category	PC
Course code: CST	**Semester: FIFTH**
Duration: 15 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 4 hrs/week Total Contact Hours: 60 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc.: 10 Marks End Semester Examination: 60 Marks

Aim of the Course

This course focuses on the basic theory of Computer Science and formal methods of computation like automata theory, formal languages, grammars and Turing Machines.

Course Objectives

The objective of this course is to explore the theoretical foundations of computer science from the perspective of formal languages and classify machines by their power to recognize languages.

Course Content:

Contents (Theory)	**Hrs./Unit**	**Marks**
UNIT 1: Introduction to Automata	15	10
1.1. Basic idea on Alphabets, Strings and Languages, Automata and Grammars, Regular Languages, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation, State transition graph, Transition table, Language of DFA. 1.2. Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA. 1.3. Minimization of Finite Automata, Distinguishing one string from other. 1.4. FA with output - Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.		
UNIT 2: Regular Expression (RE)	15	15
2.1. Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem. 2.2. Arden's Theorem and applications, Conversion of Non-deterministic systems to deterministic system (application), Construction of finite automata equivalent to a regular expression (with application), Equivalence of two finite automata (application), Equivalence of two regular expressions. 2.3. Pumping Lemma for regular Languages, Application of Pumping Lemma, Closure		

properties of Regular Languages.		
UNIT 3: Grammar Formalism	10	15
3.1. Regular grammars - Right linear and left linear grammars, Equivalence between regular linear grammar and FA. 3.2. Context Free Grammar, Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG. 3.3. Useless symbols, Simplification of CFGs; 3.4. Normal forms for CFGs - CNF and GNF, Closure properties of CFLs; Decision Properties of CFLs-Emptiness, Finiteness and Membership.		
UNIT 4: Push Down Automata (PDA):	10	10
4.1. Description and definition, Instantaneous Description, Language acceptance of PDA. 4.2. Acceptance by Final state, Acceptance by empty stack. 4.3. Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA.		
UNIT 5: Turing Machines (TM)	10	10
5.1. Basic model, Definition and representation, Instantaneous Description, Language acceptance by TM. 5.2. Computable functions, Types of Turing machines, Universal TM. 5.3. Halting problem, Introduction to Undecidability, Undecidable problems about TMs.		

Course outcomes

Student should be able to

- **Understand the basic properties of formal languages and grammars.**
- **Differentiate regular, context-free and recursively enumerable languages.**
- **Make grammars to produce strings from a specific language.**
- **Acquire concepts relating to the theory of computation and computational models including decidability and intractability.**

Reference Books

Name of Authors	Title of the Book	Edition	Name of the publisher
Hopcroft	Introduction to Automata Theory, Languages, and Computation.		Pearson
Mishra & Chandrasekaran	Theory of Computer Science (Automata, Languages and Computation).		Pearson

Kulkarni	Theory of Computation		Oxford
Nagpal	Formal Language and Automata Theory		Oxford
Kandar	Introduction to Automata Theory, Formal Languages and Computation		Pearson

Course Title: Fundamentals of AI	
Course Code	**COPE 305/2**
Number of Credits : 4 (L: 3, T: 1, P: 0)	
Prerequisites	**Having fundamental knowledge of Computers and elementary mathematics.**
Course Category	PC
Course code: CST	**Semester: FIFTH**
Duration: 15 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 4 hrs/week Total Contact Hours: 60 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc.: 10 Marks End Semester Examination: 60 Marks

Aim of the Course

Artificial Intelligence, or AI, is a unique branch of computer science which aims solely at **creating intelligent machines**. In the last few years, Artificial Intelligence has become a highly important part of the technology industry. Many students are now willing to study Artificial Intelligence and make a career in this particular field.

Course Objectives

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To understand the different ways of designing software agents.
- To know about the various applications of AI.

