DEPARTMENT OF CIVIL ENGINEERING

CEOE408 Hydro Power Engineering

Pre-requisite: Elementary knowledge of Electrical, Mechanical and Civil engineering

L	T	P/D	Credits	Total contact hours
3	0	0	3	3

Brief description of the course: The course covers various aspects of hydropower development, including power sources, small hydro importance, types of power plants, intakestructures, penstocks, turbines, power house layouts, and sustainable technologies. Students learn about environmental impact assessment, mitigation measures, stakeholder engagement, and project management principles for responsible hydropower development.

Course Content:

Unit-I (9 hrs)

Introduction

Sources of power, estimation of water power, necessity and importance of harnessing small hydro power, flow duration and power duration curves, load curve, load factors, capacity factors, utilization factors, firm and secondary power.
Types of Hydro Power Plants
Elements of Hydro power, classification of hydro-power plants, run-of-river plants, storage plants diversion canal development, pumped storage plants, tidal power plants, base load andpeak load plants in a power grid

Unit-II (7 hrs) Intakes

Intake structures, functions and their types, components of intakes-forebay, trash racks, gatesand valves, force required to operate gates.

Conveyance System

Penstocks, design criterion, economical diameter anchor blocks, cradles and footings, waterhammer, instantaneous closure of power canal, surge tank, surges in canals.

Unit-III (11 hrs) Turbines

Types of turbines, specific speed and classification of turbines, synchronous speed, scroll casing, flumes and draft tubes, dimensions of scroll casing and draft tubes, setting of turbines **Power House**
General layout and arrangements of hydro-power units, number and size of units, sub-structure, spacing of units, super-structure, underground power stations, tidal power. **Unit-IV (9 hrs)**
Environmental and Social Aspects: Environmental impact assessment (EIA) for hydropower projects. Mitigation measures for minimizing the ecological and social impacts of hydropower development. Social and community considerations, including stakeholder engagement and resettlement issues. Sustainable Hydropower Technologies Policy, Economics, and Project Management:

Note: The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/Reference:

1. Water Power Engineering, Dandekar, M. M., Sharma, K. N.
2. Hydro-Electric Engineering Practice Vol. I, II & III Brown J. G.
3. Water Power Engineering, Borrows, H. K.
4. Water Power Development, Vol. I & II, Mosonyi, E.
5. Water Power Engineering, M. M. Deshmukh

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Students gain a comprehensive understanding of hydropower sources, small hydroimportance, plant types, power generation, analysis, and sustainability.

CO2: Students acquire broad knowledge of intake structures, components, design, penstocks,sizing criteria, water hammer phenomena, and surge control techniques.

CO3: Students learn turbine types, selection factors, components (scroll casings, flumes, drafttubes), power house layout, underground stations, and tidal power projects for effective hydropower plant design and operation.

CO 4 Students gain complete knowledge of hydropower's environmental and social aspects,enabling impact assessment, stakeholder engagement, and responsible development.

DEPARTMENT OF CIVIL ENGINEERING

CEOE411 Advanced Concrete Technology

Pre-requisite: None

L	T	P/D	Credits	Total contact hours
3	0	0	3	3

Brief description of the course:

The course covers the properties of ingredients of concrete, concrete design mix, behaviourof concrete at its fresh and hardened state, procedures in concreting and special concrete and their use.

Course Content:

Unit-I (10 hrs)

Introduction -Concrete materials –Cement – Types, Physical tests on cement - Aggregates types, Tests on aggregates - Quality of Water for mixing and curing - Mineral and chemical Admixtures. Concrete Manufacturing: Batching -Mixing -Transportation -Placing of concrete
-curing of Concrete. Fresh and hardened properties of Concrete.

Unit-II (7 hrs)

Mix Design -factors influencing mix proportion -Mix design by ACI method and IS code method. Design of normal concrete, high strength concrete and self compacting concrete.

Unit-III (10 hrs)

Creep, Shrinkage and temperature effects of concrete -durability of concrete: deterioration under chemical attacks and freeze and thaw attack -permeability of concrete –Corrosion of rebar - Causes and effects - remedial measures, Fire resistance of concrete, Rebound hammer and Ultra-sonic pulse velocity testing methods, microstructure of concrete.

