ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

R - 2015

LIST OF OPEN ELECTIVES
TO BE OFFERED IN THE EVEN SEMESTER (CEG / ACT CAMPUS)

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
FACULTY OF CIVIL ENGINEERING								
DEPARTMENT OF CIVIL ENGINEERING								
B.E. Geoinformatics								
1.	GI7891	Computer Vision and Satellite Image Processing	OE	3	3	0	0	3
FACULTY OF MECHANICAL ENGINEERING								
DEPARTMENT OF MECHANICAL ENGINEERING								
2.	ME7891	Renewable Energy Technologies	OE	3	3	0	0	3
DEPARTMENT OF INDUSTRIAL ENGINEERING								
B.E. Industrial Engineering								
3.	IE7891	Reliability and Maintainability Engineering	OE	3	3	0	0	3
FACULTY OF TECHNOLOGY								
DEPARTMENT OF LEATHER TECHNOLOGY								
B.Tech. Leather Technology								
4.	LT7891	Leather Biotechnology	OE	3	3	0	0	3
DEPARTMENT OF TEXTILE TECHNOLOGY								
B.Tech. Textile Technology and B.Tech. Apparel Technology								
5.	TT7891	ERP for Garment Industry	OE	5	1	0	4	3
DEPARTMENT OF CHEMICAL ENGINEERING								
B.Tech. Chemical Engineering								
6.	CH7891	Introduction to Petroleum Streams	OE	3	3	0	0	3
FACULTY OF SCIENCE AND HUMANITIES								
DEPARTMENT OF GEOLOGY								
7.	AG7891	Advanced Remote Sensing for Geologic Applications	OE	3	3	0	0	3
8.	AG7892	Planetary Geoscience and Remote Sensing	OE	3	3	0	0	3

GI7891 COMPUTER VISION AND SATELLITE IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to describe about the fundamentals of computer vision and concepts of satellite data acquisition and analysis.

UNIT I FUNDAMENTALS OF COMPUTER VISION

Image Formation and Coordinate Transformations - Camera Matrix - Motion/Stereo Pin-hole model - Human eye / cognitive aspects of colour / 3D space; Illumination; Sampling and Quantization - Coordinate transformations and camera parameters - Satellite data acquisition- Whisk and push broom scanning: data products - Data formats: Image Display systems

UNIT II IMAGE DEGRADATION AND RESTORATION

Sensor model; Sensor parameters – Spectral, Spatial, temporal and radiometric resolution; Image Representation-spatial, frequency and feature space domain - geometry and Radiometry – Colour concepts – Sources of Image degradation and Correction procedures- Atmospheric, Radiometric, Geometric Corrections- Image Geometry Restoration-Interpolation methods and resampling techniques.

UNIT III IMAGE ENHANCEMENT

Histograms – types, scope, Univariate and multi variate statistics; Scattergrams; operators – point, local and regional operators; Contrast manipulation - contrast, spatial feature and multi image manipulation techniques - Fourier transform - principle component analysis - Optimal Rotation Transformation – Scale-space transform, wavelet transform. Multi-image fusion

UNIT IV IMAGE CLASSIFICATION

Training sites - methods of collection- training accuracy – Supervised- Parallellepiped, Minimum distance to mean and Maximum Likelihood classifiers - Baye's Theorem, Unsupervised- ISODATA and Chain methods – parametric Classification - Decision tree –SVM Classifier – other Non - parametric classifiers - sub pixel classification – Hyper-spectral image analysis – Accuracy assessment- test accuracy.

UNIT V IMAGE ANALYSIS

Pattern recognition - boundary detection and representation - textural and contextual analysis - decision concepts: Fuzzy sets - evidential reasoning - Expert system – Features, Architecture- Rule based expert system; Artificial Neural Network- Adaline, Madaline and BPN networks – Case studies

TOTAL : 45 PERIODS

OUTCOME:

- On completion of this course, the student shall be able to get familiarized about various fundamentals of computer vision, image enhancement and image processing techniques.

TEXT BOOKS:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, Pearson Education India; 2 edition, 2015
2. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, 2015.
3. Robert Shcowebgerdt, Remote sensing models & methods for image processing, 3 rd edition, 2004.