Course Content:

Contents (Theory)	**Hrs./Unit**	**Marks**
UNIT 1: Introduction to Artificial Intelligence	10	10
1.1. Introduction to AI, Future of Artificial Intelligence. 1.2. Agents and Environment, Concept of rationality, Nature of environment. 1.3. Structure of Agents, Problem solving agents to typical AI problems.		
UNIT 2: PROBLEM SOLVING	10	10
2.1. Search algorithms, informed & uninformed search strategies, Heuristic search strategies, heuristic functions. 2.2. Local search and optimization problems, local search in continuous space, search with non- deterministic actions, search in partially observable environments. 2.3. Online search agents and unknown environments.		
UNIT 3: GAME PLAYING AND CSP	10	15

3.1. Game theory, optimal decisions in games, alpha-beta search. 3.2. Stochastic games, partially observable games. 3.3. Constraint satisfaction problems (CSP), Structure of CSP, constraint propagation, backtracking search for CSP, local search for CSP.		
UNIT 4: LOGICAL AGENTS	15	10
4.1. Knowledge-based agents, propositional logic, Statement and proving of propositional theorem. 4.2. Propositional model checking. 4.3. Agents based on propositional logic, First-order logic, syntax and semantics, knowledge representation and engineering. 4.4. Inferencesin first-order logic, forward chaining, backward chaining, Resolutions.		
UNIT 5: KNOWLEDGE REPRESENTATION AND PLANNING.	15	15
5.1. Ontological engineering, categories and objects, Events. 5.2. Mental objects and modal logic, reasoning systems for categories, reasoning with default information. 5.3. Classical planning, algorithms for classical planning, heuristics for planning, hierarchical planning. 5.4. Non-deterministic domains, time, schedule, and resources, analysis.		

Course outcomes

Student should be able to

- **Use appropriate search algorithms for any AI problem.**
- **Represent a problem using first order and predicate logic.**
- **Provide the apt agent strategy to solve a given problem.**
- **Design software agents to solve a problem.**
- **Design applications for NLP that use Artificial Intelligence.**

Reference Books

Name of Authors	Title of the Book	Edition	Name of the publisher
Stuart Russell and Peter Norvig.	Artificial Intelligence: A Modern Approach.	3rd / 4th	Pearson
Kevin Night, Elaine Rich	Artificial Intelligence		TMH
Deepak Khemani	A First Course in Artificial Intelligence		TMH
Dan W. Patterson	Introduction to AI and ES		Pearson
M.C. Trivedi	A classical approach to Artificial Intelligence		Khanna publishing House
https://nptel.ac.in/courses/106106126/			

Course Title: COMPUTER GRAPHICS	
Course Code	COPE 306/1
Number of Credits :4	4 (L: 3, T: 1, P: 0)
Prerequisites	Basic knowledge of 2D and 3D geometry, Matrix, Programming language
Course Category	PC
Course code: CST	**Semester: FIFTH**
Duration: 15 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 4 hrs/week Total Contact Hours: 60 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc: 10 Marks End Semester Examination: 60 Marks

Course Objectives

- **This course prepares students for activities involving the design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering.**
- **Students will learn:**
- **(1) how to develop interactive programs that use effectively the graphics functionalities available in contemporary personal computers,**
- **(2) the fundamental principles and technologies upon which these functionalities, and possibly their future evolutions, are based, and**
- **(3) the skills for designing and implementing practical graphic solutions to challenging problems in different application domains.**

Course Content:

Contents (Theory)	Hrs./Unit	Module
Unit-1: Basic of Computer Graphics	8	A

Introduction of Coordinate representation and Pixel Graphics output devices: CRT, Raster Scan & Random Scan systems; Color CRT monitors, DVST, flat-panel displays, video controller and raster scan display processor. Graphics Input Devices: Keyboard, Mouse, Track-ball, space ball, Joysticks, data Glove, Light Pen, Digitizer, Image scanners, touch panels, voice systems; Graphics software

Unit-2: Graphics Primitives	**12**	A

Point and Lines, Line Drawing Algorithms: Simple, DDA, Bresenham's Line Drawing algorithm, Midpoint Circle and Ellipse drawing algorithm, Polygon drawing: Representation of polygon; Conventional methods for drawing polygons; Real time Scan Conversion and Run length encoding; Filled area primitives: Scan-Line Polygon Fill Algorithm, Flood-Fill Algorithm, character

