

# DEPARTMENT OF CIVIL ENGINEERING

**Scheme of Instruction and Syllabus of  
B.E. (Civil Engineering) VII & VIII Semesters  
(2018-2019)**



**UNIVERSITY COLLEGE OF ENGINEERING  
(Autonomous) Osmania University  
Hyderabad – 500 007, TS, INDIA**



**SCHEME OF INSTRUCTION FOR B.E. (CIVIL ENGG) - VII SEMESTER  
(With effect from the Academic Year 2018-2019)**

S No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC 701 CE	Structural Engg Design and Drawing-I (Concrete)	3	1	-	4	30	70	3
2	PC 702 CE	Estimation Costing and Specifications	3	1	-	4	30	70	3
3	PC 703 CE	Transportation Engg-II	3	-	-	3	30	70	3
4	PC 704CE	Finite Element Methods	3	-	-	3	30	70	3
5		Professional Elective-II	3	-	-	3	30	70	3
6		Open Elective-II	3	-	-	3	30	70	3
7	PC 801 CE	Structural Engg Design and Drawing -II (Steel)	3	1	-	4	30	70	3
8		MANDATORY COURSE Yoga/NSS/Sports	3	-	-	3	50	--	3U
10	PC 751 CE	Computer Applications lab	-	-	2	2	25	50	1
11	PW761 CE	Summer Internship	-	-	-	-	50	-	2
12	PW762 CE	Project Work-I	-	-	2	2	50	-	4
			<b>24+3</b>	<b>03</b>	<b>04</b>	<b>31+3</b>	<b>385+30</b>	<b>610</b>	<b>28</b>
* Conducted with other branches as common course									
<b>PROFESSIONAL ELECTIVE-II</b>					<b>OPEN ELECTIVE-II</b>				
1	PE 701 CE	Earthquake Resistant Design	1			OE 701 BM	Human factor Engg & Ergonomics		
2	PE 702 CE	Wastewater Treatment	2			OE 702 BM	Basic Medical Equipment		
3	PE 703 CE	Ground Improvement Techniques	3			OE 701CE	Optimization Techniques		
4	PE 704 CE	Watershed Management	4			OE 701 CS	Data Base Systems		
		* #Not Applicable for Civil Engineering Department Students	5			OE 702 CS	Information Security		
			6			OE 701 EC	Principles of Electronics Communication.		
			7			OE 702 EC	Fundamental of IOT		
			8			OE 701 ME	Startup Entrepreneurship		
			9			OE 702 ME	Finite Element Methods <sup>*#</sup>		
			10			OE 701 EE	Nonconventional Energy Sources		
<b>MANDATORY COURSE</b>									
	MC 951 SP	Yoga Practice							
	MC 952 SP	NSS							
	MC 953 SP	Sports							

**SCHEME OF INSTRUCTION FOR B.E. (CIVIL ENGG) - VIII SEMESTER  
(With effect from the Academic Year 2018-2019)**

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1		Professional Elective-III	3	-	-	3	30	70	3
2		Professional Elective-IV	3	-	-	3	30	70	3
3		Professional Elective-V	3	-	-	3	30	70	3
4		Open Elective-III	3	-	-	3	30	70	3
5	MC 901EG	Gender Sensitization*	3*	-	-	3	30	70	3 U
<b>Summary of Electives</b>									
6	PW 961 CE	Project Work-II / Internship	-	-	4	4	50	100	8
			<b>12+3</b>	<b>-</b>	<b>4</b>	<b>19</b>	<b>170+30</b>	<b>380+70</b>	<b>20</b>
<b>PROFESSIONAL ELECTIVE-III</b>					<b>PROFESSIONAL ELECTIVE-V</b>				
1	PE 801 CE	Applied Hydrology	1			PE 809 CE	Prefabrication Engineering		
2	PE 802 CE	Principles of Climate Change	2			PE 810 CE	Design of Bridges		
3	PE 803 CE	Computer Aided Analysis and Design	3			PE 811 CE	Advanced Reinforced Concrete Design		
4	PE 804 CE	Advanced Concrete Technology	4			PE 812 CE	Traffic Engineering and Infrastructure Design		
<b>PROFESSIONAL ELECTIVE-IV</b>									
1	PE 805 CE	Retrofitting and Rehabilitation of Structures							
2	PE 806 CE	Designing with Geo-Synthetics							
3	PE 807 CE	Groundwater Management							
4	PE 808 CE	Intelligent Transportation Systems							
<b>OPEN ELECTIVE-III</b>									
1	OE801MT	Statistical Applications in Engineering	5			OE 801 EC	Global and Regional Satellite Navigational Systems		
2	OE 862BE	Human Machine Interface	6			OE 801 EE	Illumination and Electric Traction		
3	OE 801 CE	Road Safety Engineering	7			OE 801ME	Composite Materials		
4	OE 802 CE	Green Building Technologies	8			OE 802 ME	Industrial and financial Management		
5	OE 801 CS	Data Science Using R	9			OE 803 ME	3-D Printing Technology		
<b>* Mandatory Course</b>									

**ON-LINE NPTEL/SWAYAM**  
**PROFESSIONAL ELECTIVE SUBJECTS**  
**AND**  
**OPEN ELECTIVE SUBJECTS**

**Approved Online NPTEL Courses for**  
**• PROFESSIONAL ELECTIVES DURING VIII SEMSTER**  
for B.E. Civil Engineering, University College of Engineering (A), O.U.