Unit-IV (9 hrs)

Special Concrete –Lightweight concrete - High Density Concrete - Hot and Cold weathering Concrete -Fibre reinforced concrete -Polymer concrete -Ferro cement -Ready mix concrete- High Performance Concrete - Self compacting concrete (Principles, Ingredients used, Production, Curing, Mechanism, Properties, Durability etc.), Sustainability of concrete.

Note: The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possiblesustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/Reference:

1. Mehta P. K. and Monterio P. J. M. (2017), Concrete: Microstructure, Properties, and Materials, 4th edition, McGraw Hill Education, USA.
2. Shetty, M.S., Concrete Technology (Theory & Practice), S. Chand and Co, Revised edition, 2015.
3. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, fifth edition, 2013.
4. A. M. Neville, Properties of Concrete, Pearson India, fifth edition.
5. IS 456 (2000), Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards (BIS), New Delhi, India.
6. IS 10262 (2019), Concrete Mix Proportioning – Guidelines, Bureau of IndianStandards (BIS), New Delhi, India.
7. ACI 318 (2014), Building code requirements for structural concrete (ACI 318-2014)and Commentary (ACI 318R-2014). American Concrete Institute, Detroit, MI, USA

Course Outcomes:

Upon successful completion of the course, the students will be able toCO1 Test all the concrete materials as per IS code.
CO2 Design the concrete mix using ACI and IS code methods. CO3 Determine the properties of fresh and hardened of concrete.
CO4 Ensure quality control while testing/ sampling and acceptance criteria.CO5 Design special concretes and their specific applications.

DEPARTMENT OF COMPUTER ENGINEERING

CSOE 404: Information Security

Course Code	**:**	**CSOE 404**
Course Title	**:**	**Information Security**
Number of Credits and L/T/P scheme	**:**	**3 and 3-0-0**
Prerequisites (Course code)	**:**	**Computer Networks**
Course Category	**:**	**OE**

Course Learning Objectives

1. To introduce the concept of information security, and number theory.
2. To make students familiar with different aspects of access control, system security and its applications.
3. To make students familiar with various cryptographic algorithms.
4. To design security solutions for different operation systems and Networks.

Course Content

Unit 1. Introduction to Information Security: Meaning of Information security, privacy, vulnerability, threat, attack, CIA Triad, CNSS Security Model, Components of an Information System, OSI Security Architecture, Model for Network Security, Network Access Security Model, Access Control

Unit 2. Introduction to Number theory: Divisibility, Division Algorithm, Euclidean Algorithm, Extended Euclidean Algorithm, Fast exponentiation Algorithm; Modular Arithmetic, Congruences, Chinese Remainder Theorem, Algebraic structures, Galois Fields

Unit 3. Introduction to Cryptography: Private Key Cryptography: Traditional Symmetric-key ciphers, Modern Symmetric Key ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Block Cipher modes of Operation; Public Key Cryptography: Trapdoor one-way Function, RSA, Diffie-Hellman Key exchange, Cryptographic Hash Function, Digital Signature

Unit 4. System and Operating Security: Overview, Security policy, File Protection Mechanisms, User Authentication, Security models, Trusted Operating System Design, Host based Intrusion detection system, Network based Intrusion detection system, Host based Intrusion prevention system, Network based Intrusion prevention system.

Unit 5. Network Security: Network security Concepts, Network threats, Security controls, Firewalls, Protecting Programs and Data, Secure Program, sniffing, spoofing, Non Malicious Program errors, Malware, Viruses and other malicious code, Control against Program, Honeypot, SDN Security, IoT Security.
Assignment (Implementation of any Security algorithm from above related topics, as an assignment)

Text Books:

1. Charles P. Pfleeger, Share Lawrence Pfleeger, Security in Computing, Pearson Education, 2/e.
2. William Stallings, Cryptography and Network Security, PHI, 7/e
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer 2006.
4. B.A. Forouzan, Cryptography and Network Security, McGraw-Hill, 3/e

Reference Books:

1. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, (Wiley 2006)
2. Charlie Kaufman, Perlman & S Peeciner, Network Security, Pearson Education, 2/e.

