Course Title	**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION**						
Course Code	**21CVT7052**						
Category	**Open Elective Course (OEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: To gain an historical, economic, and organizational perspective of occupational safety and health, to investigate current occupational safety and health problems and solutions, to identify the causes that influence occupational safety and health and to demonstrate the knowledge and skills needed to identify work place problems and safe work practice.

UNIT – I **8 Hours**

OCCUPATIONAL HAZARD AND CONTROL PRINCIPLES:

Safety, History and development, National Safety Policy. Occupational Safety and Health Act (OSHA), Occupational Health and Safety Administration - Laws governing OSHA and right to know. Accident – causation, Investigation, Investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.

UNIT – II **8 Hours**

ERGONOMICS AT WORK PLACE:

Ergonomics task analysis, Preventing ergonomic hazards, Work space envelops, Visual ergonomics, Ergonomic standards, Ergonomic programs. Emergency response - Decision for action – purpose and considerations.

UNIT – III **8 Hours**

FIRE PREVENTION AND PROTECTION:

Fire Triangle, Fire development and its severity, Effect of enclosures, Early detection of fire, Classification of fire, Fire extinguishers and Fire suppression system, Fire hydrant, Yard hydrant, Sprinkler system, Fire drill, Fire Fighting NOC, Introduction to provisions of fire and life safety as per National Building Code of India, Electrical safety.

UNIT – IV **8 Hours**

HEALTH CONSIDERATIONS AT WORK PLACE:

Types of diseases and their spread, Health emergency. Personal Protective Equipment (PPE) – Types and advantages, Effects of exposure and Treatment for engineering industries, Municipal solid waste. Environment Management Plans (EMP) for safety and sustainability.

UNIT – V **8 Hours**

OCCUPATIONAL HEALTH AND SAFETY CONSIDERATIONS:

Handling of chemicals and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, supervisors and managers.

Course Outcomes: The students will be able to	
CO 1	Acquire knowledge on history of OSHA policies, laws and regulations.
CO 2	Identify hazards in the workplace that pose a danger or threat to the safety or health of people.
CO 3	Control unsafe or unhealthy hazards and propose methods to eliminate the fire hazards.
CO 4	Discuss the role of health and safety in the workplace and effects of industries on environment and to identify workplace hazards, safety considerations and roles and responsibilities of workers, supervisors and managers.

Text Books:	
1	S Sharma, Vineet Kumar, "Safety, Occupational Health and Environmental Management in Construction". Khanna Publisher, 2013.
2	R K Jain, Sunil S Rao, "Industrial Safety, Health and Environment Management Systems". Createspace Independent Publishing Flat form, 2000.
3	Charles D Reese, "Occupational Safety and Health Fundamental principles and Philosophies", Tailor and Francis Ltd, 2017.

Reference Books:	
1	Sudhakar Paul T Rani, "Occupational Safety and Health", Createspace Independent Publishing Platform, 2018.
2	Rana S P, Goswami P K, and Indu Rathee, "Handbook of Occupational Safety and Industrial Psychology". S. Chand and Company Ltd, 2014.
3	Goetsch D. L., "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall Publishers, 2010.
4	National Building Code of India 2016 – Volume 1

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

- ✓ Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.
- ✓ First test at the end of 5^{th} week of the semester and Second test at the end of the 10^{th} week of the semester.
- ✓ The makeup test at the end of the 15^{th} week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.
- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4^{th} week and Second assignment at the end of 9^{th} week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13^{th} week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.

- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

• The question paper will have ten full questions carrying equal marks.
• Each full question will be for 20 marks.
• There will be two full questions (with a maximum of three sub - questions) from each unit.
• Each full question will have sub - question covering all the topics under a unit.
• The students will have to answer five full questions, selecting one full question from each unit.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and demonstrational learning

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓		✓						✓
CO2	✓			✓	✓	✓						✓
CO3	✓			✓	✓	✓						✓
CO4	✓			✓		✓	✓					✓

VII Semester

CRYPTOGRAPHY			
Course Code:	**21ECT7054**	**CIE Marks:**	40+5+5
Teaching Hours/Week (L:T:P:S):	3: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	3	**Exam Hours:**	03

Course objectives:

This course will enable students to:

- Preparation: To prepare students with fundamental knowledge/ overview in the field of Information Security with knowledge of mathematical concepts required for cryptography.
- Core Competence: To equip students with a basic foundation of Cryptography by delivering the basics of symmetric key, public key cryptography and authentication techniques

Module	Syllabus Content	No of Hours
1	**Introduction:** Services, mechanisms and attacks, OSI security architecture, Model for network security. **Symmetric ciphers:** Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono Alphabetic Cipher, Playfair Cipher, Hill Cipher, polyalphabetic Cipher and One-Time Pad (OTP). Transposition Techniques, Rotor Machines, Steganography.	08
2	**Finite Fields:** Groups, Rings, Fields. Modular Arithmetic: Divisors, properties of modulo operator, modular arithmetic operations and properties. Euclid's Algorithm, Greatest Common Divisor (GCD), finding GCD. Finite Fields ofthe form GF (p): Finite fields of order p.	08
3	Private Key Encryption: Simplified DES, Block Cipher Principles, Data encryption standard (DES), Strength of DES, Block Cipher Design Principles and Block Cipher Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.	08
4	Public Key Encryption: Principles of Public-Key Cryptosystems, The RSA algorithm. Key Management, Diffie - Hellman Key Exchange.	08
5	Authentication Functions and Hash Functions: Authentication functions, message authentication codes, hash functions, security of Hash functions and MACs	07

Course outcomes:

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

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

1. Explain traditional cryptographic algorithms of encryption and decryption process.
2. To apply the concepts of number theory, abstract algebra that are required for Cryptographic algorithms
3. Use symmetric cryptography algorithms to encrypt and decrypt the data.
4. Use asymmetric cryptography algorithms to encrypt and decrypt the data.
5. Explain the methods used for authentication.