REFERENCES:

1. John A.Richards, Springer – Verlag, Remate Sensing Digital Image Analysis 1999.
2. Digital Image Processing (3rd Edition) Rafael C. Gonzalez, Richard E. Woods Prentice Hall, 2007.
3. W.G.Rees - Physical Principles of Remote Sensing, Cambridge University Press, 2nd edition, 2001.

ME7891 RENEWABLE ENERGY TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:

- To instruct the importance of renewable energy sources and its utilization.
- To educate the various renewable energy technologies.

UNIT - I ENERGY SCENARIO 9

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption in various countries - Future energy plans

UNIT – II SOLAR ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT - III WIND ENERGY 9

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT - IV BIO-ENERGY 9

Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT - V OCEAN AND GEOTHERMAL ENERGY 9

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

TOTAL: 45 PERIODS

OUTCOME:

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

- Know the importance of renewable energy sources utilization and various renewable energy technologies.

TEXT BOOK:

1. G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
2. Twidell, J.W. & Weir, A., “Renewable Energy Resources”, EFN Spon Ltd., UK, 2015.

REFERENCES:

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. S.P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
3. G.N. Tiwari, “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
4. B.H. Khan, “Non-Conventional Energy Resources”, The McGraw Hill companies, 2009

IE7891 RELIABILITY AND MAINTAINABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge in reliability concepts, reliability prediction methods and Maintenance management techniques.

UNIT I RELIABILITY CONCEPT 9
Reliability definition – A priori and posteriori probabilities of failure -Reliability parameters- f(t), F(t) and R(t) functions- Mortality graph –Useful life.

UNIT II FAILURE DATA ANALYSIS 9
Data classification – Survival graphs -Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests: Kolmogorov Smirnov test, Bartlett's test, Chi square test.

UNIT III RELIABILITY PREDICTION 9
Series parallel configurations – Parallel redundancy – m/n system – Standby system -Complex systems: RBD approach – Baye's method – Minimal path and cut sets - Fault Tree analysis.

UNIT IV MAINTENANCE MODELS 9
Maintenance objectives -Imperfect maintenance -Maintenance policies –– PM versus b/d maintenance – Inspection decisions: Maximizing profit & Minimizing downtime – Replacement model.

UNIT V MAINTENANCE MANAGEMENT 9
Repair time distribution – Maintainability prediction – Measures of maintainability – Availability measures – Maintenance staffing- Spare parts management – Maintenance planning and scheduling.

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Able to understand the nature of failures and their parameters.
CO2: Able to classify, fit and analyse the failure data.
CO3: Able to predict reliability of a complex system.
CO4: Able to identify suitable maintenance policy to minimise downtime.
CO5: Able to plan and manage maintenance activities to improve availability.

TEXT BOOKS:

1. Charles E.Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata McGraw Hill, New Delhi. 2007.
2. Andrew K.S.Jardine & Albert H.C. Tsang, "Maintenance, Replacement and Reliability" Taylor and Francis, 2006.

LT7891 **LEATHER BIOTECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES
To impart knowledge on biotechnological applications in processing of skins into leather.

UNIT I PROTEINS AND NUCLEIC ACID & ENZYMOLOGY 10
Chemistry of DNA and RNA: Structure, Conformation and function Proteins - Chemistry, structure and Function, Separation Principles in proteins. Classification, assay, characterization, mechanism of action, enzyme kinetics, immobilized enzymes.

UNIT II GENETIC ENGINEERING (RECOMBINANT DNA TECHNOLOGY) 10
Principles and methods: Essentials of biotechnology - products of biotechnology, Restriction enzymes, vectors, DNA cloning strategies.

UNIT III BIOTECHNOLOGY FOR HIDES/SKINS IMPROVEMENT 13
Applications in Animal nutrition and animal production: embryo transfer, gene transfer, transgenic animals. Cleaner Leather Processing: Use of enzyme options in beam house operations - Soaking, unhairing, bating, degreasing, offal treatment: Types of enzymes - proteases, lipases - properties, assay systems and production. Types of fermentation, Preparation of media, preparation of inoculum, separation and purification of products.