S. No.	NPTEL Course	Course	Start Date	End Date	Exam Date
1	Agriculture Engineering	Irrigation and Drainage	7/30/2018	10/19/2018	As given in website
2	Civil Engineering	Theory of Elasticity	7/30/2018	10/19/2018	As given in website
3	Civil Engineering	Matrix Method of Structural Analysis	8/27/2018	10/19/2018	As given in website
4	Civil Engineering	Modern Construction materials	7/30/2018	10/19/2018	As given in website
5	Civil Engineering	Integrated Waste Management for a Smart City	7/30/2018	10/19/2018	As given in website
6	Civil Engineering	Glass in buildings : Design and applications	7/30/2018	10/19/2018	As given in website
7	Civil Engineering	Environmental Engineering-Chemical Processes	7/30/2018	10/19/2018	As given in website
8	Civil Engineering	Fire Protection, Services and Maintenance Management of Building	7/30/2018	10/19/2018	As given in website
9	Civil Engineering	Geoenvironmental Engineering (Environmental Geotechnology); Landfills, Slurry Ponds & contaminated Sites	7/30/2018	10/19/2018	As given in website
10	Civil Engineering	Unsaturated Soil Mechanics	7/30/2018	10/19/2018	As given in website
11	Civil Engineering	Introduction to Accounting and Finance for Civil Engineers	8/27/2018	10/19/2018	As given in website
12	Ocean Engineering	Structural Health Monitoring	7/30/2018	10/19/2018	As given in website
13	Ocean Engineering	Hydrostatics and Stability	7/30/2018	10/19/2018	As given in website

Url link address of the courses

<https://onlinecourses.nptel.ac.in>

**Note: Students can register for the above courses online and obtain the certificate from NPTEL.**

**Prof. M. Anjaneya Prasad**  
Chairperson, BOS (A)  
Department of Civil Engineering

**H E A D**  
Department of Civil Engineering  
University College of Engineering (A), O.U.

**Approved Online NPTEL Courses for**  
**• OPEN ELECTIVES DURING VIII SEMESTER**  
**for B.E. Civil Engineering, University College of Engineering (A), O.U.**

S. No.	Course offered by Department	Subject	Start Date	End Date	Exam Date
1	Humanities and Social Science	Developing Soft Skills and Personality (Open Elective)	8/27/2018	10/19/2018	As given in website
2	Humanities and Social Science	Water, Society and Sustainability (Open Elective)	8/27/2018	9/21/2018	As given in website
3	Management	Corporate Social Responsibility (Open Elective)	8/6/2018	9/28/2018	As given in website
4	Management	Corporate Social Responsibility (Open Elective)	8/6/2018	9/28/2018	As given in website
5	Management	Project management for managers (Open Elective)	7/30/2018	10/19/2018	As given in website

Url link address of the courses

<https://onlinecourses.nptel.ac.in>

**Note: Students can register for the above courses online and obtain the certificate from NPTEL.**

**Prof. M. Anjaneya Prasad**

Chairperson, BOS (A)

Department of Civil Engineering

**H E A D**

Department of Civil Engineering

University College of Engineering (A), O.U.

**Note:**

- 1. Students who are planning to go and also selected students for full semester INTERNSHIP during their 8th semester will have to complete the course requirement through online SWAYAM/ MOOC/ NPTEL courses with relevant examinations based on the guidelines stipulated by College.**
- 2. The credits for all the NPTEL courses will be credited for the successful students only during the VIII semester by the Examination Cell, UCE (A), O.U.**
- 3. The Professional Electives, Open Electives and Project work will be offered to regular students. The selected students for full VIII Semester (16 weeks) internship will undertake internship based on the guidelines stipulated by College and submit a report to the Department of their Internship in place of Project work – II of VIII semester.**
- 4. All other students will be taking the Professional Electives or Open Electives along with Project work – II of VIII semester.**

**SEMESTER – VII  
DETAILED SYLLABUS**



**STRUCTURAL ENGINEERING DESIGN - I (Concrete)**

<i>Instruction</i>	: 3+1 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

**Objectives:**

- Understand the design procedures for columns and footings.
- Know the design of different types of water tanks.
- Learn the various types of bridges and their functional advantages.
- Be able to understand the IRC Loadings for bridge design
- Determine the various parameters of slab bridges.

**Outcomes:**

- Will Be able to design bridges as per IRC loading
- Able to design Water tanks with staging
- Will be able to compute design parameters of slab bridges

**UNIT - I**

Introduction to Columns and footings, Definition, IS codes. Elastic design and detailing of combined rectangular footings. Elastic design and detailing of retaining walls-cantilever and counter fort types.

**UNIT - II**

Types of water tanks, Definition, IS codes. Elastic design and detailing of rectangular and circular, ground and over head tanks including Intze tanks. Design of staging.

**UNIT - III**

**Bridges:** Introduction to Bridges, Classification of Bridges, Recent advances in Bridge Engineering. IRC loading – impact factor – effective width method and Pigeaud’s method. Elastic design and detailing of (i) R.C. Slab bridges and (ii) T-beam bridges for IRC loadings. Girder design using Curbon’s method.

**Suggested Reading:**

1. Krishna Raju, N. (2009). “Structural Design and Drawing (third Edition).” Universities press.
2. Punmia, B. C., Jain, A.K and Jain, A. K. (2006). “RCC designs (Reinforced concrete structures). Laxmi publications (10<sup>th</sup> edition).
3. Phatak,(1990). “Bridge Engineering.” Satya Prakashan Publishers.
4. Johnson D. Victor. (2006). “Essentials of Bridge Engineering.” Oxford &IBH Publishers, Pvt.Ltd., New Delhi.
5. I.S. Code Books related to I.R.C loading

**Note:** All latest relevant IS codes necessary for teaching this course may be introduced and referred in detail by the Faculty Concerned.

**STRUCTURAL ENGINEERING DESIGN & DRAWING - II (Steel)**

<i>Instruction</i>	: 3+1 periods per
<i>weekDuration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

**Objectives:**

- Understand the basic concepts of welded plate girder design
- Learn the basic principles of gantry girder design
- Study the various types of bridges, bridge bearings and their design procedures
- Know the concepts of design for chimneys and transmission towers

**Outcomes:**

- Analyze and design the plate girder and gantry girder
- Design the railway steel bridges and bridge bearings
- Apply the design principles of chimneys and transmission towers

**UNIT - I**

**Plate Girders:** Design of welded plate girders for static loads, connections, intermediate and bearing stiffeners, web and flange splices.

**UNIT - II**

**Gantry Girders:** Basic principles, codal provisions and detailed design.

**Bearings:** Types and materials, detailed design of bearings for bridges.

**UNIT - III**

**Bridges:** Deck and trough type bridges, economical span, bridge rules (Railway Board, Ministry of Railways), detailed design of plate girder bridges and truss bridges.

**Chimneys and Towers:** General design principles of chimneys and transmission towers.

**Suggested Reading:**

1. N. Subramanyam, *Design of Steel Structures*, Oxford University Press, 2008.
2. B.C. Punmia, *Comprehensive Design of Steel structures*, Laxmi Publishers, 2001.
3. P. Dayaratnam, *Design of steel Structures*, S. Chand & Company Ltd, 2003.
4. N. Krishna Raju, *Design of Bridges*, Oxford and IBH Publishers, New Delhi, 1998.
5. Relevant I.S. Code books on Design of Steel Structures.