Suggested Learning Resources:

Text Books:

1. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3

Reference Books:

1. Cryptography and Network Security, Behrouz A Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.
3. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", Wiley Publications, 2nd Edition, ISBN: 9971-51-348-X.

Weblink:

https://nptel.ac.in/courses/106105031

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Group Activity can be given to improve programming skills

VII Semester

ARM EMBEDDED SYSTEMS			
Course Code:	21ECT7052	**CIE Marks:**	50
Teaching Hours/Week (L: T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the basic hardware components of embedded system.
2. Develop the hardware software co-design and embedded firmware design approaches.
3. Exposure to ARM processors and ARM based embedded systems.
4. Understand the architectural features and instructions of ARM Cortex M3 & M4 processors.
5. Explain the need of real time operating system for embedded system applications.

Module-1	**08 hrs**

Embedded System Components: Embedded Vs General computing system, Classification of Embeddedsystems, Major applications and purpose of Embedded Systems. Elements of an Embedded System (Block diagram and explanation), Memory (ROM and RAM types), Sensors and Actuators – Light Emitting Diode(LED), 7-Segment LED Display, Keyboard, Communication Interfaces – Inter Integrated Circuit (I2C) Bus, Serial Peripheral Interface (SPI) Bus, Universal Serial Bus (USB), Infrared (IrDA), Bluetooth (BT), Wi-Fi.

Text 1

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-2	**08 hrs**

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Hardware Software Co-Design concept, Computational Models in Embedded Design, Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Typical Embedded product design and development approach, Electronic Design Automation (EDA) Tools in embedded design.

Text 1

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

ARM Embedded System: RISC Design Philosophy, ARM design Philosophy, Embedded System hardware and Embedded System software.

ARM Processor Fundamentals: Registers, Current Program Status Registers, Pipeline, Exceptions, Interrupts and the Vector table, Core Extensions, Architecture Revisions, ARM processor families.

Text 2

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation, YouTube videos
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

ARM Cortex-M Processors: ARM processor evolution, Architecture versions, Cortex-M3 and Cortex-M4 processors, Cortex-M processor family, Differences between a processor and a microcontroller, ARM and the microcontroller vendors, Selecting Cortex-M3 and Cortex-M4 microcontrollers, Advantages of the Cortex-M processors, Applications of the ARM Cortex-M processors, Resources for using ARM

processors and ARM microcontrollers, Architecture of the Cortex-M3 and Cortex-M4 processor, Operationmodes and states, Instruction set (Moving data within the processor, Arithmetic operations, Logic operations, Shift and rotate instructions), ARM programming examples.

Text 3

Teaching Learning Method:	Chalk and Talk, Power point presentations
RBT Level:	L1, L2, L3

Module-5	**08 hrs**

RTOS and IDE for Embedded System Design: The Operating System Architecture, Types of operatingsystems, Task, process and threads (Only POSIX Threads with an example program), Multiprocessing andMultitasking, Preemptive Task scheduling techniques, How to choose an RTOS.

Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram, The Integrated Development Environment (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques.

Text 1

Teaching Learning Method:	Chalk and Talk, Power point presentations
RBT Level:	**RBT Level:** L1, L2, L3

Course outcomes:

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

CO 1 - Describe the different elements of embedded system and their selection methods.
CO 2 - Develop the hardware Software co-design and firmware design approaches.
CO 3 - Describe the architectural features of ARM processors and ARM embedded systems.
CO 4 - Apply the knowledge gained for Programming ARM Cortex M3 & M4 for different applications.
CO 5 - Develop real time embedded system applications using suitable IDEs.

Suggested Learning Resources:

Text Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited,2nd Edition.
2. Andrew N Sloss, "ARM System Developer's guide", Elsevier Publications, 2016.
3. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors", Newnes,Elsevier.

Reference Books:

1. James K Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Languageand C", 2nd Ed., Man Press LLC ©, 2015.
3. K V K K Prasad, "Embedded real time systems", Dreamtech publications, 2003.
4. Rajkamal, "Embedded Systems",2nd Edition, McGraw hill Publications, 2010.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				1										
CO2	3	2	2		2										
CO3	3				1										
CO4	3	2	2		2										
CO5	3	2	2	1	2										

High-3, Medium-2, Low-1

Sub Title : Fundamentals of Satellite Communication		
Sub Code: 22ETT7051	**No. of Credits : 3=3:0:0 (L-T-P)**	**No. of lecture hours/week : 3**
Open Elective		
Exam Duration : 3 hours	**CIE + SEE = 50 + 50 =100**	**Total No. of Contact Hours : 39**

Course Objectives:

After completing the course, the students should:

1. Analyse the different orbits and orbital parameters.
2. Understand antenna look angles and eclipse.
3. Understand different link budget analysis.
4. Understand various subsystems and controls.
5. Become familiar with earth segments

Unit No.	Syllabus	No. of Teaching hours
1	**Orbits :** Introduction, Kepler's Laws, Definitions, Orbital Elements, Apogee and Perigee Heights, Orbital perturbations, Sidereal Time, The Orbital Plane, Sun-synchronous Orbit. - relevant problems	08
2	**Geostationary Orbit :** Antenna Look Angles, Polar Mount Antenna, Limits of Visibility, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits	08
3	**Space Link :** EIRP, Transmission Losses, Link Power budget equation, System noise, CNR , Uplink, Downlink, Combined CNR. - relevant problems	08
4	**Space Segments :** Power supply, Attitude Control, Station Keeping, Thermal Control, TT&C Subsystem, Transponders **Specialized services:** Satellite Mobile service, VSATs , Radarsat, GPS **(Text2)**	08
5	**Earth Segment :** Receive only home TV system, out door unit, indoor unit, MATV, CATV,Tx-Rx earth station	07

Course Outcomes:

1. Analyze different types of orbits and orbital parameters.
2. To calculate look angle for a satellite .
3. Compute different types of losses in satellite communication.
4. Able to analyze different subsystems
5. Have knowledge of earth segment.