generation, Antialiasing		
Unit-3: 2D viewing	15	B
Viewing pipeline, Window-to-viewport transformation, 2-D Clipping, Chen-Sutherland Line Clipping, Liang-Barsky algorithm, Polygon Clipping: Sutherland-Hodgeman and Weiler-Atherton polygon clipping; Text Clipping		
Unit-4: 2D and 3D Transformation	12	C
Scaling, Rotation, Translation, Shearing, Reflection; Homogeneous coordinates, Composite Transformations, Affine transformation; 3-D concepts and representation, Projections: Perspective, Orthographic, Axonometric, Oblique projections		
Unit-5: 3D transformation and viewing	13	C
Curves and surfaces: Spline representations, Bezier curves, B-spline curves , Visible surface detection methods: Back-face detection, depth-buffer, Z- buffer , scan-line method; Illumination models: Basic illumination models: Ambient light, Diffuse reflection, Specular reflection and Phong Model, Warn model, Half-toning and dithering techniques; RGB, YIQ, HSV and CMY color models, Key-frame animation. ****Some C programs should be done to implement different algorithms in tutorial classes.**		
Course outcomes		
After the successful completion of the course the student should be able to: **1. Know and be able to discuss hardware system architecture for computer graphics. This includes, but is not limited to graphics pipeline, frame buffers, and graphic accelerators/co-processors.** **2. Know and be able to design and implement model and viewing transformations,** **3. Know and be able to use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to: • Composite 3D homogeneous matrices for translation, rotation, and scaling transformations. • Plane, surface normals, cross and dot products. • Hidden surface detection / removal** **4. Know and be able to select and use among models for lighting/shading.** **5. Know and be able to use and select among current models for surfaces (e.g., geometric; polygonal; hierarchical; mesh; curves, splines).** **6. Be able to discuss future trends in computer graphics and quickly learn future computer graphics concepts and APIs.**		
Reference Books		

1. Computer Graphics C Version, D. Hearn And P. Baker, Pearson Education
2. Computer Graphics, Foley and van Dam, Person Education
3. Computer Graphics with OpenGL, Hearn and Baker, Pearson
4. Procedural Methods for computer graphics, Rogers, TMH
5. Computer Graphics with virtual reality systems, R. K. Maurya, Wiley-India
6. Computer Graphics, Sinha & Udai, TMH

West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Course Title :	DIGITAL IMAGE PROCESSING
Course Code	COPE306/2
Number of Credits :4	3 (L: 3, T: 1, P: 0)
Prerequisites	NIL
Course Category	PC
Course code : CST	Semester : FIFTH
Duration : 15 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme
Theory : - 4 hrs/week	Continuous Internal Assessment : 20 Marks
Lectures:-3hrs/week **Tutorial: 1 hr/week**	Attendance-10 Marks
Total Contact Hours:60 Hours	Viva/Presentation/Assignment /Quiz etc : - 10 Marks
Practical : NIL	End Semester Examination : 60 Marks
Aim:	Develop basic concept of Image Processing in Computer Science

Course Objectives:

1. **To become familiar with digital image fundamentals**
2. **To get exposed to simple image enhancement techniques in Spatial and Frequency domain.**
3. **To learn concepts of degradation function and restoration techniques.**
4. **To study the color image processing techniques.**
5. **To become familiar with image compression and recognition methods**

Course Content:

Contents (Theory)	Hrs	Marks	Module
UNIT 1: Image Processing Fundamentals	**09**	09	A

- **Overview & Nature of Image Processing**
- **Digital Image Representation & types of Images**
- **Components of Image Processing system**
- **Steps in Image Processing:**
  - ❖ **Elements of Visual Perception**
  - ❖ **Image Sensing and Acquisition**
  - ❖ **Image Sampling and Quantization**
- **Relationships between pixels**
- **2D mathematical preliminaries, 2D transforms - DFT, DCT**
- **Image Processing Applications**

UNIT 2: Image Enhancement in the Spatial Domain	**13**	**13**	**A**

- **Some Histogram Processing in details,**
- **Enhancement Basic Gray Level Transformations,**
- **Using Arithmetic/Logic Operations,**
- **Basics of Spatial Filtering**
- **Smoothing Spatial Filters,**
- **Sharpening Spatial Filters,**
- **Combining Spatial Enhancement Methods**

UNIT 3: Image Restoration.	**13**	**13**	**B**

- **A Model of the Image degradation/Restoration process,**
- **Noise Modelling**
- **Image Restoration in the Presence of Noise Only–Spatial Filtering**
  - ✓ **Arithmetic mean filter**
  - ✓ **Geometric mean filter**
  - ✓ **Median filter**
- **Order Statistics**
- **Adaptive filters**
- **Band reject Filters**
- **Band pass Filters**
- **Notch Filters – Optimum Notch Filtering**
- **Image Restoration Techniques**
  - ➢ **Inverse filter**
  - ➢ **Wiener Filter**
- **Geometric Transformations**