**e-Resources:**

1. <http://nptel.ac.in/>
2. <http://mhrd.gov.in/e-contents>
3. <http://spoken-tutorial.org/>

PC 702 CE

## ESTIMATION, COSTING AND SPECIFICATIONS

<i>Instruction</i>	: 3+1 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Objectives:

- Understand the basic principles and specifications for estimations
- Know the basic procedures for Tenders and Tender documents
- Understand the detailed estimation of buildings , roads and Irrigation structures

### Outcomes:

- Will be able to prepare tender documents
- Will be able to prepare estimates for various engineering structures
- Will be able to prepare schedule for civil engineering works

### UNIT - I

**Basic principles and specifications:** General and detailed specifications of works. Departmental procedures to the construction works. Types of estimates, various types of contract, turnkey projects, essentials of contracts and conditions of contracts, Schedule of rates, standard data, rate analysis, Bill of quantities.

**Tenders and Documentation:** Tenders, preparation of tenders, tender documentation, Tender notice, work order, Earnest money deposit, and security money deposits, comparative statements, additional conditions mentioned by tender, and those implications. Measurement book and muster roll, advances in tender procedures. National bidding/International bidding / Shopping. BOT, BOOT and PPP projects. Role of IT in tenders and construction industry.

### UNIT - II

**Estimation of Buildings and Roads:** Traditional residential buildings., advanced buildings (earth work. footings, columns, beams and slabs etc) by long wall and short wall method and centre line method, bar bending schedules, estimation of reinforcement quantities , Estimation of road works using levels (Cross sections and longitudinal sections). Preparation of estimates using computer software/excel sheets/available software's, Introduction to MS project.

### UNIT - III

**Estimation of Irrigation Structures:** Pipe culvert, Slab culvert. Simple Bridge. Irrigation on canal including earth work (cutting and banking), Retaining walls, overhead Water tank and aqueduct.

### **Suggested Reading:**

1. Dutta, B.N. (2005). "Estimating and Costing in Civil Engineering:Theory and Practice." S. Dutta & Co., Luknow.
2. Chakraborti, M. (2002). "Estimating. Costing and Specifications in Civil Engineering." M. C. Chakraborti, Kolkata.
3. Jagjit Singh. (1996). "Estimating and Costing in Civil Engineering." Galgotia publications, new Delhi.

## TRANSPORTATION ENGINEERING – II

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Objectives:

- To study various signal design concepts
- Emphasize the significance of traffic signs and road markings
- To understand various techniques of pavement construction and maintenance
- To know the concepts related to transport planning and economic analysis

### Outcomes:

- Apply the concepts of signal design
- Knowledge regarding construction techniques of flexible and rigid pavements
- Understand concepts of transportation planning process
- Perform economic analysis of transportation projects

### UNIT-I

**Urban Transportation Planning:** Scope and approach to Transport planning, Stages in planning, Trip generation, trip distribution, traffic assignment, transportation planning for small and medium cities.

### UNIT-II

**Highway Construction:** General features of Highway construction, Embankments and sub grade, Excavation of earth, construction of flexible and cement concrete pavements, low volume roads, quality control and quality assurance, waste material for pavement construction.

### UNIT-III

**Pavement Evaluation and Maintenance:** Need for pavement evaluation and maintenance, Distresses in flexible and rigid pavements, structural evaluation of pavements, overlay design, methods of maintenance of flexible and rigid pavements, pavement management systems.

**Highway Drainage:** Objects, requirements and importance of Highway Drainage System, surface and sub surface drainage system.

#### **UNIT-IV**

**Traffic Control Devices:** Traffic Signals, types, principles of phasing, phase diagram, signal timings, splitting of phase.

**Traffic signs & Road markings:** Types of road signs, guidelines for provision of road signs, road markings.

#### **UNIT-V**

**Highway Economics and Finance:** Need for economic evaluation, Principles of economic evaluation, Highway user costs and benefits, Methods of economic analysis and its application to transportation projects.

#### **Suggested Reading:**

1. S.K.Khanna, C.E.G. Justo and A.Veeraragavan, Highway Engineering Neemchand and Bros, New Delhi, India, Tenth Edition, 2014.
2. L.R.Kadyali, Principles and practice of Highway Engineering, Khanna Publications, New Delhi, 2000.
3. L.R.Kadiyali, Traffic Engineering and Transport Planning, Khanna Publications, new Delhi.
4. R.Winfrey, Economic Analysis for highways, International text book company, USA.

PE 704 CE

## FINITE ELEMENT METHODS

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Analysis of discontinuous problems of structural mechanics can be handled.
- Methods to solve 2-D and 3-D problems of structural analysis are introduced.
- All kinds of loads, material properties and analysis types can be handled.
- The method is primarily, a high-end computer oriented numerical analysis tool and it has a scope to be used as an interdisciplinary subject.

### Outcomes:

- Will be able to analyze frames
- Able to displacement of portal frames using FEM method
- Will be able to model using MSC Nastran software

### UNIT – I

**Finite Difference Method with Central Differences:** Solving ODE's and PDE's with central differences. Application to beam and plate bending problems of simple geometry.

**Variational Formulation :** Finite Element Formulation - Stationarity of Functional – Given the Functional or Differential equation – Number of elements limited to two.

**Virtual Work Formulation:** Application to problems of plane trusses with static indeterminacy not exceeding three.

### UNIT – II

**1-D Elements:** Strain-displacement relation matrix / stiffness matrix / Minimum Potential Energy Approach / Rayleigh-Ritz Method / introduction to natural coordinates / stiffness matrix of second order bar element / Axial bar subjected to point loads, body forces and surface traction forces / Problems with kinematic indeterminacy not exceeding two.

**2-D Triangular Elements:** Displacement models / criterion for convergence / geometric invariance / conforming and non conforming elements - 3-node triangular elements (CST) / determination of strain-displacement matrix / area coordinates-shape functions / determination of element stiffness and load matrices, assembling global stiffness and load matrices / Problems with kinematic indeterminacy not exceeding three.

### UNIT – III

**Introduction to FEM:** Types of Problems – Types of Materials – Elastic / Inelastic situations – Types of forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations – Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua - Equilibrium equations for 2-D / 3-D boundary elements – Boundary conditions – Strain-displacement relation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.