CO-PO-PSO Mapping :

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	2		2	1						1	3	2	1
CO2	3	3	2		2	1						1	3	2	1
CO3	3	3	2		2	1						1	3	2	1
CO4	3	3	2		2	1						1	3	2	1

NOTE : Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High)

TEXT BOOKS:

1. Satellite communications –Dennis Roddy,4thEdition,McGraw Hill International edition,2008.
2. Fundamentals of Satellite Communication-SK Raman,PearsonEducation,2011

REFERENCE BOOKS/WEBLINKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2006.
2. Satellite Communication Concepts and Applications – K.N.RajaRao, 2nd Edition., PHI ,Publication year 2013.
3. www.nrsc.gov.in

Course Title	**ELECTRIC VEHICLE TECHNOLOGY**						
Course Code	**21EET7051**						
Category	**OEC**						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: **40+5(A)+5(GA)**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE: **03 Hours**		

COURSE OBJECTIVE:

1. Understand and acquire knowledge of battery driven electric vehicle, characteristics and their applications
2. Acquire knowledge about vehicle dynamics, Motors, Power Electronics, Batteries, and Charging
3. Study the performance of different types of electric drives.
4. Learn vehicle dynamics with constant and variable parameters

5 Analyse through Mat lab/ Simulink tool in real time applications

COURSE CONTENT:

UNIT I **8 hours**
Introduction to Electric Vehicle: Historical background of hybrid and electric vehicles, benefits of EVs, overview of types of EVs and its challenges motor drive technologies; IC engine based technology, requirements of EVs different types of EV motors used for electric vehicle. energy source technologies; Regone plot, types and comparison of batteries, ultra-capacitors/ ultra-fly wheels, fuel cells, on-board renewable energy sources**.**
UNIT II **8 hours**
EV Battery Charging Technologies: Charging schemes, charging algorithms, medium of charge transfer, types of wireless power transfer, battery management system. **EV Systems and Configuration:** Typical BEV configuration, hybridisation of energy sources, modes of operation, HEV systems and configuration: power train efficiency and energy efficiency improvement, types of HEV, HEV systems and configurations; modes of operation, classification and comparison of EVs,
UNIT III **8 hours**
Vehicle Dynamics 1: Introduction, tractive effort, aerodynamic drag, the resistance offered by tire, rolling resistance etc.; gradient and hill climbing force, vehicle road load force, gradability, acceleration force. Tractive effort- simulation
UNIT IV **8 hours**
Vehicle Dynamics 2: Dynamic equation with constant Fte- constant tractive effort, terminal velocity, distance, time and energy equations; dynamic equation variable Fte- derivation of different dynamic equations with variable FTE- variable tractive effort and different regions of vehicle speeds.
UNIT V **8 hours**
Vehicle Dynamics Modelling and simulation: Simulation of vehicle dynamic equation constant Fte; simulation of vehicle dynamic equation variable Fte. vehicle dynamics modelling and Simulation in Mat Lab/Simulink with real time application. Driving cycle, Range modelling.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animatio videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Summarize the fundamental concepts of Electric Vehicles.

CO2: Understand principles of operation of hybrid and electric vehicles.

CO3: Analyze the Electric Vehicle dynamics with constant and variable parameters
CO4: Apply Electric Vehicle dynamics for real time applications
CO5: Estimate the transient stability of the power system through different numerical methods.

REFERENCE BOOKS

1 Iqbal Husain," Electric and Hybrid Vehicles, Design Fundamentals", CRC Press,2003
2 M. Ehsani, Y. Gao, S. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles" CRC Press,2005.
3 Tom Denton. , "Electric And Hybrid Vehicles" Routledge / Taylor & Francis Group 2016
4 Donald L Anglin & William H. Crouse, "Automotive Mechanics" ,McGraw-Hill,1985

ONLINE RESOURCES

1. https://swayam.gov.in/nd1_noc20_ee18
2. https://youtu.be/Ay-4AZTnTEQ Electric Vehicle Part -1,Dr Amit Jain, IIT Delhi
3. https://nptel.ac.in/courses/108/102/108102121/

SCHEME FOR EXAMINATIONS

i. The question paper will have ten full questions carrying equal marks.
ii. Each full question will be for 20 marks.
iii. There will be two full questions from each module.
iv. Each full question will have sub-questions (subject to a maximum of four sub-questions)
v. The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO11	3	3	2		1							1		2	2
CO2	3	3		1	2	1								1	1
CO3	3				2						1	1	1	2	1
CO4	4	3			1	1							1	2	2
CO5	4	3		3				3					3	3	3
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Aircraft Instrumentation**						
Course Code	**21EIT7051**						
Category	Professional Elective Courses - III						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives

Sl. No.	Description
1.	Understand the Instrument display and Cockpit layout
2.	Understand the Operation of Flight instruments
3.	Study the characteristics of Gyroscopic Instruments
4.	Understand the operation of engine instruments and data recording system.

Unit	Syllabus	No. of Hrs
1	AIRCRAFT INSTRUMENTS: Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Attitude Director Indicator(ADI) & Horizontal Situation Indicator, glass cockpit. AIR DATA INSTRUMENTS: Tyes of Air Data Instruments:-Pneumatic type and Air data computers, International Standard Atmosphere (ISA). Combined pitot and static probe, separate static ports. Pneumatic -type Air Data Instruments: Air speed indicator, altimeter and Vertical Speed Indicator and Instantaneous vertical speed indicator	**10**
2	AIR DATA WARNING SYSTEM: Mach warning system, altitude alerts system, airspeed warning system. Directional Systems: Earth's total magnetic field, horizontal and vertical components of total field, direct reading compass and its limitations, fluxgate detector units .	**7**
3	GYROSCOPIC AND ADVANCED FLIGHT INSTRUMENTS: Gyro scope and its properties, gyro system, Types of gyros-Conventional Mechanical, Ring laser gyros, Fiber optic gyros, basic mechanical gyro and its properties, Gyro horizon, Advanced direction indicator, Turn and bank indicator.	**7**
4	ENGINE INSTRUMENTS: Introduction, Engine Speed measurement- Electrical Tacho Generator, Optical Tachnometer, Hall Effect sensor, torque measurement- Hydro mechanical Transducer, Electronic Torque Meter, Pressure measurement	**7**
5	ENGINE FUEL INDICATORS: Fuel quantity indicator (FQI)- volumetric FQI,Fuel flow rate Indicator- Rotating vane flowmeter, Integrated flow meter. FLIGHT DATA RECORDING: Cockpit Voice Recorder, Flight Data Recorder, future developments	**8**