Course outcomes

On successful completion of this, course students will:

1. Able to understand the information security and number theory concepts.
2. Able to analyses different aspects of access control, system security and its applications.
3. Able to understand and analyse various cryptographic algorithms.
4. Able to design and develop security solutions for different operation systems and networks

DEPARTMENT OF COMPUTER ENGINEERING

ITOE 404: Information Security

Course Code	**:**	**ITOE 404**
Course Title	**:**	**Information Security**
Number of Credits and L/T/P scheme	**:**	**3 and 3-0-0**
Prerequisites (Course code)	**:**	**Computer Networks**
Course Category	**:**	**OE**

Course Learning Objectives

1. To introduce the concept of information security, and number theory.
2. To make students familiar with different aspects of access control, system security and its applications.
3. To make students familiar with various cryptographic algorithms.
4. To design security solutions for different operation systems and Networks

Course Content

Unit 1. Introduction to Information Security: Meaning of Information security, privacy, vulnerability, threat, attack, CIA Triad, CNSS Security Model, Components of an Information System, OSI Security Architecture, Model for Network Security, Network Access Security Model, Access Control

Unit 2 Introduction to Number theory: Divisibility, Division Algorithm, Euclidean Algorithm, Extended Euclidean Algorithm, Fast exponentiation Algorithm; Modular Arithmetic, Congruences, Chinese Remainder Theorem, Algebraic structures, Galois Fields

Unit 3. Introduction to Cryptography: Private Key Cryptography: Traditional Symmetric-key ciphers, Modern Symmetric Key ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Block Cipher modes of Operation; Public Key Cryptography: Trapdoor one-way Function, RSA, Diffie-Hellman Key exchange, Cryptographic Hash Function, Digital Signature

Unit 4. System and Operating Security: Overview, Security policy, File Protection Mechanisms, User Authentication, Security models, Trusted Operating System Design, Host based Intrusion detection system, Network based Intrusion detection system, Host based Intrusion prevention system, Network based Intrusion prevention system.

Unit 5. Network Security: Network security Concepts, Network threats, Security controls, Firewalls, Protecting Programs and Data, Secure Program, sniffing, spoofing, Non Malicious Program errors, Malware, Viruses and other malicious code, Control against Program, Honeypot, SDN Security, IoT Security

Text Books:

1. Charles P. Pfleeger, Share Lawrence Pfleeger, Security in Computing, Pearson Education, 2/e.
2. William Stallings, Cryptography and Network Security, PHI, 7/e
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer 2006.
4. B.A. Forouzan, Cryptography and Network Security, McGraw-Hill, 3/e

Reference Books:

1. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, (Wiley 2006)
2. Charlie Kaufman, Perlman & S Peeciner, Network Security, Pearson Education, 2/e.

Course outcomes:

On successful completion of this, course students will:

1. Able to understand the information security and number theory concepts.
2. Able to analyses different aspects of access control, system security and its applications.
3. Able to understand and analyse various cryptographic algorithms.
4. Able to design and develop security solutions for different operation systems and networks

DEPARTMENT OF ELECTRICAL ENGINEERING

EEOE406: ENERGY CONSERVATION UTILIZATION AND SAFETY STANDARDS

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description

This course aims to provide students with the basics of energy conservation and management, utilization of the electrical energy and safety hazards.

Course Content

Unit 1: Energy Conservation and Management (14)

Overview of energy conservation and management, Importance of energy conservation and its role in sustainable development, Energy management principles and practices, Energy auditing and benchmarking, Energy policy and regulations

Energy-efficient technologies and systems, Building energy conservation measures, Industrial energy conservation practices, Transportation energy efficiency, Renewable energy integration and optimization

Unit 2: Electrical Energy Conservation and Utilization-I (11)

Laws of illumination, coefficient of Utilization and depreciation, Polar curves, photometry, integrating sphere, Types of Lamps and their usage as per energy conservation, Basic principles of light control, Types and design of lighting scheme, lighting calculations.

Principles of Electric Heating, Various Schemes and methods of Resistance Heating-Direct and Indirect heating, Induction heating, Dielectric heating and Microwave heating. Applications of Heating and modern heating methods. Simple problems.