UNIT 4: Color Image Processing	**11**	**11**	**C**

- **Color image storage & processing**
- **Color Models**
  - ➢ **RGB, HSI, HSV, CMY, CMYK color models.**
- **Pseudocolor Image Processing**
- **Basics of Full-Color Image Processing**
- **Color Transformations**
- **Smoothing and Sharpening**

UNIT 5: Image Compression	**14**	**14**	**C**

- **Fundamentals of image compression**
- **Image Compression Models**
- **Compression Algorithms**
- **Error-Free/lossless Compression**
  - ➢ **Run Length Coding**
  - ➢ **Huffman Coding**
  - ➢ **Shannon –Fano Coding**
  - ➢ **Bit-plane Coding**
- **Lossy Compression**
  - ✓ **Lossy Predictive Coding**
  - ✓ **Transform Coding**
- **Image Compression Standards**

- **JPEG standard**
- **MPEG standard**

Reference Books

1. **"Digital Image Processing", Rafael C Gonzalez Richard E. Woods, Pearson**
2. **"Digital Image Processing", Kenneth R. Castleman, Pearson**
3. **"Principles of Digital Image Processing", Wilhelm Burger, Mark J. Burge, Springer**
4. **"Digital Image Processing", S. Sridhar, Oxford**

Course outcomes:

- **Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.**
- **Operate on images using the techniques of smoothing, sharpening and enhancement.**
- **Understand the restoration concepts and filtering techniques.**
- **Learn the basics of compression and recognition methods for color models**

Unit No.	Unit Title	Group	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Image Processing Fundamentals	A	5	4	0	09
2.	Image Enhancement in the Spatial Domain	A	3	4	6	13
3.	Image Restoration	B	3	4	6	13
4.	Color Image Processing	C	5	4	2	11
5.	Image Compression	C	4	4	6	14
	Total		**20**	**20**	**20**	**60**

Legends: R = Remember; U = Understand; A = Apply and above levels(Bloom's revised taxonomy)

Course Title: Microprocessor & Microcontroller Lab using simulator/debug	
Course Code	CST307
Number of Credits :1	2hrs/week
Prerequisites	Knowledge about instruction set and internal architecture of 8086 and 8051
Course Category	PC
Course Code: CST	**Semester: FIFTH**
Duration: 15 weeks	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Laboratory: 2 hrs/week Total Contact Hours: 30 Hours	Continuous Internal Assessment: 60Marks External Assessment: 40 Marks

Course Objectives:

Understanding and implementation of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices.

Course Content:

Sr. No.	Topics for Practice	
		Skill Area
1 (8086)	#To Add Two Binary Number Each 1 Bytes Long (without and with carry) #To Add Two Binary Number Each 2 Bytes Long (without and with carry) #To Add array of 1 Bytes numbers. #To Add array of 2 Bytes numbers. #To Add Two Binary Number Each 4/8 Bytes Long #Exchange two memory location without using exchange instruction. #To Find the Maximum Number in a given array. # Short in ascending/descending order Use of DOS interrupt INT 20 and INT 21: # A string is stored in memory location starting from 0200h ended with character $. Display the string. # A one-byte number is stored at 0200h, print the binary of that byte. # Display a hexadecimal byte stored at DL register. # Reading 1/2 digit hexadecimal number from keyboard. ** Writing any other program like using stack, subroutine, code conversion, string manipulation is welcome. # Carry out the interfacing ADC/DAC, Stepper motor etc.	8086

2	# How do mode bits of timer 0 and 1 swapped at the TMOD? # Complement the port P2 bits. # Complement the bit 3 of internal RAM at 21H # Add/Subtract two 8 bit numbers. # Add two 16 bit numbers. # Add two BCD numbers. **Other programs to control timer, subroutine, bit manipulation etc. is welcome. # Use simulator like EDSim51 and perform C programming.	C, Simulator

**** Programs can be written in any mode like by using physical kit, Simulator, Assembler, DEBUG utility etc.**

Course outcomes

On completion of this course, the students will be able to:

- **Program 8086 Microprocessor, 8051 and PIC Microcontrollers for application specific solution**
- **Design microprocessors/microcontrollers-based systems**
- **Implement and develop new experiments on microprocessor/microcontroller based systems.**

Reference Books

1. Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
2. Ray and Burchandi, “Advanced Microprocessors and Interfacing”, Tata McGraw–Hill.
3. Kenneth J Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, Thomson Publishers, 2nd Edition.
4. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18, -Muhammad Ali Mazidi, RolindD.Mckinay , Danny causey -Pearson Publisher
5. Microprocessor ans microcontroller, Krishna Kant, PHI