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1.	Develop basic knowledge on the behavior and the characteristics of various indicators in aircraft	Knowledge, Understand (Level 1,Level 2)
2.	Acquire knowledge on the aircraft computer systems	Knowledge, Understand (Level 1,Level 2)
3.	Identify the different types of aircraft instruments and their operation	Knowledge, Understand (Level 1,Level 2)
4.	Analyze the performance of aircraft instruments in functionality of Aircraft System	Understand, Analyze (Level 2, Level 4)

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
Co1	**3**	**2**			**1**							**1**	**1**	**1**	**1**
Co2	**2**	**3**			**1**							**1**	**1**	**1**	**2**
Co3	**2**	**2**	**2**	**1**	**2**							**2**	**1**	**1**	**3**
Co4	**2**	**1**			**1**							**1**	**1**	**1**	**2**

Text Book:

1. Aircraft Instrumentation and Systems- S.Nagabhushana, L.K Sudha, I.K.International Publishing House Pvt.Ltd. 2013.

Reference Books:

1.

2. Aircraft digital electronic and computer systems - Michael H. Tooley, second edition, Taylor & Francis Group, 2022

3. Design and development of aircraft systems - Seabridge, Allan G, 3rd edition, Wiley; 3rd edition ,2020

4. Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, McGraw-Hill, 3rd edition,1992.

Course Title	**Robotics and Applications**						
Course Code	**21EIT7052**						
Category	Open Elective Course **(OEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course objectives:

The main objective of the course is to

1. Understand the generic technology and principles associated with robotics and automation systems.
2. Understand the principles and operations of different sensors used for robotic applications and robot programming and machine vision.
3. Understand the kinematics and motion planning aspects of robotic system.

Unit No	Syllabus	No of Teaching hours
1	**Introduction :** robot definition, classification of robot, history, robot components, robot degrees of freedom, robot joints, coordinates, reference frames, asimov's laws of robotics, robot programming modes, characteristics, applications	**8 Hours**
2	**Sensors in Robotics**: Transducers and sensors, characteristics of sensors, sensors in robotics, tactile sensors, proximity and range sensors, uses of sensors in robotics, problems.	**8 Hours**
3	**Machine Vision**: Introduction to machine vision, sensing and digitizing function in machine vision, image processing and analysis, training the vision system, robotic applications, problems. Robot Programming: Methods of robot programming, lead - through programming methods, a robot program as a path in space, motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead-through methods, problems.	**8 Hours**
4	**Robot kinematics :** rotation matrix, homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles RPY representation, Directand inverse kinematics for industrial robots for position and orientation.	**8 Hours**
5	**Motion planning:** Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Jointtrajectory, Cubic Spline Trajectory.	**8 Hours**

Course outcomes:

At the end of this course the students is able to

CO1: Demonstrate the technology and principles associated with robotics and automation systems.

CO2: Identify sensors, robotics vision, applications and also robot programming.

CO3: Solve direct and inverse kinematics of simple robot manipulators.

CO4: Apply spatial transformation and mathematical equations to obtain the forward kinematic equation of robot manipulators and path planning.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	2	-	2
CO2	3	3	2	1	-	-	-	-	-	2	-	2
CO3	2	2	2	1	-	-	-	-	-	2	-	2
CO4	2	2	2	1	-	-	-	-	-	2	-	2

Text Books:

1. **Introduction to robotics,** Saeed B Niku, Prentice Hall of India, 2005.
2. **Robotics control sensing Vision and Intelligence**- K.S.Fu, R.C.Gonzalez, C.S.G. Lee, McGraw Hill, 1987.
3. **Industrial Robotics: Technology, Programming and Applications,** Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, 2nd Edition, Tata McGraw Hill, 2012.

Reference Books:

1. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learning Publishers, 1998
2. **Introduction to robotics** John J Craig third Edition pearson Education Inc., 2005
3. **Introduction to robotics** SK Saha Tata Mc Graw Hill **,** 2008

ADMISSION YEAR : 2021-22 **ACADEMIC YEAR: 2024-25**
SEMESTER : SEVENTH

Course Title	**ROBOTICS**	
Sub Code: 21MET7051	**No. of Credits: 3 = 3:0:0 (L-T-P)**	**No. of lecture hours/week : 03** **No. of tutorial hours/week :00**
Exam Duration: 03 Hrs.	**Max. Marks : CIE+ Asmt +GA + SEE=40+5+5+50=100**	**Total No. of Contact Hours:50**
Category	**OEC**	
Pre-requisites	**Nil**	

COURSE OBJECTIVES:

1. To understand the application of robots in an industry based on its structure
2. To understand the basic function of controllers
3. To analyse the position representation of points on various linkages with respect to other linkages using homogenous transportation matrices
4. To understand trajectory planning and to program robots for different operations using VAL-II and other methods
5. To understand the functions of vision system and applications for inspection in assembly