Unit 3: Electrical Energy Conservation and Utilization-II (11)

Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems, problems of single-phase traction with current unbalance and voltage unbalance. Systems of train lighting, special requirements of train lighting, methods of obtaining unidirectional polarity constant output- single battery system, Double battery parallel block system, coach wiring, lighting by making use of 25 kV AC supply, Speed control of Traction motors (DC Series motors) Series-Parallel connection, Shunt Transition, Bridge Transition. Problems on series-parallel control

Unit 4: Safety Standards (6)

Overview of applicable safety standards, National and international safety codes, Compliance requirements, identifying electrical hazards in various environments, Site Safety: Industrial, Construction, and Residential, working on energized equipment, Emergency response and evacuation plans Real-life examples of electrical accidents and their prevention, Best practices for electrical safety implementation,

Text Books

1. Smith, Craig B., and Kelly E. Parmenter. Energy, management, principles: Applications, benefits, savings. Elsevier, 2013.
2. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai and Sons, 2017.
3. Sutherland, Peter E. Principles of electrical safety. John Wiley & Sons, 2014.

References/Textbooks:

1. Generation Distribution and Utilization of Electrical Energy, C.L. Wadhwa, New Age International Publishers, 3rd Edition, 2017
2. Kreith, Frank, and D. Yogi Goswami, eds. Energy management and conservation handbook. CRC Press, 2007.
3. Fordham-Cooper, W. Electrical safety engineering. Elsevier, 1998.
4. John Cadick, P. E., Mary Capelli-Schellpfeffer, Dennis K. Neitzel, and Al Winfield. Electrical safety handbook. McGraw-Hill Education, 2012.

Course Outcomes

On successful completion of the course, students will be able to

CO1 Understand the principles and importance of energy conservation.
CO2 Determine the lighting requirements for flood lighting, household and industrial needs
CO3 Understand basic principles of electric heating and Traction
CO4 Identify and assess electrical hazards in various environments

DEPARTMENT OF ELECTRICAL ENGINEERING

EEOE407: ROBOTICS

Pre-requisite: MAIC101, EEPC241

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief description:

Aims to give fundamental concepts of kinematics, dynamics and control of industrial Robotic manipulator

Unit-I **(10)**

Definition, Motivation, Historical development, Basic structure, Classification, Workspace, Grippers. Rigid motion and frame Transformations. DH parameters

Unit-II **(10)**

Robot Arm Forward and Inverse Kinematics, Forward and Inverse Kinematics, redundancy resolution, Velocity kinematics and Jacobian, Singular value decomposition, singularity and manipulation ability

Unit-III **(12)**

Lagrange formulation of dynamics.
Trajectory generation: Cartesian Scheme, Joint space scheme
Teaching methods: Manual teaching, Lead through teaching
Sensors and actuators as used in robotics.

Unit-IV **(10)**

Control Scheme: Position Control, Force control, Hybrid position and force control, Industry Multi DOF robotic manipulator case studies.
Design exercises in MATLAB/LABVIEW and case studies.

References/Textbooks:

1. J.J. Craig, “Introduction to Robotics – Mechanics A Control”, Addison Wesley, 2001.
2. A.J. Koivo, “Fundamentals for Control of Robotic Manipulation”, John Wiley Inc. New York, 2001.
3. Spong and Vidyasagar, “Robot Dynamics and Control”, John Wiley and Sons, 2005.
4. Sciavicco and Siciliano, “Modeling and Control of Robot Manipulators”, McGraw Hill International Edition, 1998.
5. Foundations of Robotics : T. Yoshikawa , PHI India

COURSE OUTCOMES:

On successful completion of the course, students will be able to

Upon completion of the course, the students will be able to
CO1: Understand the basic concept of industrial robotic Manipulator
CO2: Derive direct and inverse kinematic equations of a given robot.
CO3: Derive the dynamic equations of an industrial robot. CO4: Develop the control algorithm necessary to run the given robot

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ECOE-403: INTERNET OF THINGS

Pre-requisite: …….

L	T	P	Credits	Total contact hours
3	0	0	3	36

Brief Description about the course:

This course will be focused on introducing students to new trends, applications, system architecture and challenges involved in developing/deploying internet of things systems using real industrial use cases. A number of systems are getting connected to the internet, where the sensor data is analyzed to monitor and control the systems. Correctly analyzing data coming from multiple sensors, choosing the right hardware given the power and performance tradeoff, hardware heterogeneity and security are some of the challenges involved in developing IoT applications. The course will cover the real-world use cases of IoT applications and hands-on projects related to those based on the concepts learned in the class.

Course Contents:

UNIT - I 8 hrs.

Overview of IoT systems: New trends, applications and challenges. IoT system architecture: Edge devices, sensors, actuators, gateway, data storage and historical analysis in the cloud.

UNIT – II 10 hrs.

