TEERTHANKER MAHAVEER UNIVERSITY
FACULTY OF ENGINEERING

OPEN ELECTIVE COURSES

Under

Choice Based Credit System

[w.e.f. 2020-21]

Course Code: OEENG105	**B.Tech- Civil Engineering** **Remote Sensing and GIS**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of remote sensing and remote sensing systems	
CO2.	**Understanding** the concepts and fundamentals of GIS.	
CO3.	**Understanding** the process of data acquisition of satellite images and their characteristics	
CO4.	**Applying** knowledge of remote sensing and GIS in different civil engineering applications.	
CO5.	**Analysing** images and extract information on the earth surface from multi-resolution imagery at multi-scale level;	
Course Content:		
Unit-1:	**Introductions to remote sensing**; Applications and importance of remote sensing, **Indian Remote sensing satellites:** Characteristics of IRS1A, IRS1B, IRS1C, IRS1D, IRS P5 , IRSP6,CARTOSAT-1 and CARTOSAT-2 **Remote Sensing – I:** Basic concepts and fundamentals of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units, overview of Indian Remote sensing satellites and sensors.	**8 Hours**
Unit-2:	**Remote Sensing – II:** Energy resources, energy interactions with earth surface features and atmosphere, resolution, visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis. **Geographic Information System:** Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.	**8 Hours**
Unit-3:	**Types of data representation:** Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS - Advantages and disadvantages. File management, Spatial data – Layer based GIS, Feature based GIS mapping. **GIS Spatial Analysis:** Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.	**8 Hours**
Unit-4:	**Introduction to GPS:** Available GPS net works, Limitations and applications of GPS; GPS receivers. **Applications of GIS**: Application areas and user segments; Guide lines for preparation of GIS; Applications of GIS for land use and housing management; Assessment of physical transformation in an urban area.	**8 Hours**
Unit-5:	**Water Resources Applications**: Land use/Land cover in water resources, Surface water mapping and inventory, Watershed management for sustainable development. Reservoir sedimentation, Ground Water Targeting, Identification of sites for artificial Recharge structures.	**8 Hours**

Text Books:	**1.** LRA Narayana, *Remote Sensing and its Applications* University Press **2.** Peter A Burragh and Rachael A. Mc Donnell, *Principals of Geo physical Information Systems* Oxford Publishers. **3.** Thomos M . Lillesand, Ralph.W. Keifer and Jonathan. W. Chipman *Remote Sensing and image interpretation*	
Reference Books:	**1.** C.P.Lo Albert, K.W. Yonng, Concepts & Techniques of GIS, Prentice Hall (India) Publications. **2.** M.Anji Reddy, *Remote Sensing and Geographical Information systems*, B.S.Publications. **3.** Kang – tsung chang, *GIS*, TMH Publications & Co., **4.** S.Kumar, *Basics of Remote sensing & GIS*, Laxmi Publications. *Latest editions of all the suggested books are recommended.	

Course Code: OEENG106	**B.Tech- Mechanical Engineering** **Metallurgy**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the basic concepts of bonds in solids, Grain and grain boundaries, Properties of metals and alloys.	
CO2.	Understanding the purpose of different types of phase diagram, Lever rule, coring miscibility gap and importance of Iron carbon phase equilibrium diagram.	
CO3.	Understanding the purpose of heat treatment in material and importance of TTT curve in steel.	
CO4.	Analysing various properties and application of ceramics and polymers and apply its knowledge to select suitable material for specific purpose.	
CO5.	Analysing design of dies, process of rolling, slip casting, forging, extrusion of metal powders.	
Course Content:		
Unit-1:	**Structure of Metals:** Bonds in Solids – Metallic bond – crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Constitution of Alloys: Necessity of alloying.	**8 Hours**
Unit-2:	**Equilibrium of Diagrams:** Experimental methods of construction of equilibrium diagrams, Isomorphous, alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state –allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys.	**8 Hours**
Unit-3:	**Heat treatment of Alloys:** Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hard enability, surface – hardening methods, Age hardening treatment, Cryogenic treatment of alloys.	**8 Hours**
Unit-4:	**Ceramic materials:** Crystalline ceramics, glasses, cermet's, cements, abrasive materials, nanomaterials–definition, properties and applications of the above. Polymers: Characteristic and its applications, types of polymers	**8 Hours**
Unit-5:	**Powder Metallurgy:** **The importance of Powder Metallurgy:** Various methods of producing metal powders. Characteristics of metal powders and their correlation with the various methods of production. Hazards in metals powder production. Testing and classification of powders. **Treatment of metal powders prior to compacting:** Mixing and conditioning of metal powders. Compacting of cold and hot pressing and their limitations. Design of dies. Rolling, slip casting, forging and	**8 Hours**