**Iso-parametric elements:**

**Quadrilateral elements:** Construction of shape functions using natural coordinates/Strain-displacement matrices/Load matrices for body force and surface traction/Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular elements, kinematic indeterminacy not exceeding three.

### UNIT – IV

**Method of Weighted Residuals:**

**Galerkin's Method of Weighted Residuals:** Application to problems of mathematics / structural engineering, number of trial functions not exceeding two.

**Galerkin's Finite Element Method:** Weak form of Trial Function - Application to problems of mathematics / structural engineering, number of elements limited to two.

### UNIT – V

**Axi-symmetric Problems:** Strain-displacement relationship/stress-strain relationship / determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.

**Tetrahedron elements:** Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron (brick) elements.



**Introduction to MSC Nastran:** Illustration on different modules of Nastran/ Structural engineering applications of the package/Creation of a simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results.

**Suggested Reading:**

1. Cook, R. D. (1981). “Concepts and Application of Finite Element Analysis”, John Wiley and Sons.
2. Zienkiewicz, O. C. And Taylor, R. L, (1989). “The Finite Element Method”, Vol.1, McGraw Hill Company Limited, London.
3. Reddy, J. N, (1993). “An Introduction to the Finite Element Method”, McGraw Hill, New York.
4. Chandrupatla, T. R. And Belegundu, A. D, (2001). “Introduction to Finite Elements in Engineering”, Prentice Hall of India, New Delhi.
5. Seshu. P, (2003). “Finite Element Analysis”, Prentice Hall of India Private Limited, New Delhi.
6. David V. Hutton, (2005). “Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Bathe, K. J, (2006). “Finite Element Procedures”, Prentice Hall of India, New Delhi.

**PROFESSIONAL ELECTIVE – II**  
**COURSES**

PE 701 CE

## EARTHQUAKE RESISTANT DESIGN

<i>Instruction</i>	: 3+1 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Objectives:

- Understand concepts and characteristics of Earthquakes and its motions
- Describe the seismic design philosophy and the forces involves
- Impart knowledge on rehabilitation and retrofitting and remedial measures

### Outcomes:

- Will be able to design structure using seismic principles
- Able to evaluate damage patterns due to earth quakes
- Able to analyze structure suitable for retrofitting

### UNIT - I

**Engineering Seismology:** Causes of earthquakes, seismic waves, magnitudes, intensity and energy release, characteristics of strong earthquake ground motions, soils effects and liquefaction.

### UNIT - II

**Theory of Vibrations:** Introduction, long and short period structure. Single, two and multi-degree of freedom systems. Concepts of damped and un-damped vibrations, response spectrum, response spectrum analysis.

### UNIT - III

**Seismic design philosophy:** Concepts of seismic resistant design, reduction factors, over strength, ductility and redundancies, determination of earthquake forces on structures. Seismic design and detailing of masonry, reinforced concrete and steel buildings

### UNIT - IV

**Seismic performance of buildings:** case studies of major earthquakes in the country, damage to buildings, damage patterns, performance of non-engineered buildings, rural houses during earthquakes.

## **UNIT - V**

**Seismic resistant design:** Basic principles of earthquake resistance. Concepts of earthquake resistance construction in rural areas, base isolation and energy dissipation devices.

**Rehabilitation and retrofitting:** seismic retrofitting, repair, rehabilitation and retrofitting. Methods of retrofitting importance of re-analysis. Case studies.

### **Suggested Reading:**

1. Chopra, A.K. (2004). "Dynamics of structures, Theory and application to earthquake Engineering." Pearson Education.
2. Pankaj Agarwal and Manish Shrikhande (2006). "Earthquake Resistance Design of Structures." Prentice Hall of India.
3. Kramer, S. L. (2004). Geotechnical Earthquake Engineering, Pearson Education.
4. Mario Paz. (1995). International Handbook of Earthquake Engineering: Codes, programs and examples, Springer Verlag.
5. D.S.Prakash Rao. (2005). Design principles and detailing of concrete structures, Tata McGraw-hill publishing company.

PE 701 CE

## WASTEWATER TREATMENT

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Description of different units of primary treatment and their relative importance
- Illustration about various techniques of natural and mechanical systems of sewage disposal
- Knowledge of disposal methods for conservation of water quality in lakes, rivers, and oceans

### Course Outcomes:

- Planning for wastewater treatment facilities and conservation of ecological systems
- Selection of appropriate technologies for natural and mechanical systems of sewage disposal

### UNIT – I

**Planning in domestic wastewater treatment:** Outline of unit processes, different types of treatment methods, primary treatment, screening, neutralization, equalization, flocculation, sedimentation, flotation, nitrification-denitrification systems. Environmental impact and others considerations in planning treatment facilities.

### UNIT – II

**Joint treatment:** General characteristics of industrial sewage, processes involved in the treatment of industrial sewage, self purification of streams for combined discharges of domestic and industrial wastes, joint treatment requirements, and ordinances.

**Aerated Lagoons:** Design of facultative aerated, aerobic flow through dual powered aerated and extended aeration lagoons.

### UNIT – III

**Waste stabilization ponds:** Types of ponds, factors affecting pond eco-system, design of aerobic and anaerobic stabilization ponds.

**Design of wastewater irrigation systems:** Rapid infiltration system, over land flow systems, and vermin-culture

#### **UNIT – IV**

**Design of sludge treatment units:** Sources, types of sludge, characteristics of sludge, weight-volume relationship, sludge treatment processes, selection criteria for sludge treatment processes, sludge drying beds, and sludge calculations.

#### **UNIT – V**

**Effluent Disposal:** Receiving water standards, disposal into lakes, rivers, mathematics of mass transport, diffusion-advection, and hydraulic models of physical systems. (Continuous flow stirred tank, reactor model, and plug flow reactor model) disposal into the ocean, outfall design.