Sensor networks: Wireless sensor networks (WSN), localization, node mobility, energy efficiency in WSN. Communication: MQTT, wifi, Bluetooth, RFID, LoRa, communication security.

UNIT - III 8 hrs.

IoT system optimization: Low power devices, energy harvesting, performance trade-off, choosing the right hardware.

Unit – IV 10 hrs.

Smart and connected devices: Raspberry-pi, Google home mini, Alexa, Echo show Case studies: Smart cities, transportation, manufacturing, automobile.

Text Books / Reference:

1. Peter Waher “Learning Internet of Things”
2. S. Misra, C. Roy, and A. Mukherjee, 2020 “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press.

3. Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri, “Internet of Things: Architectures, Protocols and Standards” WILEY.
4. Andrew Minteer, “Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices”.

Course Outcomes

On completion of this course, you should be able to:

CO1: Understand the IoT system and its applications.

CO2: Understand IoT system and sensor networks.

CO3: Apply the IoT system and optimization

CO4: Apply the IoT knowledge in smart cities, transportation and manufacturing.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

ECOE-404: COMPUTER NETWORKS AND INFORMATION SECURITY

Pre-requisite: none

L	T	P	Credits	Total contact hours
3	0	0	3	36

Brief Description about the course

The objective of this course is to provide an understanding of theoretical aspects of computer networks and network security, including the protocols involved in the secure exchange of information between communicating devices.

Course Content

UNIT-I

Introduction: Overview and motivation: Telephone Network and the Internet Network, Circuit Switching vs. Packet Switching, Architecture-OSI, TCP/IP models, Physical and Data link layer protocols: Encoding, Framing, Error detection, HDLC, PPP, sliding window protocols.

9hrs

UNIT-II

Network Layer protocols: Internet addressing, IP, ARP, ICMP, CIDR, Routing algorithms. Transport Layer protocols: UDP, TCP, flow control, congestion control. Application Layer protocols: DNS, Web, HTTP, email, authentication, encryption. 9hrs

UNIT-III

Introduction to Network Security, Need for Network Security, Network Security Fundamentals, Security Concepts and Terminology, TCP/IP and OSI Network Security, Access Control Issues (Packet Filters, Firewalls) 9 hrs

UNIT-IV

Communication Security (OSI Layer Security Protocols), Security Tools, Cryptography, System Security - Intruders and Viruses, E-mail and Web Security, 9 hrs

Reference Books

1. Michael Goodrich, Roberto Tamassia, *Introduction to Computer Security*: Pearson publications, 2nd edition, 2021, ISBN-13: 978-0133575477.

2. L. L. Peterson and B. S. Davie, *Computer Networks: A Systems Approach*, 6th edition, Elsevier publications, 2021, Paperback ISBN: 9780128182000.

3. A. S.Tanenbaum and D.J. Wetherall, *Computer Networks*, Pearson publications, 5th Edition, 2013, ISBN-13: 978-8131770221.

4. W. Stallings, "Cryptography and Network Security", Pearson Education.

5. J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach*, 7th Edition, Pearson publications, 2017, ISBN-13: 9780134296159.
6. Kun Peng, *Anonymous Communication Networks: Protecting Privacy on the Web*, Auerbach publications, 2019, ISBN: 9780367378738.

Course outcomes:

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

CO1 Understand the architecture and protocols of computer networks.

CO2 Understand the various layers of OSI/TCP IP model.

CO3 Comprehend the necessity of network security along with the basic concept of Network security.

CO4 Investigate various network vulnerabilities like virus, worm, malware, rootkit and devise strategies to mitigate them.