	extrusion of metal powders. Implosive compaction. Factors influencing the properties of compacts. **Sintering:** Its significance in powder metallurgy, sintering.	
Text Books:	**1.** Sidney H. Avener., Introduction to Physical Metallurgy. **2.** Donald R.Askeland/Thomson, Essential of Materials Science and Engineering. **3.** Powder metallurgy – A.K. Sinha	
Reference Books:	**1.** Kodgire, Material Science and Metallurgy. **2.** Rahgavan V., Elements of Material Science. **3.** Vinas W.G., Mancini H.L., An Introduction to Material Science. **4.** Yesudian C.D.& Harris Samuel, Material Science & Material. **5.** Flinn R.A. Trojan P.K., Engineering Materials and their Applications, Jaico Books. ***Latest editions of all the suggested books are recommended.**	

Course Code: OEENG107	**B.Tech- EC** **Introduction of Machine Learning using Python**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding basic concept of machine learning, advantages and disadvantages, applications, learning algorithms: supervised learning, unsupervised learning, semi- supervised learning, reinforcement learning, decision trees, Hunt's algorithm for learning a decision tree.	
CO2.	Understanding concept of KNNs, SV Msand Naïve Bayes algorithms in text classification, decision boundary of KNN, feature selection using KNN, linear classifiers.	
CO3.	Understanding concept of ANN and regression, perceptron algorithm, decision boundary of single neuron, linear regression, logistic regression, and logistic regression for multi-class classification.	
CO4.	Understanding of basic data analysis using most advance python programming language.	
CO5.	Evaluating machine learning-based real-time problems in data sciences.	
Course Content:		
Unit-1:	**Introduction to Machine Learning:** Introduction; History, Advantages, Scope and Applications; Learning Algorithms: Supervised Learning; Unsupervised Learning; Semi-Supervised Learning; Reinforcement Learning. **Decision Trees:** Introduction, Scope, Advantages; Hunt's algorithm for learning a decision tree; Details of tree induction	**8 Hours**
Unit-2:	**KNNs, SVMs and Naïve Bayes:** Examples of few text classification problems; Naïve Bayes for text classification; Introduction to KNN algorithm; Decision boundary KNN Vs Decision tree; What is the best K; KNN Problems; Feature selection using KNNs; Linear Classifiers; Learning non-linear patterns.	**8 Hours**
Unit-3:	**ANN and Regression:** Motivation for Artificial Neural Network; Perceptron Algorithm; Decision Boundary for a single Neuron; Introduction to Linear Regression; ***R*^2**: Coefficient of Determination; Logistic regression vs Linear Regression; Can we use Regression Mechanism for Classification? Logistic Regression – Deriving the Formula; Logistic Regression for Multi-class Classification; Logistic Regression Decision Boundary.	**8 Hours**
Unit-4:	**Introduction of Python**: Introduction to Python and Computer Programming, Data Types, Variables, Basic Input-Output Operations, Basic Operators, Boolean Values, Conditional Execution, Loops, Lists and List Processing, Logical and Bitwise Operations	**8 Hours**
Unit-5:	**Python Modules**: Loops, Functions, Tuples, Dictionaries, and Data Processing, Modules, Packages, String and List Methods, and Exceptions	**8 Hours**

Text Books:	**1.** Brian, O, Management Information System, Tata McGraw Hill.	
Reference Books:	**1.** Jawadekar, W., *Management Information System*, Tata McGraw Hill. **2.** Jain, S., *Management Information System*, Tata McGraw Hill. **3.** Machine Learning with Python Cookbook by Chris Albon Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472, April 2018: First Edition ***Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	https://nptel.ac.in/courses/106/106/106106139/ https://www.youtube.com/watch?v=CzdWqFTmn0Y	