#	**Contents**	**hr**
UNIT-1	**INTRODUCTION TO ROBOTICS**	**07**
	Introduction, definition ,automation and robotics ,advantages and disadvantages ,investment on robot ,social impact , labour robots and productivity ,management and robotics ,overview of robots ,advanced technological features of a modern robots ,need for robots ,the characteristics and application of future industrial robot	
UNIT-2	**STRUCTURE OF ROBOTIC SYSTEM**	**08**
	Anatomy of robot ,classification of robot ,robot configuration Robotic system, robot links ,joints in robots ,robot specifications, performance parameters, robot drive systems, hydraulic actuators pneumatic actuators ,electric drives ,steeped motors ,wrists and motions ,design of gripper fingers, problems	
UNIT-3	**SENSORS**	**07**
	Introduction ,classification of sensors and their functions ,touch sensors ,binary sensors ,analog sensors ,tactile sensors, proximity sensing, range sensing, and force-torque sensors.	
UNIT-4	**VISION SYSTEMS**	08
	Block diagram of vision system,constructional features of vidicon camera – lighting techniques and devices , analog to digital signal conversion- - image storage. Image processing and analysis, Feature Extraction and Object recognition,components of digital image processing	
UNIT-5	**COMPUTER –INTEGRATED MANUFACTURING SYSTEMS**	**09**
	Hierarchial computer control, flexible manufacturing systems- the FMS concept – transfer system-head changing FMS-variable mission manufacturing system FMS s in japan, CAD/CAM systems, the factory of the future “	

COURSE OUTCOMES: On completion of the course, student should be able to;

1. Able to define brief history of robotics. Social and economic aspects of robotics, advantages and disadvantages of using robots in industries. Overview of robots present and future applications.
2. Explain the drives and control system required for various applications of robots.
3. Analyse Homogeneous transformation, kinematic and dynamic analysis of robots
4. Analyse Inverse kinematic and trajectory planning related problems and will be able to understand the concept of trajectory planning and write the program for robot for various applications.
5. have knowledge of Robotics, automation, robotics motion, sensors and control, machine vision, robotic programming and roles of robots in industry

Text Books:

1. Ganesh S .Hegde " industrial robotics" laxmi publications ltd 2006
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 2001
3. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, Industrial Robotics: Technology, Programming and Applications, 2nd Edition, Tata McGraw Hill, 2012.
4. Roland Siegwart, Illah R. Nourbakhsh, an d Davide Scaramuzza, "Introduction to Autonomous Mobile Robots, 2nd Edition, PHI, 2011

REFERENCES:

1. Groover, M.P. "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2005
3. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 2008
4. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 2005
5. Deb S.R. "Robotics Technology and Flexible Automation" Tata McGraw Hill, 2003.

MAPPING OF COs WITH POs												
COs/POs	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	2	1	1	1	1	2	1	1
CO2	3	3	2	3	1	1	1	2	1	3	1	2
CO3	3	3	3	2	2	1	1	1	2	3	1	1
CO4	3	3	3	1	2	1	1	1	1	2	1	2
CO5	3	3	3	1	2	1	1	1	1	2	1	2
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

ADMISSION YEAR : 2021-22 **ACADEMIC YEAR: 2024-25**
SEMESTER : SEVENTH

Course Title	**COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION**	
Sub Code: 21MET7052	**No. of Credits: 3 = 3:0:0 (L-T-P)**	**No. of lecture hours/week : 03** **No. of tutorial hours/week :00**
Exam Duration: 03 Hrs.	**Max. Marks : CIE+ Asmt +GA + SEE=40+5+5+50=100**	**Total No. of Contact Hours:50**
Category	**OEC**	
Pre-requisites	**Nil**	

Course Objectives:

1. To impart knowledge of CIM and Automation and different concepts of automationby developing mathematical models.
2. To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
3. To expose students to computer aided process planning, material requirement planning, capacity planning etc.
4. To introduce the students to concepts of Additive Manufacturing, Internet of Things,and Industry 4.0 leading to Smart Factory.

UNIT	CONTENT	Hrs.
UNIT 1	**Introduction to CIM and Automation:** Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating,Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM. Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in process, Numerical problems and automation strategies.	**08**
UNIT 2	**Automated Production Lines and Assembly Systems:** Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage,partial automation, analysis of automated flow lines with Storage buffer, fundamentals of automated assembly systems, numerical problems.	**08**
UNIT 3	**Flexible Manufacturing Systems:** Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture. **Line Balancing:** Line balancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method.	**08**

UNIT 4	**Computerized Manufacture Planning and Control System:** Computer AidedProcess Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control. **Automated Assembly Systems:** Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feedback, escapement and placement. **Automated Guided Vehicle System**: Introduction, types, Vehicle guidance and routing, System management.	**08**
UNIT 5	**Additive Manufacturing Systems:** Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing. **Future of Automated Factory:** Industry 4.0, functions, applications andbenefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT forsmart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics,cyber-physical manufacturing systems.	**07**

TEXT BOOKS:

1. Automation, Production system & Computer Integrated manufacturing, M. P. Groover" 4thEdition, 2015, Pearson Learning.
2. Principles of Computer Integrated Manufacturing, S. Kant Vajpayee, Prentice Hall India.
3. CAD/CAM/CIM, Dr P Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

REFERENCE BOOKS

1. "CAD/CAM" by Ibrahim Zeid, Tata McGraw Hill.
2. "Principles of Computer Integrated Manufacturing", S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.
3. "Work Systems and the Methods, Measurement and Management of Work", Groover M.P, Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. "Computer Automation in Manufacturing", Boucher, T. O., Chapman & Hall, London,UK, 1996.
5. "Introduction to Robotics: Mechanics and Control", Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Readong, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. "Understanding Additive Manufacturing", Andreas Gebhardt, Hanser Publishers, 2011

10. Industry 4.0: The Industrial Internet of Things, A press, 2017, by Alasdair Gilchrist.

COURSE OUTCOMES (COS): On completion of this course you should be able to:

CO1: Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts.

CO2: Explain the basics of automated manufacturing industries through mathematical models and analyse different types of automated flow lines.

CO3: Analyse the FMS, GT, AS/RS and automated flow lines to reduce down time and enhance productivity.

CO4: Design and development of various types of Computerized Manufacture Planning and ControlSystem, materials handling systems, CAPP, MRP, capacity planning, shop floor control and CAQC.