#### **Suggested Reading:**

1. Metcalf and Eddy, *Wastewater Engg; treatment, disposal reuse*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1995
2. Soli J Arceivala, *Wastewater Treatment for pollution control*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998
3. Kiely Gerard, *Environmental Engineering*, McGraw-Hill International Limited., London, 1998
4. Hammer, M.J. and Hammer, M.J. Jr., *Water and Wastewater Technology*, Prentice-Hall of India Pvt. Ltd., New Delhi, 1998
5. Nemerow, Nelson Leonard, *Theories and Practices of Industrial Waste treatment*, Addison Wesley Publishing Company Inc., Massachusetts, 1963

## **GROUND IMPROVEMENT TECHNIQUES**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessionals	30 Marks

### **Course Objectives**

- To understand the objectives, necessity and scope of ground improvement
- To learn different methods of insitu densification of cohesive / cohesion less grounds
- To understand the types, functions and applications of Geosynthetics

### **Course Outcomes:**

- Ability to understand the causes and to identify the scope for ground improvement
- Selection of ideal ground improvement technique appropriate for a given ground conditions
- Competence in dealing with the applications of ground improvement in Infrastructure Engineering projects

### **UNIT - I**

**Introduction:** Objectives and necessity of Ground Improvement – Formation of Rock and soils – Alteration of ground after its formation – Reclaimed soils – Ground improvement potential – Geotechnical processes.

### **UNIT - II**

**Densification Of Cohesion less Soils:** Surface and deep compaction – Vibration methods – Vibro-compaction, vibro-displacement, vibro-replacement methods.

### **UNIT - III**

**Densification Of Cohesive Soils:** Drainage methods – selection of pumps and accessories, Pre-compression methods – consolidation properties of soils – Pre-loading technique – consolidation acceleration methods - consolidation aided with vertical drains – Sand Drains - Pre-fabricated vertical drains, Consolidation by Electro-osmosis and vacuum compression methods, Compression monitoring.

### **UNIT - IV**

**Grouting:** Aspects of grouting – Types of grouting materials – grouting procedure – Applications of grouting in ground improvement

**Soil Stabilization:** Types and suitability of stabilization methods - Mechanical, Cementing methods – Aggregates and dispersants – Stabilization procedure – quality control in Soil Stabilization.

#### **UNIT - V**

**Reinforced Earth:** Concept of reinforced earth – Types and suitability of reinforcement material – fiber reinforced earth – factors affecting reinforced earth.

**Geo-Synthetics:** Classification of Geosynthetics – Functions and applications – Concept of design by function. Reinforced Soil Walls – Gabions.

#### **Suggested Reading:**

1. H.R. Hausmann, *Principles of Ground Modification*, Mc-Graw Hill Publications.
2. P.Nicholson, *Soil Improvement and Ground Modification Methods*, Butterworth-Heinemann Ltd.
3. Purushotham Raj, *Ground Improvement Techniques*, Laxmi Publications.
4. R.M.Koerner, *Designing with Geosynthetics*, Prentice Hall Inc.
5. Fang.H.S., (1985), *Foundation Engineering Hand Book*, CBS Publications.



PE 704 CE

## WATERSHED MANAGEMENT

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Objectives:

- Understand the concept of watershed and watershed management systems
- Investigate the characteristics of watershed parameters
- Enhance the working knowledge to create the data base of watershed using geospatial techniques

### Outcomes:

- Able to characterize watershed
- Able to estimate soil loss by suitable equations
- Able to plan watershed activities

### UNIT - I

**Definition and concept of Watershed:** Concept of watershed development, History of Watershed management and its relevance to India, objectives of watershed development, need for watershed development in India, selection of watershed, issues for watershed policies, Integrated and multidisciplinary approach for watershed management.

### UNIT - II

**Characteristics of Watershed:** Size, shape, physiographic, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

### UNIT - III

**Principles of Erosion:** Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation.

**Measures to Control Erosion:** Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rock fill dams, brushwood dam, Gabion.

### UNIT - IV

**Water Harvesting:** Rainwater harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds and percolation tanks.

**Land Management:** Land use and land capability classification, management of forest, agricultural, grassland and wild land, reclamation of saline and alkaline soils.

## **UNIT - V**

**Ecosystem Management:** Role of Ecosystem, crop husbandry, soil enrichment, inter mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, silvi pasture, horticulture, social forestry and afforestation.

**Applications:** Planning of watershed management activities, people's participation, preparation of action plan, administrative requirements. Social aspects of watershed management, community participation, private sector participation, industrial issues, socio-economy, integrated development, water legislation and implementations, case studies, applications of geospatial techniques in watershed management systems.

### **Suggested Reading:**

1. Murthy, J.V.S. (1998). "Watershed Management." New Age International (P), Ltd., New Delhi,
2. Awurbs, R. and James, W.P. "Water Resources Engineering." Prentice Hall Publishers
3. Goswami, M.D. (2004). "Watershed Management: Theory and Practices." Ritwik and Gargee (P)., Guwahati, Assam.
4. Majumdar, D.K. (2000). "Irrigation and Water Management." Prentice Hall, New Delhi.
5. Mohan Das, M. and Das Saikia, M. (2013). "Watershed Management." PHI Learning (P)., Ltd., New Delhi.
6. Haan, C.T., Johnson, C.T., AND Brakensiek, D.L. (1982). "Hydrologic Modeling of Small Watersheds." ASAE, Michigan, 1982.
7. Michael, A.M. (2014). "Irrigation Theory and Practice." Second Edition, Vikas Publishing House, New Delhi, India.

**COMPUTER APPLICATIONS LABORATORY**

<i>Instruction</i>	: 2 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 25marks
<i>SEE</i>	: 50 marks
<i>Credits</i>	: 1

1. Calculation of shear force  $I$  bending moment at any section for a simply supported beam carrying a u.d.l., shorter than span.
2. Structural design of an RCC beam section using limit state method, given are the grade of concrete, grade or steel, BM and SF.
3. A rectangular cross section is subjected to a non-central force parallel to axis of member. Determine the stresses at any location of the section. Direct and bending stresses.
4. Calculation of normal depth and critical depth in a trapezoidal channel
5. Computation of discharge over a rectangular notch using velocity of approach
6. Determination of pre and post jump depths from known specific energy values
7. Calculation of  $\Phi$ -index
8. Estimation of specific capacity and maximum pumping rate of a well
9. Analysis of pipe network in water distribution systems
10. Flood routing using Muskingham's method
11. Design of an irrigation channel using Kennedy's theory
12. Design of trapezoidal notch canal fall
13. Compute distribution of increment in vertical stress due to applied point load on a (a) Horizontal Plane (b) Vertical plane. Using the computed values, plot the distribution utilizing VC as front end tool.
14. Compute the values of a pressure bulb and using the values plot pressure bulb utilizing VC as front end tool.
15. Compute the consolidation settlement duly dividing the strata in to infinitesimally small layers to fulfill the Terzaghi's assumption.
16. Compute earth pressure on to a retaining wall and check its stability.
17. Compute bearing capacity of a shallow foundation as per IS: 6403 -1980
18. Develop a code in C to design a single vertical pile, pile group to suit various ground conditions.