Course Code: OEENG101	**B.Tech- EE** **Artificial Neural Network and Fuzzy Logic**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Remembering Soft Computing concepts, technologies, and applications.	
CO2.	Understanding the underlying principle of soft computing with its usage in various application.	
CO3.	Understanding application on different soft computing techniques like ANN and Fuzzy logic.	
CO4.	Applying concept of supervised and unsupervised learning schemes on real life systems.	
CO5.	Applying concept of Fuzzy Logic Crisp & fuzzy sets fuzzy relations on electrical systems to deal with parameter ambiguities.	
Course Content:		
Unit-1:	**Overview of Soft Computing,** Difference between Soft and Hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithms.	**8 Hours**
Unit-2:	**Artificial neural networks,** Biological neural networks, ANN architecture, Basic building block of an artificial neuron, Activation functions, Introduction to Early ANN architectures (basics only)- McCulloch & Pitts model, Perceptron, ADALINE, MADALINE.	**8 Hours**
Unit-3:	**Supervised Learning:** Introduction and how brain works, Neuron as a simple computing element, the perceptron, Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron.	**8 Hours**
Unit-4:	**Unsupervised Learning**: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network.	**8 Hours**
Unit-5:	**Fuzzy Logic** Crisp & fuzzy sets fuzzy relations fuzzy conditional statements fuzzy rules fuzzy algorithm. Fuzzy logic controller. Genetic algorithms basic concepts.	**8 Hours**
Text Books:	1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai –PHI Publication	
Reference Books:	**1.** Kosko, B, "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", Prentice Hall, New Delhi. **2.** Timothy J Ross, "Fuzzy Logic with Engineering Applications", John Willey and Sons, West Sussex, England. **3.** Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston. **4.** Klir G.J. &Folger T.A., "Fuzzy sets, Uncertainty and Information", Prentice –Hall of India Pvt. Ltd., New Delhi. **5.** Zimmerman H.J., "Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht. ***Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	https://nptel.ac.in/content/syllabus_pdf/127105006.pdf https://www.youtube.com/watch?v=xwUKQcT1bKc&feature=youtu.be	

Course Code: OEENG103	**B.Sc. (H)-Mathematics** **Fundamental of Statistics**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the concept of statistics, types of various data and their diagrammatical representation.	
CO2.	Understanding the concept of probability and distributions, addition, multiplication law of probability and Bayes' theorem with its applications.	
CO3.	Applying the concept of probability mass function, probability density function, distribution function on various discrete distribution and continuous distribution.	
CO4.	Analysing the data using various measures of central tendency, dispersions, correlation coefficients and regression.	
Course Content:		
Unit-1:	Introduction to statistics: Meaning, Definition, Characteristics. Data: classification and tabulation of data, diagrammatical representation of data, histograms, frequency polygons, smooth frequency polygons, cumulative frequency curve.	**8 Hours**
Unit-2:	Measures of central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Mean deviation, Standard deviation and Variance. Measures of Skewness and Kurtosis.	**8 Hours**
Unit-3:	Correlation: Introduction of correlation coefficient, Types of Correlation, Rank Correlation. Regression Analysis: Regression equations, Linear Regression, Relation between correlation coefficient and regression coefficients.	**8 Hours**
Unit-4:	Probability: Sample space, events and algebra of events, independent events. Kinds of Probability: classical, statistical, and axiomatic, Conditional Probability, laws of addition and multiplication and Bayes' Theorem.	**8 Hours**
Unit-5:	Probability distribution: random variable, discrete and continuous random variables, Probability mass function, Probability density function, Distribution functions. Bernoulli, Binomial, Poisson, Exponential, Uniform and Normal distribution.	**8 Hours**
Text Books:	**1.** Gupta, S. C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons.	
Reference Books:	1. Goon A.M., Gupta M.K. and Dasgupta B.: Fundamentals of Statistics, The World Press, Kolkata. 2. Mood, A.M. Graybill, F.A. and Boes, D.C.: Introduction to the Theory of Statistics, Tata McGraw-Hill Pub. Co. Ltd. *** Latest editions of all the suggested books are recommended.**	