UNIT IV WASTE MANAGEMENT FOR LEATHER 8
General features of the organic and inorganic pollutants of tannery. Stabilisation and disposal of organic and chemical wastes and their biological treatment. Possible energy generation from wastes.

UNIT V UTILISATION OF COLLAGENOUS TISSUES FOR BIOMEDICAL AND OTHER APPLICATIONS 4
Collagen and its application in food, cosmetic and medical fields.

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course, the student will understand basic biotechnology concepts and its relevance for application in leather processing.

REFERENCES

1. Rohm, H.J. and Reed, G. "A Comprehensive treatise on Biotechnology", Verlag Chemie, lecinheim,1983.
2. Pelczar, J.,Reid, R.D.and Chan, F.C.S.,"Microbiology", Tata McGraw Hill, 1977.
3. Old, R.W., and Primrose, S.B., "Principles of Genemanipulation" 3/e Cambridge, 1985.
4. Stryer, L."Biochemistry" 3/e W.H. Freeman and Co. 1989.
5. Lehninger, A.L., Nelson, D.L., Gx M.M "Principles of Biochemistry", CBS Publications, 1993
6. Puvanakrishnan, R and Dhar, S.C."Enzyme Technology in Beamhouse practices'" CLRI Publication.
7. Wrinter, N.A., "Biological treatment of waste water", 1982.
8. Schroeder, E.D., "Waste and Waste water treatment",. McGraw - Hill Inc. 1983

TT7891	ERP FOR GARMENT INDUSTRY	L	T	P	C
		1	0	4	3

UNIT I **3+0**

Garment manufacture – sequence of operations; introduction to pattern making, marker planning, cutting, sewing and finishing

UNIT II **9+36**

Enterprise Resource Planning – principle, frame work, scope; application of ERP in apparel industry - business concepts, costing, order booking, MRP, purchase, production planning, production orders, inventory control, packing, shipping, scheduling, sample preparation and approval, business reports

UNIT III **3+24**

ERP in apparel production – time study, cutting, production tracking, cut panel process, garment quality control, order completion, machine repairs and maintenance, reports

Total number of periods (Theory + Lab): **15+60**

TEXT BOOKS:

1. Veena Bansal, “Enterprise resource planning”, Pearson Education India, 2013
2. Sadagopan. S., “ERP-A Managerial Perspective”, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2001
3. Garg and Venkitakrishnan, Venkitakrishnan N.K. “ERPWARE, ERP Implementation Framework”, Prentice Hall of India Pvt. Ltd., New Delhi, 2004

REFERENCES:

1. Vinod Kumar Grag and Venkitakrishnan N.K., “Enterprise Resource Planning: Concepts and practice”, Prentice Hall of India Pvt. Ltd, New Delhi, 2011
2. Joseph.A.Brady, Ellen F. Monk, Bret J. Wagner, “Concepts in Enterprise Resource Planning”, Course Technology, 2001

CH7891 INTRODUCTION TO PETROLEUM STREAMS L T P C
3 0 0 3

AIM

To impart detailed knowledge on petroleum refining upstream & downstream operations and to get awareness on the importance of plant safety and risk analysis in petroleum industries

OBJECTIVES

Students learn the types of petroleum source rocks, exploring methods of crude, petroleum testing methods, detailed knowledge on refining operations , environmental aspects and safety measures

UNIT I INTRODUCTION TO SOURCE ROCKS AND CLASSIFICATION 9

Definition of source rock, Characteristics of Reservoir rocks, Reservoir pore space, porosity-primary and secondary porosity, effective porosity, fracture porosity - permeability – effective and relative permeability relationship between porosity, permeability and texture, Entrapment and accumulation of hydrocarbons, Sedimentary basins -origin and classification

UNIT II PETROLEUM EXPLORATION 9

Overview of petroleum exploration in India, Introduction to Geophysical/Geological methods used in petroleum exploration. Basic concepts of Gravity/Magnetic methods, seismic methods

UNIT III OIL RECOVERY TECHNIQUE 9

Calculation of hydrocarbon volumes, Material balance applied to oil reservoirs, Reservoir drive mechanism- Solution gas drive- Gas cap drive- Natural water Drive- Compaction drives under related pore compressibility phenomena. Oil Recovery Techniques

UNIT IV PETROLEUM REFINING 9

Overall refinery operations & Indian scenario, Crude oil classification, Petroleum Products and their specifications, Atmospheric and Vacuum distillation units, Reforming, cracking and hydro treating processes.