**SUMMER INTERNSHIP**

*CIE* : 50 marks

*Credits* : 2

The students will be attending to Industry for Internship to various Government and Private Organizations. Students should take help of teaching staff and Alumni to identify the industry for practical training. The students should prepare a report about their internship during the vacation period for presentation. .

The Department will appoint a coordinator who will coordinate the following.

- Grouping of students
- Allotment of originations for Internship.
- Monitoring and presentation by students after the Internship.

**PROJECT WORK – 1**

*CIE* : 50 marks

*Credits* : 4

**Course Objectives:**

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic literature survey and documentation
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas

**Course Outcomes:**

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

The Department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:  
Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

Grouping of students (max 3 in a group)

Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

**Each group will be required to:**

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

# **MANDATORY COURSES**

MC952SP

### **NATIONAL SERVICE SCHEME (NSS)**

Instruction per week	3 Hours
CIE	50Marks
Credits	3 units

#### **Objectives:**

1. To help in Character Moulding of students for the benefit of society
2. To create awareness among students on various career options in different fields
3. To remould the students behaviour with assertive skills and positive attitudes
4. To aid students in developing skills like communication, personality, writing and soft skills
5. To educate students towards importance of national integration, participating in electoral process etc by making them to participate in observing important days.

#### **List of Activities:**

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme
5. Blood Donation / Blood Grouping Camp
6. Imparting computer education to school children
7. Creating Awareness among students on the importance of Digital transactions
8. Stress management techniques
9. Health Checkup Activities
10. Observation of Important days like voters day, World Water Day etc.
11. Road Safety Awareness Programs
12. Energy Conservation Activities
13. Conducting Programme's on effective communication skills
14. Awareness programme's on national integration
15. Orientation on Improving Entrepreneurial Skills
16. Developing Effective Leadership skills



17. Job opportunity awareness programs in various defence, public sector undertakings
18. Skill Development Programmes
19. Creating awareness among students on the Importance of Yoga and other physical activities
20. Creating awareness among students on various government sponsored social welfare schemes for the people.

**Note:** *At least Ten Activities should be conducted in the Semester.* Each event conducted under Swachh Barath, Plantation and important days like voters day, world water day may be treated as a separate activity.

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MC9535P

## **SPORTS**

*Instruction per week*  
*CIE*

*3 Hours*  
*50 Marks*

### ***Objectives:***

1. To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
2. To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
3. To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
4. To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
5. To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

### ***Outcomes:***

1. Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
2. Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
3. Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
4. Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.

5. Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

**I. Requirements:**

- i) Track Paint (students should bring)
- ii) Shoes
- iii) Volley Ball, Foot Ball and Badminton (Shuttle)
- iv) Ground, Court, indoor stadium and swimming pool

**II. Evaluation Process:**

*Total Marks 50*

- i) 20 marks for internal exam (continuous evaluation)
  - a) 8 marks for viva
  - b) 12 marks for sports & fitness
- ii) 30 marks for end exam
  - a) 10 marks for viva
  - b) 20 marks for sports & fitness

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MC951SP

## **YOGA PRACTICE**

*Instruction per week*  
*CIE*  
*Credits*

*3 Hours*  
*50 Marks*  
*3 Units*

### **Objectives:**

1. Enhances body flexibility
2. Achieves mental balance
3. Elevates Mind and Body co-ordination
4. Precise time management
5. Improves positive thinking at the expense of negative thinking

### **Outcomes:**

1. Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
2. An all-round development-physical, mental and spiritual health-takes place.
3. Self-discipline and discipline with respect society enormously increases.
4. University environment becomes more peaceful and harmonious.

### **UNIT-I**

#### **Introduction**

Yoga definition-Health definition from WHO - Yoga versus Health - Basis of Yoga - yoga is beyond science- Zist of 18 chapters of Bhagavadgita - 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga – Internal and External yoga - Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi) - Pancha koshas and their purification through Asana, Pranayama and Dhyana.

## **UNIT-II**

### **Suryanamaskaras (Sun Salutations)**

Definition of sun salutations - 7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar) - Various mantras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations - Physiology - 7 systems of human anatomy - Significance of performing sun salutations.

## **UNIT-III**

### **Asanas (Postures)**

Pathanjali's definition of asana - Sthiram Sukham Asanam - 3rd limb of Ashtanga yoga - Loosening or warming up exercises - Sequence of perform in asanas (Standing, Sitting, Prone, Supine and Inverted) - Nomenclature of asanas (animals, trees, rishis etc) - Asanas versus Chakras - Asanas versus systems - Asanas versus physical health - Activation of Annamaya kosha.

## **UNIT-IV**

### **Pranayama (Breathing Techniques)**

Definition of Pranayama as per Shankaracharya - 4th limb of Ashtanga yoga - Various techniques of breathing - Pranayama techniques versus seasons - Bandhas and their significance in Pranayama - Mudras and their significance in Pranayama - Restrictions of applying bandhas with reference to health disorders - Pranayama versus concentration - Pranayama is the bridge between mind and body - Pranayama versus mental health - Activation of Pranamaya kosha through Pranayama.

## **UNIT-V**

### **Dhyana (Meditation)**

Definition of meditation - 7th limb of Ashtanga yoga - Types of mind (Conscious and Sub-Conscious) - various types of dhyana. Meditation versus spiritual health - Dharana and Dhyana - Extension of Dhyana to Samadhi - Dhyana and mental stress - Activation of Manomaya kosha through dhyana - Silencing the mind.

### **Suggested Reading:**

1. Light on Yoga by BKS Iyengar
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati
3. Light on Pranayama by BKS Iyengar
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda
6. Yoga education for children Vol-11 by Swami Niranjanananda Saraswati
7. Dynamics of yoga by Swami Satyananda Saraswati

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**OPEN ELECTIVE – II  
COURSES**

**HUMAN FACTOR ENGINEERING & ERGONOMICS  
(OPEN ELECTIVE-II)**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	3

**Objectives:**

- Provide a broad based introduction to ergonomic principles and their application in the design of work, equipment and the workplace.
- Consideration is given to musculo-skeletal disorders, manual handling, ergonomic aspects of the environment as well as to the social and legal aspects.