Course Code: OEENG104	**B.Sc. (H)-Physics** **Learning Science through Computational Physics**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Remembering the concepts of motion and change in motion.	
CO2.	Understanding the basic concepts behind general science aspects and to connect themselves to science.	
CO3.	Understanding the concepts of connection between learning theory and computer gaming and simulations.	
CO4.	Understanding the basic role of computer gaming and simulations, play in the assessment of student learning on the Tthermodynamics, Light and Global Warming, Sound and Noise.	
CO5.	Applying the concepts in the Virtual laboratory.	
Course Content:		
Unit-1:	**Motion.** Students measure the motion of things through classroom activities and determine position versus time plots. Through this experience they can understand speed and velocity and change in velocity which is acceleration. They study Galileo's law of falling bodies and the law of inertia (no mathematical derivation is required).	**8 Hours**
Unit-2:	**Change in motion**. Newton's laws and how a net force is determined by acceleration. The notion that forces occur in pairs. Newton's law of gravitation and weight. The connection between orbits and gravity is found through demonstrations like "shoot the monkey" where an object is observed to fall from a straight line path. Students understand the function of the law of Gravitation between masses. The effects of gravity on the universe are presented and explored.	**8 Hours**
Unit-3:	**Work-Energy Theorem.** The definition of work, kinetic energy, and gravitational potential energy are stated. Students understand the relationship between work and energy through conceptual exercises(. Various toys show the relationship between different types of energy and how they transform from one mechanical form to another. The law of conservation of energy is concluded as an extension of the conservation of mechanical energy. Different energy forms are discussed as well as the definition of power.	**8 Hours**
Unit-4:	**Thermodynamics**. The different statements of the second law of thermodynamics are explored in terms of heat flow, machines, and entropy through exercises or thought problems. Temperature and heat are defined through examples and demonstrations. The relevance of the second law is made to the automobile and power plants.	**8 Hours**

Unit-5:	**Light and Global Warming, Sound and Noise.** The definition of frequency, wave speed, intensity, amplitude, and wavelength are presented. The definition of waves, frequency, amplitude, beats, notes, decibel, music and noise, musical instruments are also presented. The connection between Faraday's law and moving magnetic fields is shown experimentally to show the electromagnetic properties of light. Light is an electromagnetic wave and it interacts with matter. The concept of trace gases in the environment and their interaction with light is explored. The impact of this interaction on the earth's temperature is studied.	**8 Hours**
	List of Experiments through Virtual laboratory 1) Study of projectile motion, Collision of balls, 2) Newtons second law of motion. 3) Study of moment of inertia of flywheel. 4) Study of heat flow through conduction, convection and radiation. 5) Study of Doppler effect in sound and light.	
Text Books:	1. Fundamentals of Physics: Resnick, Haliday and Walker, Willey publication. 2. Learning Science Through Computer Games and Simulations: Committee on Science Learning: Computer Games, Simulations, and Education Margaret A. Honey and Margaret L. Hilton, Editors.	
Reference Books:	1. Physics Part I & II Textbook for Class XI (Set of Two Books) is a book written by NCERT 2. Physics Part I & II Textbook for Class XII (Set of Two Books) is a book written by NCERT ***Latest editions of all the suggested books are recommended.**	
Additional Electronic Reference Material:	1. http://www7.nationalacademies.org/bose/Gaming_Sims_Homepage.html. 2. https://vlab.amrita.edu/index.php?sub=1	

Course Code: OEENG102	**B.Sc (H)- Chemistry** **Industrial Chemistry**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Remembering the introduction of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO2.	Understanding the classification & properties of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO3.	Understanding the manufacturing & uses of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO4.	Understanding about oils & fats.	
CO5.	Analysing the saponification value, acid value and iodine number.	
Course Content:		
Unit-1:	**Silicate Industries:** Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.	**8 Hours**
Unit-2:	**Fertilizers:** Different types of fertilizers. Need for fertilizers, Straight and mixed fertilizers, Sources of fertilizers, Artificial fertilizers, Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, Ammonium sulphate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. NPK fertilizers**.**	**8 Hours**
Unit-3:	**Alloys:** Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demagnetization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.	**8 Hours**
Unit-4:	**Paints and Pigments:** Introduction, : Characteristic of the pigments Classification of paints, Manufacture of paints, for example white lead, Sublimed white lead (Basic sulphate), Zinc oxide, Lithophone, Titanium dioxide, manufacture, Ultramarine blue , Read lead, Chrome green, Guignet's green , Reinmann's green , Setting of the paints Requirements of a good paint Emulsion paints, Constituents of emulsion paints. Advantages, Luminescent paints. Heat resistant paints, Varnishes, Manufacturing of varnishes, Lacquers, Solvents and thinners.	**8 Hours**

Unit-5:	**Soaps & Detergents:** Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity. Soap: Soap and its manufacture, Toilet and transparent soap, Other soaps, Oil to be used for soap, Cleansing action of soap. Detergents: Principal groups of synthetic detergents, Classification of surface-active agents, Anionic detergents, Cationic detergents. Non-ionic detergents. Amphoteric detergents.	**8 Hours**
Text Books:	**1.** Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut.	
Reference Books:	**1.** E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. **2.** R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi. **3.** https://nptel.ac.in/content/storage2/courses/103107086/module1/lecture1/lecture1.pdf *** Latest editions of all the suggested books are recommended.**	