DEPARTMENT OF MECHANICAL ENGINEERING

MEOE431: NUCLEAR ENGINEERING

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
3	-	-	3	40

1. **Concepts of Nuclear Physics:** The atom, structure, the nucleus, nuclear structure, atomic transmutation of elements, detection of radio-activity, particle accelerator, decay, natural of elements, nucleus interactions, decay rates, half-life, transuranic elements. **(6hrs)**
2. **Neutorn Interaction:** Advantages of using neutron, neutron moderation, fission chain reaction, thermalisation of neutrons, fast neutrons, prompt and delayed neutrons, fission products. **(4hrs)**
3. **Energy Release:** Mass energy equivalence, mass defect, binding energy, energy release in fission & fusion, thermonuclear reaction, fusion bomb. **(4hrs)**
4. **Reactor Materials:** Fissile & fertile materials, cladding & shielding materials, moderators, coolants. **(4hrs)**
5. **Reactor Technology:** Basic principles, fuel assembly, neutron balance, reactor kinetics, reactor coefficients, reactor stability, excess reactivity, Xenon poisoning, burnable absorbers, reactivity control, heat balance, production& transfer of heat to the coolant, structural considerations. **(10 hrs)**
6. **Nuclear Reactors:** Types of nuclear reactors, pressurized water reactors, boiling water reactors, CANDU type reactors, gas cooled & liquid metal cooled reactors, fast breeder reactors. **(6hrs)**
7. **Safety Considerations & Waste Disposal:** Hazards, plant site selection, safety measures incorporated in; plant design, accident control, disposal of nuclear waste. **(4hrs)**
8. **Health Physics & Radio-isotopes:** Radiation: units, hazards, prevention, preparation of radio-isotopes& their use in medicine, agriculture & industry. **(2hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/References:

1. M. M. El-Wakel, Nuclear Power Engineering, McGraw Hill
2. Shultis and Faw, Fundamentals of Nuclear Science and Engineering, CRC Press
3. Stephenson, Introduction to Nuclear Engineering, McGraw Hill
4. Murray, Nuclear Energy, Butterworth-Heinemann.

Course Outcomes:

CO1: To understand the concepts of neutron physics and various nuclear Processes involved in Nuclear Power Plants.
CO2: To calculate heat generation from nuclear reaction.
CO3: To design and analyze the performance of nuclear power plants.
CO4: To get acquainted with applications of radioactivity.
CO5: To appreciate the hazards associated with radioactivity and the necessity of waste disposal.

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

HSOE-406: Emotional Intelligence

Course Category: OE
Course Code: HSOE 406
Credits: 3 (L-3)
Semester: 8th

Internal: 50 Marks
Theory: 50 Marks
Total: 100 Marks
Time: 3 hrs

Course Objectives

To introduce the ability of emotional intelligence in the students and to acquaint them with management of emotions.

Instructions for examiner

The number of questions to be set will be five, one from each unit. The examinees will be required to attempt all five questions. All questions shall carry equal marks.

UNIT I

The Concept of Emotions, Emotions and Brain. Emotions and Decision Making. Affect. Emotional Intelligence: Definition, development of Emotional Intelligence, Emotional Quotient (EQ), Difference between IQ and EQ, Components of Emotional Intelligence. Culture and Emotions.

UNIT II

The Levels of Emotional Awareness, Recognizing Emotions in Oneself, The Universality of Emotional Expression, Perceiving Others' Emotions, Managing Emotions.

UNIT III

Assessment of Emotional Intelligence: Ability-Based Tests, Trait-Based Tests, Competency-Based Tests, Behavior-Based Tests, Advantages and Disadvantages of Assessment Types.

UNIT IV

Emotional Intelligence and Personality, Emotional Intelligence and Cognition, Emotional Intelligence at the Workplace, Emotional Intelligence in Personal Relationships, Emotional Intelligence, and Conflict Management. Emotional Intelligence and Effective Leadership.

Course Outcomes

By studying the course, the students will be able to understand importance of regulations of emotions in their personal and professional life. They will also able to recognize, understand, and manage their own as well as other's emotions.

Suggested Readings

Bar-On, R., & Parker, J.D.A.(Eds.) (2000). *The handbook of emotional intelligence*. San Francisco, California: Jossey Bros.

Di Fabio, A. (2012). *Emotional Intelligence: New Perspectives and Applications*. BoD – Books on Demand.

Goleman, D. (1995). *Emotional Intelligence.* New York: Bantam Book.

Goleman, D. (1998). *Working with Emotional Intelligence*. New York: Bantam Books.

Singh, D. (2003). *Emotional intelligence at work* (2nd ed.) New Delhi: Response Books.

DEPARTMENT OF PHYSICS

PHOE403: LASER TECHNOLOGY

L	T	P	Credits	Total contact hours
3	0	0	3	36

Pre-requisite: **PHIC101**

Brief Description about the course: This course elaborates the interaction of light with matter and physical principles underlying the fabrication of laser systems, necessary conditions laser active materials and their applications in different fields of science and technology.