UNIT V ENVIRONMENTAL CONCERNS 9

Introduction to environmental control in the petroleum industry, Guidelines for occupational health monitoring in oil and gas industry. Hazard identification- Hazard evaluation- Classification of fires- The fire triangle- Distinction between fires and explosions- Flammability characteristics of liquids and vapors- Well blowout fires and their control- Fire fight equipment- Suppression of hydrocarbons fires.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Geology of Petroleum, A.I. Levorsen,2nd Edition. CBS, Publishers, 2006.
2. Field Geophysics, John Milsom and AsgerEriksen, 4th Edition, John Wiley, 2011.
3. Petroleum Refinery Engineering – W.L. Nelson, Mc Graw Hill.
4. Jones, D.S.J. and Pujadó, P.R., Handbook of petroleum processing, Springer, The Netherlands, 2006

REFERENCES :

1. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, “Enhanced oil Recovery – I & II”
2. Parkash, S., Refining processes handbook, Gulf Professional Publishing, 2003

AG7891 ADVANCED REMOTE SENSING FOR GEOLOGIC APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

This course introduces the advanced and recent concepts of Remote Sensing and Image processing, their applications to geology and natural hazard studies. The students will also be introduced to spectral geology, an important aspect of terrestrial and planetary remote sensing.

UNIT I INTRODUCTION 7

Conventional and advanced remote sensing techniques – comparison. Need for spectroscopic techniques and advanced remote sensing for geology. Discussion on the list of geological data/parameters that can be extracted using advanced remote sensing approaches.

UNIT II SPECTRAL GEOLOGY 9

Need for spectral geology. Principles of spectroscopy and spectral geology.
Geologically significant regions of the electromagnetic spectrum. Spectral signature and fingerprint of minerals, rocks and mineralized regions**.** Causes of absorption**.**
Spectral libraries - Integration of spectral signature/ fingerprint with Geochemistry.
Case studies.

UNIT III HYPERSPECTRAL SENSING FOR GEOLOGY 8

Scaling up of spectral geology in airborne and satellite instruments.
High spectral resolution data - Characteristics, specifications and applications. Spectrographic imagers- High Resolution Sensors and Hyperspectral Imaging Devices - hyperspectral sensors- airborne and spaceborne - Hyperspectral Issues.
Specification of Spectrographic imagers- hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, MODIS, Hyperion, HySI, MMM, EnMAP.

UNIT IV ADVANCED IMAGE PROCESSING TECHNIQUES 12

Fuzzy concept in geology; Concept of pure and mixed pixels, Hard and soft classification – Per-pixel and Sub-pixel classification techniques - spectral unmixing- linear and non-linear. ANN - fundamentals- applications in improving classification accuracy. Feature extraction and selection.
Hyperspectral Data Analysis : Hyperspectral Data Cube, Hyperspectral Profiles, Data Redundancy. Problems with Dimensionality, Atmospheric Correction – Methods. Derivative spectral analysis, Methods of generating derivative spectra - electronic, electro-mechanical, numerical techniques; Case studies.

UNIT V GEOLOGICAL APPLICATIONS 9

Advanced remote sensing and image analysis for: Mineral exploration, mineral deposit characterization, Petroleum exploration, rock alteration studies, weathering grade estimation, lineament studies, geothermal potential mapping, planetary geoscience.

TOTAL: 45 PERIODS

OUTCOME

On completion of this course, the student will be able to extract more better and accurate geological information and geomorphic information from in images apart from performing satellite image processing for earth resources and planetary studies.