CO5: Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

MAPPING OF COs WITH POs												
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	2	1	1	1	1	2	1	1
CO2	3	3	2	3	1	1	1	2	1	3	1	2
CO3	3	3	3	2	2	1	1	1	2	3	1	1
CO4	3	3	3	1	2	1	1	1	1	2	1	2
CO5	3	3	3	1	2	1	1	1	1	2	1	2
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

ADMISSION YEAR : 2021-22 **ACADEMIC YEAR: 2024-25**
SEMESTER : SEVENTH

Course Title	POWER PLANT ENGINEERING	
Sub Code: 21MET7053	No. of Credits: 3 = 3:0:0 (L-T-P)	No. of lecture hours/week : 03 No. of tutorial hours/week :00
Exam Duration: 03 Hrs.	Max. Marks : CIE+ Asmt +GA + SEE=40+5+5+50=100	Total No. of Contact Hours:50
Category	OEC	
Pre-requisites	Nil	

Course Objectives:

1. To familiarize with energy policy of India and trends of energy generation
2. To demonstrate layout and components of steam power plants, diesel engine power plants, hydroelectric power plants, nuclear power plants
3. To implement principles of power generation through solar energy, wind energy, ocean, tidal energy & fuel cells.
4. To apply basic calculation to understand design principles of conventional energy conversion.
5. To demonstrate competence in understanding performance of energy conversion devices through experiments.

#	CONTENTS	Hrs.
UNIT-1	THERMAL POWER PLANTS	08
	Introduction: Energy sources for generation of electric power, energy policy of India, present status and future trends, major power plants in India. Thermal power plants: selection of site, general layout of the plant, major components boilers, economizers, super-heaters, air pre-heaters, Fuels fuel and ash handling equipment, high pressure boilers, steam turbines, station heat balance and plant efficiency.	
UNIT-2	DIESEL ENGINE POWER PLANT	08
	Introduction applications of diesel engines in power field, advantages and disadvantages diesel engine power plant, types, general layout, combustion in a Ci engine, performance characteristics, supercharging, layout of diesel engine power plant, numerical problems.	
UNIT-3	HYDROELECTRIC POWER PLANTS	08
	Introduction; classification of hydro-plants, selection of site, rain fall and run off, calculation of storage capacity, plant layout estimation of power available selection of hydraulic turbines and their governing, general layout of hydro power plant.	
UNIT-4	NUCLEAR POWER PLANT	08
	Nuclear power plant; Introduction, atomic structure and rado-activities nuclear reactions, binding energy, nuclear reactors, types of reactors, pressurized water reactors, boiling heater reactors, heavy water –cooled and moderated (CANDU) reactor, gas cooled reactors, liquid metal cooled reactors, Indian nuclear power installations, comparison between Nuclear and Thermal plants, numerical problems.	
UNIT-5	NON CONVENTIONAL POWER GENERATION	08
	Introduction, direct energy conversions, MHD, thermionic and thermoelectric power generation, fuel cells, geothermal energy, hydrogen energy systems, numericals.	

TEXT BOOKS

1. Power Plant Engineering, P. K. Nag, Tata McGraw Hill, 4 Edition, 2014.

2. A Text Book of Power Plant Engineering, R. K. Rajput, Laxmi publication, New Delhi, 4 Edition, 2007.

REFERENCE BOOKS

1. Power Plant Engineering, G.R. Nagpal and S.C. Sharma, Khanna Publishers, 16 Edition, 2012.

COURSE OUTCOMES: After completion of the course, students will be able to:

CO1: Describe the sources of energy, energy generation by Thermal power plants and its trends in India, working principles of various components of Thermal power plants.

CO2: Discuss the layout, generation of Electric energy, working principles of components of Diesel power plants and its Applications.

CO3: Explain Hydrology, required flow graphs for calculating the capacity, site selection and different components of hydroelectric power plant

CO4: Explain nuclear materials, principles of energy release and components of reactors and different types of nuclear reactors and nuclear waste disposal

CO5: Describe the different nonconventional energy conversion methods for power generation.

MAPPING OF COs WITH POs												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	2	3	-	-	-	-	3
CO2	3	2	-	-	-	1	3	-	-	-	-	3
CO3	3	3	-	-	-	3	1	-	-	-	-	3
CO4	3	1	-	-	-	3	3	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1,												

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Title	**COMPOSITE MATERIALS & MANUFACTURING**	
Sub.Code:**21MET7054**	No. of Credits:**03 = 3:0:0 (L-T-P)**	No. of Lecture Hours/Week**:03**
Exam Duration: **03** Hrs.	**Max. Marks : CIE+ Asmt +GA + SEE=40+5+5+50=100**	Total No.of Contact Hours:**40**
Category	**OEC**	
Pre-requisites	**Nil**	

Course learning objectives:

1. This subject introduces different types of composite materials to the students
2. Students are introduced to different properties of composite materials
3. Students get to know the different applications of these materials

#	CONTENTS	Hrs
UNIT-1	**INTRODUCTION TO COMPOSITES**	**08**
	Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites in aerospace, automotive, medical, sports, marine industry.	
UNIT-2	**PROCESSING OF POLYMER MATRIX COMPOSITES**	**08**
	Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. Advantages and Limitations of PMC's PMC processes - Hand lay-up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GFRP).	
UNIT-3	**PROCESSING OF METAL MATRIX COMPOSITES**	**08**
	Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting, Recycling of Metal Matrix Composites	
UNIT-4	**PROCESSING OF CERAMIC MATRIX COMPOSITES**	**08**
	Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).	