Course Title: Major Project	
Course Code	**PR 302**
Number of Credits	**^^To be assigned in 6th Semester^^**
Prerequisites	Having fundamental knowledge different languages, database, network etc.
Course Category	PC
Course code: CST	**Semester: Fifth**
Duration: 15 weeks	**Marks: ^^ Given in 6th Semester**
Teaching Scheme	**Examination Scheme**
Practical: 4 hrs/week Total Contact Hours: 44 Hours	

Aim of the Course

- To develop technical skill.
- To make use of hardware in developing Software.
- Analysis of different type of case studies.
- Software package development.
- Industrial practices in installation and maintenance of computers and computer networks.
- Fabrication of computers.
- Fault diagnosis and testing of computers.
- Industrial practices in respect of documentation and fabrication.
- A variety of computers and peripherals in assembly organizations.

Course Objectives

- ✓ Work in Groups, Plan the work and coordinate the work.
- ✓ Develop leadership qualities.
- ✓ Develop Innovative ideas.
- ✓ Practically implement the acquired knowledge.
- ✓ Develop basic technical Skills by hands on experience.
- ✓ Write project report.
- ✓ Develop skills to use latest technology in Computer/Information Technology field.
- ✓ Analyze the different types of Case studies.
- ✓ Use effectively oral, written and visual communication
- ✓ Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- ✓ Identify, analyze and solve problems creatively through sustained critical investigation.

Course Content:

Sr. No.	Topics for Practice (Any one)	Skill Area
01	To develop Web pages	HTML,CSS, JAVA Script, MySQL,JSP, ASP
02	To develop Application packages	C/C++/Python/ JAVA/ VB

03	To develop online examination system	PHP / Java, MySQL
04	Develop Web based application	JAVA Script/ PHP, MySQL
05	Android App development	Android studio/Java
06	Image processing application	Python/Mat-lab
	Database oriented application development like Student information system, Library management system etc.	Java/ Python

- Any other project work can be done as guided by project guide (like AI based application, Pattern recognition etc.)
- If someone wants to extend the workflow from the minor project, he or she can be able to extend

Course outcomes

After completing the course:

- To enable students to implement Project Planning in their Industrial In-plant Training Project work.
- To be capable of self-education and clearly understand the value of achieving Perfection in the respective Project work.
- Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Reference Books

Name of Authors	Title of the Book	Edition	Name of the publisher
Verhas Peter	Java Projects	2nd	Packt Publishing Limited
Vishal Kumar Shah	Amazing Python Projects for Beginners		Notion Press
A. Adams, C. Campbell, A. Khan	Programming Books Bundle with Project		Code Academy
Horstmann	Core Java - Vol 1	11e	Pearson
Horstmann	Core Java - Vol 2	11e	Pearson

Course Code	**SI 301.**
Course Title	**SUMMER INTERNSHIP II.**
Course Category	**Internship Programme.**
Number of Credits	**1**
Offered to	**4th Semester, Diploma in Comp. Sc. & Tech. Student.**
Pre Requisite	**Elementary knowledge on Computer**

Aim of the Course:

- providing exposure to students in skill development.
- To offer an opportunity for the young students to acquire on job skills, knowledge, attributes and perceptions along with the experience needed to constitute a professional identity beyond Institutional environment.
- To provide means to acquire professional knowledge beyond curriculum.

Course Content:

After the end of **Second Semester**:

- The students are required to involve in Inter/Intra Institutional activities viz. training and simulation program in different Institutes, Polytechnics, Technical Colleges. (OR)
- Even in other Departments within the same Polytechnic. (OR)
- Soft skill training organized by Training & Placement Cell of the respective Institutions; contribution at innovation/entrepreneurship cell of the institute; participation in workshops/competitions etc; Learning at Departmental Lab/ Institutional workshop. (OR)
- Online or Offline Participation in any skilled training related with Computer Science and Technology field for duration of 1 month from any recognized Organization.

Documentation in the form of report should be submitted by the candidates for evaluation purposes.

Course Outcomes

At the end of the course the students will be able to

CO I	To test the theoretical learning in practical situations by accomplishing the task assigned during the internship period.
CO II	Able to apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
CO III	To assess interest and abilities in the actual field of work.
CO IV	Learn to appreciate time management in real life.