REFERENCES

1. Schowengerdt, R. A., Remote sensing - Models and methods for image processing. Academic press. London.1997.
2. Richards, J. A, Remote Sensing Digital Image Analysis., Springer-Verlag, London 1986.
3. Duda R.O & Hart PE,Pattern classification & Scene Analysis.. Wiley,New York, 1973.
4. Morton Nadia & Eric Smith P, Pattern Recognition Engineering. John Wiley, New York, 1993.
5. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press. London. 1996.
6. Mather, P. M., 1987. Computer processing of remotely sensed images- An introduction, St. Edmundsbury Press Ltd.

7. Pramod K. Varshney and Manoj K. Arora, 2004 — Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data, Springer publication.
8. Ravi P. Gupta, Remote Sensing Geology, Springer-Verlag New York, 2002
9. https://speclab.cr.usgs.gov/PAPERS.refl-mrs/refl4.html

AG7892 PLANETARY GEOSCIENCE AND REMOTE SENSING L T P C
3 0 0 3

OBJECTIVES

To introduce the concepts of planetary geoscience to the senior students of geoinformatics, which will form a basis to understand planetary remote sensing and planetary-informatics.

UNIT I INTRODUCTION TO PLANETARY SCIENCE 7

Solar system - origin - physics, chemistry, Components of the solar system; Surface features of the solid bodies in the solar system; physical properties of objects in the solar system.

UNIT II PLANETS 9

Physical properties- optical properties- rotation and magnetic field-surface temperature. Surface features of the terrestrial planets; Inner planets- Geological processes in inner planets, impact cratering; Outer planets – formation and evolution processes -characteristic features.

UNIT III EARTH AND MOON 8

The earth: Planetary evolution- gross properties – solar terrestrial relations- -interior- geologic processes; Moon-origin- basic facts- internal structure-surface features- environment- surface composition and mineralogy and atmospheric conditions.

UNIT IV ASTEROIDS-METEORITES- COMETS 9

Classification-physical and chemical properties, difference between asteroids-comets- meteors-geochemistry- satellites- medium, small and tiny their- geology, interior, surface properties, atmosphere and potential for life.

UNIT V PLANETARY REMOTE SENSING 12

Spectral characters of planetary minerals and rocks. Planetary Missions to - Moon- Mars-Venus - Jupiter for geological exploration; Indian missions - Planetary image data formats. Rovers and their significance in planetary geology.

Study of planetary images; construction of geological maps from planetary images; Planetary landforms and their significance.

Return samples by Apollo-Luna. Characteristics and interpretation.

TOTAL: 45 PERIODS

OUTCOME

At the end of the course, the students will have a sound knowledge of planetary geoscience in general and about the inner planets in particular. In addition, the role of remote sensing in improving our understanding of planetary geoscience and planetary-informatics will also be appreciated by the students.

REFERENCES

1. Gunter Faure & Teresa M. Mensing. 2007. Introduction to planetary science: the Geological perspective, Publisher Springer-Verlag New York.
2. Imke de Pater and Jack J. Lissauer. 2001. Planetary Sciences, Published by Cambridge University press.
3. A.M. Davis 2003. Meteorites, Comets, And Planets, Published by University of Chicago, IL, USA.
4. Grant H. Hieken, David T. Vaniman, Bevan M. Frech. 1991. Lunar Sourcebook: A User's Guide to the Moon, Cambridge University Press.

5. Nadine Barlow. 2008. Mars: An Introduction to its Interior, Surface and Atmosphere. Cambridge Planetary Science (No. 8)
6. Mary Chapman. 2007. The Geology of Mars .Cambridge Planetary Science (No. 5)
7. K D Abhyankar. 1999. Astrophysics of the Solar system, Universities Press, Hyderabad, India.
8. A.N. Rencz, 1999. Manual of Remote Sensing, Third Edition, Volume 3, John Wiley & Sons, USA.
9. Encrenaz, T.; Kallenbach, R.; Owen, T.; Sotin, C. 2005. The Outer Planets and their Moons. Springer Space Science Reviews.
10. Ronald Greeley. (2013). Introduction to Planetary Geomorphology. Cambridge University Press.