UNIT-5	ADVANCES IN COMPOSITES	07
	Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications. **Nanocomposites:** Polymer Nano Composites – Types, Nano reinforcements, Applications, Metal Matrix Nano Composites – Types, Nano reinforcements, Applications, Ceramic Nano Composites - Types, Nano reinforcements, Applications 3D Printing of Composites : Introduction to 3D printing, 3D Printing of Polymer and Metal Matrix Composites, Applications of 3D Printed composites	

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., Composite materials, Springer – Verlag, 1987
3. M. Balasubramanian, Composite materials and Processing, CRC Press, 2014

REFERENCE BOOKS

1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press, 1993.
2. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3. Sharma S.C., Composite materials, Narosa Publications, 2000.
4. Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December 2001.
5. Manoj Kumar Buragohain, Composite Structures: Design, Mechanics, Analysis, Manufacturing, and Testing; CRC Press, 2017
6. Srinivasan K; Composite Material: Production Properties Testing; Narosa Publishers; 2009.

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Knowledge about composites and its applications
CO2: Understand the various processing methods of polymer matrix composites
CO3: Enhance awareness on intricate knowledge on metal matrix composites
CO4: Familiarize with the basics of ceramic matrix composites processing
CO5: Knowledge on the recent advances in composites

MAPPING OF COs WITH POs												
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	2	3	2	3	1	3	3
CO2	2	3	3	2	3	3	3	1	2	3	3	2
CO3	3	3	2	3	3	3	3	1	3	2	3	2
CO4	3	3	2	3	3	2	3	2	1	2	3	3
CO5	3	3	3	3	2	2	3	2	3	1	3	3
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	

Course Title	**OPERATIONS RESEARCH**						
Course Code	**21IMTE7051**						
Category	**OEC**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**00**	**0**	**0**	**03**	**40**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:
1. To Define and formulate the LPP for different product types with constraints. 2. Application of graphical, Simplex and Big M and Duality technique. 3. To Define and discuss the Transportation methods to find optimum cost. 4. To explain and define the concepts of queuing and Game theory. 5. Determine the Critical path and its duration, different types of floats using PERT/CPM.

Unit No.	Syllabus Content	No of Hours
1	**INTRODUCTION:** OR Methodology, Definition of OR, Application of OR to Engineering and Managerial Problems, Features of OR models, Limitation of OR. Models of OR. **LINEAR PROGRAMMING I:** Definition, Mathematical formulation, Standard form, solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal, Redundancy, Degeneracy, Graphical Method.	08
2	**LINEAR PROGRAMMING II:** Simplex method, variants of simplex algorithm – Artificial (Big-M method) basis techniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method. Application problems	08
3	**TRANSPORTATION PROBLEM:** Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems. **ASSIGNMENT PROBLEM:** Formulation of the Assignment problem, unbalanced assignment problem **TRAVELING SALESMAN PROBLEM**	08
4	**QUEUING THEORY:** Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analysing of M/M/1 queuing model. M/M/K/ Model. **GAME THEORY:** Formulations of games, Two persons zero sum game, games with and without saddle point, graphical solutions (2xn, mx2 game), and dominance property. Solution of game through LPP.	08
5	**PROJECT MANAGEMENT USING NETWORK ANALYSIS:** Network construction, determination of critical path and duration, CPM Structured approach, Calculations of schedules and floats, PERT-Estimation of project duration and variance.	08

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

Note 2: Two assignments are evaluated for 5 marks.

Outcomes:

1. Can formulate the LPP using constraints and solve by graphical method.
2. Able to determine the optimum solution using Simplex method.
3. Can find out the optimum transportation and assignment cost.
4. Can identify and apply different queuing model to service and arrival pattern problems and solve the game problems by graphical method and dominance property rule
5. Able to determine the Critical path and its duration using PERT/CPM.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3					3			2
CO2	3	3	3	3					3			2
CO3	3	3	3	3					3			2
CO4	3	3	3	3					3			2
CO5	3	3	3	3					3	2	3	3

	Course Title: DATABASE MANAGEMENT SYSTEMS		
	Course Code : 21CST7051	**No. of Credits: 3: 0: 0 (L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE+ Assignment + SEE = 45+5+50=100**	**Total No. of Contact Hours : 42**

	Description
Course Objectives:	1. To understand the different issues involved in the design and implementation of a database system. 2. To study the physical and logical database designs, database modeling, relational algebra concepts. 3. To understand and use data manipulation language to query, update and manage a database. 4. To develop an understanding of essential DBMS concepts such as normalization and transaction concepts.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction:** Introduction, an example, Characteristics of Database approach; Advantages of using DBMS approach; Data models, schemas and instances; three schema architecture and data independence; Database languages and interfaces; Classification of Database management systems. Entity-Relationship model; using High- Level conceptual Data Models for database Design; An example Database Application; Entity types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and structural Constraints; Weak Entity types; Refining the ER Design, ER to relational schema diagram mapping	9
2	**Relational Model and Relational Algebra:** Relational Model Concepts; relational Model constraints and Relational Database Schemas; update operations, Transactions and dealing with constraint violations; Unary Relational Operations; SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra.	8
3	**SQL:** Specifying basic constraints in SQL; schema change statements in SQL; Basic queries in SQL; More complex SQL queries-Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL.	8
4	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Cod Normal form, Properties of Relational Decompositions; Algorithms for relational Database Schema Design; Multi-valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form	9
5	**Transaction Management:** Transaction and System Concepts, Desirable Properties of Transactions, characterizing schedules based on Recoverability, characterizing schedules based on Serializability. Two-Phase Locking Techniques for Concurrency Control, Concurrency Control based on Timestamp ordering.	8

Course Outcomes	Description	RBT Levels
CO1	Understand the basic concepts and architecture associated with DBMS so as to employ the conceptual and relational models to design large database systems.	L4
CO2	Create, maintain and manipulate a relational database using SQL.	L4
CO3	Analyze the database design & normalize it so that the data conforms to design principles.	L4
CO4	Apply the characteristics of database transactions and assess how they affect database integrity and consistency.	L3

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	P06	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12
CO1	3	3	3	2								
CO2	3	3	3	3	2							
CO3	3	3	2	2								
CO4	2	2	2									

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

1. Fundamental of Database Systems by Elmasri and Navathe, 7th Edition, Addison-Wesley, 2015, **ISBN-10:** 0133970779, **ISBN-13:** 978-0133970777

REFERENCE BOOKS:

1. Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke – 3rd Edition, McGraw-Hill, 2006.
2. An Introduction to Database Systems by C.J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education,2013.
3. Data Base system Concepts by Silberschatz, Korth and Sudharshan, 5th edition McGraw Hill, 2011.