**Outcomes:** Successfully the student will be able to:

- apply ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace
- conduct ergonomic risk assessments
- develop appropriate control measures for ergonomic risk factors
- describe work-related causes of musculo-skeletal disorders
- design a workplace according to good ergonomic principles
- Assess ergonomic aspects of the working environment and work organization.

**UNIT-I: Overview of Ergonomics (20%)**

**General Principles** -Aims, objectives and benefits of ergonomics , Definition and scope of ergonomics and systems of work , The role of the ergonomist , Fitting the job to the person and the person to the job , Human characteristics, capabilities and limitations , Human error , Teamwork and ageing , Interfaces between job, person and environment , Human computer interaction

**Biological Ergonomics**- Body systems - musculo-skeletal and nervous , Anatomy, static and dynamic anthropometry . Biomechanics . Applying work physiology - body metabolism, work capacity and fatigue, Static and dynamic postures

**Psychology**-Perception of risk , Motivation and behaviour , Memory , Signal Detection Theory and vigilance , 'Work 'Stress' - causes, preventative and protective measures , Work organisation - shift working and overtime

**Developing an Ergonomics Strategy at Work**- Culture of an organisation - commitment and decision-making , 'Macro-ergonomics' and participatory ergonomic



teams , Ergonomics at the design stage , Developing ergonomics, professional ergonomists and competence

### **UNIT-II: Ergonomics Methods and Techniques (20%)**

**Work Design** -Task analysis and allocation of functions, User trials , Problem solving - scientific method

**Ergonomics Risk Assessment-** Definitions of hazard and risk, Priorities, Risk evaluation quantity and quality of risk, Assessment systems , Overall ergonomics approach, Control measures monitoring and feedback

**Measurements and Information Gathering-**Ergonomics standards, Observational techniques, Rating scales, questionnaires and check lists, Use of models and simulation

### **UNIT-III: Musculo-Skeletal Disorder (20%)**

**Manual Handling-**The nature and causes of manual handling disorders , Risk assessment , Job design and training , Principles of handling and preventative and protective measures

**Work Related Upper Limb Disorders (WRULD)-** The nature and causes of WRULD/ 'Repetitive Strain Injuries'/Cumulative Disorders , Risk assessment , Principles of control, preventive and protective measures

### **UNIT-IV: Workplace, Job and Product Design (20%)**

**Workplace Layout and Equipment Design-** Principles of workstation and system design, Space and workstation design principles, Risks to health: Musculoskeletal problems, Visual fatigue, Mental stress, Requirements for eye tests, Design considerations for Visual Display Unit (VDU) Stations: Ergonomic factors, Work stations, Design of work and practice, Carrying out assessments of risk at VDU workstations

**Controls, Displays and Information-**Visual, auditory and other displays , Quantitative and qualitative information , Compatibility and population stereotypes , Warnings, signs and labels , Sources and selection of data , Principles of software ergonomics

### **UNIT-V: Relevant Physical Factors of the Work Environment (10%) & Standards and Social Aspects (10%)**

**Lighting** - Visual acuity and colour vision , Lighting levels, contrast and glare , Reflections and flicker fusion

**Noise** - Noise induced hearing loss , Distraction, annoyance and emergency signals

**Thermal Environment-** Body temperature regulation and acclimatisation, Subjective assessments - thermal comfort and discomfort

**Other Considerations-** Smell, taste and tactile senses, Vibration - effects and subjective assessment

**Clothing and Protective Equipment-** Objective and subjective effects, Risk perception, and wearability , Design, style and fit  
**Standards** - ISO standards , Sources of other standards  
**Selection and Training-** Training Needs Analysis, Testing and interview techniques  
**Instruction and Supervision-**Health information, legal requirements, Supervision and records, Measuring health and illness

**Suggested Reading:**

1. Introduction to Human factors and Ergonomics, 4<sup>th</sup> edition by Gariel Salvendy, John & Willey & Son's.
2. Introduction to Human Factors and Ergonomics, 4<sup>th</sup> Edition by Robert Bridger, CRC Press.
3. An Introduction to Human factors Engineering by 2<sup>nd</sup> Edition, Christopher D. Wickens, Sallie E. Gardon, Yili Liv, PHI series.
4. Stephen Konz and Steve Johnson 2007 Work Design: Occupational Ergonomics 7th Edition Holcomb Hathway.
5. Dul & Weerdmeester 2003 Ergonomics for Beginners Taylor & Francis.
6. R.S.Bridger 2003 Introduction to Ergonomics Taylor & Francis

**BASIC MEDICAL EQUIPMENT  
(OPEN ELECTIVE-II)**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	3

**Objectives:**

- State the Physiological reasons for using a particular piece of Biomedical Equipment.
- Describe the operating principles of a wide range of biomedical equipment.
- To familiarize the latest technologies of modern medicine
- To make learners able to use new and updated diagnostic methodologies
- To make learners capable enough of adopting the methods of recovery and improving health with a service approach

**Outcomes:**

- Perform tests to assess the performance and safety of various Equipments.
- Learn the maintenance of biomedical equipment.

**UNIT-I**

**Medical Monitoring and recording:** Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor, data recording, replay and analysis, Telemetry.

**UNIT-II**

**Physiotherapy and Electrotherapy Equipment:** Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator etc.

**UNIT-III**

**Medical Imaging Equipment:**

X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging: Physics of ultrasonic waves, medical ultrasound, basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, Biological effects, Merits.

#### **UNIT-IV**

##### **Critical care Equipment:**

Ventilators: Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system: Infusion pumps, basic components, implantable infusion system, closed loop control in infusion pump. Cardiac Defibrillators: Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

#### **UNIT-V**

##### **Therapeutic Equipment:**

Cardiac pacemakers: Need for cardiac pacemakers, External and implantable pacemakers, types.

Dialysis Machine: Function of kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters: The stone diseases problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

##### **Suggested Reading:**

1. R.S.Khandpur, Hand Book of Biomedical Instrumentation, Tata McGrawHill, Second Edition, 2014.
2. John G.Webster, Medical Instrumentation Application and design, Wiley India Edition, 2009.