Course Content

UNIT-I (9 Hours)

Laser Fundamentals: Concept of Laser emission, Characteristics of Lasers, Main components of Laser system, Necessary and sufficient conditions for Laser action, Einstein coefficients, population inversion, laser pumping, two, three and four level laser systems.

UNIT-II (9 Hours)

Laser Beam Propagation and Transformation: Optical cavities, Types of optical resonator, Stability criterion (stable and unstable resonator), Threshold gain coefficient, Resonator modes (longitudinal and transverse modes), Threshold condition of laser oscillation, Q-switching and mode locking.

UNIT-III (9 Hours)

Types of Laser: Solid State laser (Ruby laser, Nd: YAG, Nd: Glass etc**),** Gas laser (CO_2 and Argon ion laser) and Dye laser, Excimer laser, Free electron laser, Chemical laser and Semiconductor laser, Homojunction Laser (Laser Diode) and Heterojunction Laser.

UNIT-IV (9 Hours)

Laser Applications: Laser in materials processing and industry, Lasers in Micro- and Nano-fabrication and metrology, Lasers in spectroscopy, Lasers in communication and Holography, Lasers induced fusion, Laser systems for biomedical and remote sensing applications.

Text Books/Reference Books

T-1: W.T. Silfvast, **"Laser Fundamentals"**, Cambridge University Press, 2004

T-1: B.B. Laud, **"Lasers and Non-linear Optics"**, Wiley Eastern Limited, 2nd Edition 1991

R-1: Orazio Svelto, **"Principle of Lasers"**, 5th Edition, Springer New York 2010

R-2: K Thyagarajan and Ajoy Ghatak, **"Lasers: Fundamentals and Applications"**, Springer, USA, 2010.

R-3: Ajoy Ghatak and K. Thyagarajan, **"Fiber Optics and Lasers: The two revolutions"**, Macmillan India, 2006, Reprint 2008-09.

R-4: G. Kaur and Gary R. Pickrell, **"Modern Physics"**, McGraw Hill education, 2014.

Course Outcomes:

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

CO1: Know latest developments in laser technology and their applications in science, technology and research.

CO2: Utilize laser technology in modern devices and technologies based on lasers.

CO3: Apply laser technology in spectroscopic and industrial applications.

DEPARTMENT OF PHYSICS

PHOE404: ULTRASONICS AND APPLICAITONS

Pre-requisite: **PHIC101**

L	T	P	Credits	Total contact hours
3	0	0	3	36

Brief Description about the course: This course provides knowledge about the physics of ultrasonic waves, ultrasonic instruments their applications in industries.

UNIT- I (9 Hours)

Concept of Ultrasonics: Physics of ultrasonics-wave motion, velocity of propagation, characteristic impedance, reflection, attenuation and transmission through layers, Acousto-optic effect, Acoustic Grating, Ultrasonic velocity and thickness measurement.

Unit II (9 Hours)

Production of Ultrasonics: Ultrasonic transducers: piezoelectric and magnetostrictive transducers, Equivalent circuits, Impedance matching, High and low power devices.

Unit III (9 Hours)

Ultrasonic Instrumentation: Detection of Ultrasonic, Instrumentation and applications: Ultrasonic sensing using plus echo and Doppler techniques, SONAR, Industrial processing units, Ultrasonic measurement and control; Limitation of Ultrasonics.

Unit IV (9 Hours)

Ultrasonic Industry Application: Industrial Ultrasonic: Drilling, welding and soldering, Ultrasonic testing, Cavitation, Ultrasonic cleaning, Flaw detection diagnostic: Pulse–echo and Transmission technique, Echocardiogram, Laser Ultrasonics, Ultrasonic Microscopy, Ultrasonic imaging and therapy.

Text Books/Reference Books

T-1: J. David & N. Checke, **"Fundamental and Applications of Ultrasonics"**, 2nd Edition, CRC Press, 2017.

T-2: Ensminger, **"Ultrasonics Fundamental, Technology & Applications"**, CRC Press, 2011.

R-1: K C Srivastava, **"Ultrasonic Testing"**, 2003.

Course Outcome

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

CO1: Realize the concept of ultrasonics and its industrial applications.

CO2: Design and develop ultrasonic instrumentations for potential applications.

CO3: Solve industrial problems and design instruments on ultrasonics.