SELF STUDY REFERENCES / WEBLINKS:

1. Database Management System: https://onlinecourses.nptel.ac.in/noc19_cs46/course
2. **Introduction to Database Management Systems:** **https://www.youtube.com/watch?v=OMwgGL3lHlI&list=PLBlnK6fEyqRiyryTrbKHX1Sh9ldhX**
3. SQL Tutorial - Full Database Course for Beginners: https://www.youtube.com/watch?v=HXV3zeQKqGY

COURSE COORDINATOR:	**Dr. Asha**

Course Title: AGILE TECHNOLOGIES		
Course Code: 21CST7052	No. of Credits: 3: 0: 0 (L-T-P)	No. of lecture hours/week : 4
Exam Duration : 3 hours	CIE + SEE = 50+50	Total No. of Contact Hours : 50

Description

To understand the importance of Agile methods and its benefits in software development process,
To understand the Principle of XP practicing and to apply in releasing and Planning.
To understand the principles of Mastering Agility values and principles
To understand the roles of prototyping in the software process.

To understand the concept of Mastering Agility

Syllabus Content	No of Hours
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor	10
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility	10
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: "Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	10
Mastering Agility Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	10
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence : Software Doesn't Exist, Design Is for Understanding, Design Tradeoffs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	10

Course Outcomes	Description At the end of the course students can able to	RBT Levels
CO1	Understand The XP Lifecycle, XP Concepts, Adopting XP concept in S/w development process.	R1
CO2	Apply XP practicing Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements and Customer Tests.	R2
CO3	Apply the values , Principles and Practices using Mastering agility in software development.	R3
CO4	Adept the basics of Deliver values, design trades and Universal Design Principles in software process..	R4

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO2	PO3	PO4
CO1	1	2	3		2	1			3		3	2	3	1
CO2	1	3	2	1	3	1	1	2	2		2	1	2	2
CO3	1	2	3	1		1	1	1	2		3	2	1	2
CO4	1	3	2	3	2				2		3	1	3	2

Strong -3 medium -2 weak -1

TEXT BOOKS:

1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007 ISBN 978-159-904-68-39

REFERENCE BOOKS:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
2., "Agile and Iterative Development a Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

COURSE COORDINATOR:	Dr. Siddaraju

	Sub Title : INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
	Sub Code:21CST7053	**No. of Credits:3=3 : 0 : 0 (L-T-P)**	**No. of lecture hours/week : 3**
	Exam Duration : 3 hours	**CIE +Assignment + SEE = 45 + 5 + 50 =100**	**Total No. of Contact Hours :42**

Course Objectives:	**Description**
	Course objectives: The objective of the course is to: To understand agent programming for different applications. To learn different problem solving methods for artificial agents. To learn knowledge representation To learn implementing machine learning concepts and methods.

Unit No	**Syllabus Content**	**No of Hours**
1	**Introduction:** what is AI**,** the foundations of AI,history of AI,the state of the art, **Intelligent agents:** Agents and environments, good behavior, concept of rationality, nature of environments, structure of agents. **Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4**	**8**
2	**Problem-solving by Searching:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening search; **Informed Search Strategies**: Heuristic functions, Greedy best first search, A*search. **Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4,3.5,3.6**	**9**
3	**Knowledge Representation:** introduction, ontologies, objects and events, representations and mappings, approaches to knowledge representations, forward versus backward chaining, matching and control knowledge, slots and filler structure, issues in knowledge representation, developments in the field of knowledge representation. **Text book 2:-Chapter 4**	**8**
4	**Learning**: what is learning, forms of learning, learning decision trees, theory of learning, learning by examples, inductive learning, explanation based learning, regression and classification with linear models, ensemble learning, statistical learning, reinforcement learning ,applications **Text Book 2: Chapter8-8.1,8.2,8.3,8.4,8.5,8.6,8.7,8.8,8.13,8.14,8.15,8.16**	**9**
5	**Neural network and applications:** introduction, learning in neural networks, choosing cost functions, types of learning, recurrent neural network, back propagation,convolutional neural networks,applications,challenges **Text Book 2: Chapter5-5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8,.5,9.**	**8**

COURSE OUTCOMES:

Course Outcomes	**Description**	**RBT Levels**
CO1	Describe and implement different types of agents for real time applications with proper understanding of agent programming	**L3**
CO2	Analyze and apply search methods of problem solving techniques in real time applications.	**L4**

CO3	Design and apply different learning algorithms and methods for improving agents performance.	**L4**

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**
CO1	**2**	**2**										
CO2	**2**	**3**	**3**	**2**								**2**
CO3	**3**	**3**	**3**									**2**

Strong -3 Medium -2 Weak -1

TEXT BOOKS:

Artificial Intelligence: A Modern Approach, by Stuart Russell and Peter Norvig, 2nd Edition, Publisher: Pearson education ltd-2013 ISBN: 978-81-7758-367-0
Artificial Intelligence Concepts and Applications by Lavika Goel 1st Edition, Publisher: wiley India pvt ltd-2021 ISBN: 978-81-265-1993-4

REFERENCE BOOKS:

Luger, G. F., & Stubblefield, W. A., Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, 5th edition (2005).
Nilsson, N. J. Artificial Intelligence - A Modern Synthesis. Palo Alto: Morgan Kaufmann. (1998).
Nilsson, N. J., Principles of Artificial Intelligence. Palo Alto, CA: Tioga (1981).
Rich, E., & Knight, K., Artificial Intelligence. New York: McGraw-Hill (1991).

SELF STUDY REFERENCES/WEBLINKS:

http://Nptel.ac.in/courses/106/106/106140
http://Nptel.ac.in/courses/106/102/102220

COURSE COORDINATOR:	**ARATHI .P**