DEPARTMENT OF CHEMISTRY

CHOE-11: FUNCIONAL MATERIALS

Course Code	**:**	**CHOE11**
Course Title	**:**	**Functional Materials**
Number of credits	**:**	**3 (3L)**
Prerequisites (Course code)	**:**	**Nil**
Course Type	**:**	**Elective**
Total Marks	**:**	**100 (Int. 50 + Ext. 50)**

Course Learning Objectives:

- To enable the students to acquire knowledge of the importance and significance of materials for engineering applications.
- To bring adaptability to new developments in materials chemistry and a knowledge of contemporary issues relevant to engineering.
- To make them apply the knowledge of fundamental chemistry for synthesis new materials, applications and analysis of complex engineering problems that meet the specified needs with appropriate consideration for the industrial applications.

Course Content:

UNIT 1: High energy materials

Introduction, classification (explosives, propellants and pyrotechnics), historical overview, short introduction to detonation, density, deflagration, combustion, heat of formation, heat of detonation, stability and sensitivity, thermodynamics (detonation parameters, combustion parameters), new primary explosives, polymer bonded explosives (PBXs), secondary explosives and newly developed materials, oxidizers, experimental characterization of energetic materials (sensitivities, long-term stabilities, Gap test, etc.), significance of high nitrogen content, heterocycles, explosophoric groups, energetic salts, nitration reactions, energetic materials of the future. (10 L)

UNIT 2: Magnetic and photovoltaic materials

Introduction to magnetic materials, magnetic fields, magnetization and magnetic moment, magnetic measurements, magnetic properties, magnetism in materials, magnetic domains, domain walls, domain processes, magnetic order and critical phenomena, electronic magnetic moments, magnetics technological applications, soft magnetic materials, hard magnetic materials, magnetic recording, magnetic evaluation of materials, photovoltaic materials and phenomena, III-V materials, cadmium telluride, copper indium gallium selenide and other I-III-VI materials, recent development for solar cells, dye sensitized solar cells and hybrid perovskites. (10 L)

UNIT 3: Nanomaterials and biomaterials

Introduction and synthetic strategy of nanomaterials, applications of nanoparticle in various fundamental research, industries, medical field and environmental issue, toxicity, biosafety and ethical issue in application of nanoparticle, composites and nano-composite, organic materials, Introduction to biomaterials, performance of biomaterials, historical background, metallic biomaterials, ceramic biomaterials, polymeric and biodegradable biomaterials, composite biomaterials, biofuctional hydrogels, biomaterial interactions, wound healing biology, materials-host interactions, statistics, regulatory considerations, standardized materials testing.

(10 L)

UNIT 4: Catalysts

Introduction, mechanism, homogeneous catalysis, heterogeneous catalysis, industrial homogeneous processes: hydrogenation reaction, hydroformylation reaction, carbonylation reaction, heterogeneous processes by zeolite and metal-organic frameworks, advantages and disadvantages.
(6 L)

UNIT 5: Materials and recent applications

Sustainable energy sources, energy applications of nanotechnology, industrial applications of nanotechnology, potential applications of carbon nanotubes, industrial applications of catalysts, soft tissue replacement, hard tissue replacement, drug delivery.

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Course Outcomes:

Upon successful completion of this curriculum students will be able to:

- Gain the basic knowledge of materials and their applications in day to day life.
- Learn the fundamental principles of new materials and developing strategy.
- Understand the importance of solid materials in various industrial applications.

Reference Books:

1. P. W. Cooper, Explosive Engineering, Wiley-VCH, New York, 1997

2. J. Akhavan, The Chemistry of Explosives, RSC Paperbacks, Cambridge, 1998.

3. S. Fordham, High Explosives and Propellents, Pergamon, Press, Oxford, 1980.

4. R. Meyer, J. Kohler, A. Homburg, Explosives, Wiley-VCH, Weinheim, 2002.

5. Thomas M. Klapötke, Chemistry of High-energy Materials, Walter de Gruyter, 2011.

6. Solar Photovoltaics: Fundamentals Technologies and Applications, Solanki PHI Learning Pvt. Ltd., 2009.

7. A. K. Cheetham, Solid state chemistry: compounds; Oxford University Press: Oxford, 1992 (ISBN: 0198551665, 9780198551669).

8. J. N. Lalena, D. A. Cleary, Principles of Inorganic Materials Design; Wiley: New York, 2010 (ISBN: 978-0-470-40403-4).