## OPTIMIZATION TECHNIQUES

<i>Instruction</i>	<i>: 3 periods per week</i>
<i>Duration of Semester End Examination</i>	<i>: 3 hours</i>
<i>CIE</i>	<i>: 30 marks</i>
<i>SEE</i>	<i>: 70 marks</i>
<i>Credits</i>	<i>: 3</i>

### Course Objectives:

- To understand the basic concepts of operations research.
- To study about the linear programming and non linear programming.
- To gain knowledge on various gradient search methods.

### Course Outcomes:

- Ability to solve problems of L.P. by graphical and Simplex methods
- Ability to formulate Operation Research formulation
- Ability to solve problems of Integer Programming

### UNIT-I

**Introduction:** Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems.

### Unit – II

**Linear Programming:** Definitions and Formulation of the LPP, Graphical methods, numerical problems by graphical method, Simplex algorithm, Numerical problems using Simplex method,

### Unit – III

Artificial Variables, solution by the Big-M method, Two-Phase method, special cases in Simplex method viz. Degeneracy, alternate optima, unbound solutions and infeasible solutions and numerical problems. Duality principle, Dual problems and numerical problems.

### UNIT-IV

#### Non-Linear Programming:

Introduction, local and global optima, concave and convex functions, Kuhn-Tucker conditions, graphical solutions. Direct search method, Gradient method, Quadratic programming problems.

## **UNIT-V**

### **Integer Linear Programming**

Importance of Integer Linear Programming, Necessity, Definitions, Gomory's cutting plane method, Branch and bound method, zero-one programming, numerical problems.

#### **Suggested Reading:**

1. Hillier, F. S. and Lieberman, G. J. (2009). "Introduction to Operations Research." Ninth Edition, McGraw-Hill, Holden-Day.
2. Taha, H.A. (2008). "Operations Research, Pearson Education India." New Delhi, India
3. Anand Sharma. (2014). "Quantitative Techniques for Decision Making." Himalaya Publishers.
4. Srinivasa Raju, K. and Nagesh Kumar, D. (2014). "Multicriterion Analysis in Engineering and Management." Prentice Hall of India (PHI) Learning Pvt. Ltd, New Delhi.
5. Rao, S.S. (2009). "Engineering Optimization: Theory and Practice." John Wiley.
6. Sharma J.K. (2013). "Operation Research: Theory and Applications." Fifth Edition, Macmillan Publishers, New Delhi, India.

## **DATABASE SYSTEMS**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 marks
Credits	3

### **Course Objectives:**

- To introduce three schema architecture and DBMS functional components
- To learn formal and commercial query languages of RDBMS
- To understand the principles of ER modeling and theory of normalization
- To study different file organization and indexing techniques
- To familiarize theory of serializability and implementation of concurrency control, and recovery

### **Course Outcomes:**

Student will be able to:

- Understand the mathematical foundations on which RDBMS are built
- Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model, and refine the relational model using theory of Normalization
- Develop Database application using SQL and Embedded SQL
- Use the knowledge of file organization and indexing to improve database application performance
- Understand the working of concurrency control and recovery mechanisms in RDBMS

### **UNIT – I**

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object-based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

## **UNIT – II**

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases.  
Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

## **UNIT – III**

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

## **UNIT – IV**

Indexing and Hashing: Basic Concepts, Ordered Indices, B<sup>+</sup>-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.  
Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

## **UNIT – V**

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validation-based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems



## **Suggested Reading:**

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6<sup>th</sup> Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3<sup>rd</sup> Edition, 2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4<sup>th</sup> Edition, 2004

## **INFORMATION SECURITY**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 marks
Credits	3

### **Course Objectives:**

- To learn legal and technical issues in building secure information systems
- To provide an understanding of network security
- To expose the students to security standards and practices

### **Course Outcomes:**

On completion of this course student should be able to:

- Describe the steps in Security Systems development life cycle( SecSDLC)
- Understand the common threats and attack to information systems
- Understand the legal and ethical issues of information technology
- Identify security needs using risk management and choose the appropriate risk control strategy based on business needs
- Use the basic knowledge of security frameworks in preparing security blue print for the organization
- Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools
- Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
- Understand the technical and non-technical aspects of security project implementation and accreditation

### **UNIT-I**

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

## **UNIT-II**

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, Recommended Risk Control Practices.

## **UNIT-III**

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

## **UNIT-IV**

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

## **UNIT-V**

Implementing Information Security: Information security project management, Technical topics of implementation, Non Technical Aspects of implementation, Security Certification and Accreditation.

Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.

Information Security Maintenance: Security management models, Maintenance model, and Digital Forensics.

### **Suggested Reading:**

1. Michael E Whitman and Herbert J Mattord, "*Principles of Information Security*", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "*Information Security Fundamentals*", Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "*Information Security, Policy, Processes, and Practices*", PHI, 2008.
4. Mark Merkow and Jim Breithaupt "*Information Security Principle and Practices*", Pearson Education, 2007

## PRINCIPLES OF ELECTRONIC COMMUNICATIONS

<i>Instruction</i>	: (3L) hrs per week
<i>Duration of SEE</i>	: 3 hours
<i>CIE</i>	: 30 Marks
<i>SEE</i>	: 70 Marks
<i>Credits</i>	:3

### **Course Objectives:**

- Provide an introduction to fundamental concepts in the understanding of communications systems.
- Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
- Provide an introduction to the evolution of wireless systems and current wireless technologies.

### **Course Outcomes:**

Student will be Able to

- Understand the working of analog and digital communication systems
- Understand the OSI network model and the working of data transmission
- Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

### **UNIT- I**

**Introduction to communication systems:** Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels, **Signal Transmission Concepts**-Baseband transmission and Broadband transmission, **Communication parameters**-Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation**-Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

## UNIT- II

**Analog and Digital Communications:** Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

## UNIT- III

**Data Communication and Networking:** Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet , Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

## UNIT- IV

**Telecommunication Systems:** Telephones, Telephone system, Paging systems, Internet Telephony.

**Optical Communications:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

## UNIT- V

**Wireless Communications:** Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

### ***Suggested Reading:***

1. *Principles of Electronic Communication Systems*, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. *Data Communications and Networking*, Behrouz A. Forouzan, 5e TMH, 2012.
3. Kennady, Davis, *Electronic Communications systems*, 4e, TMH, 1999.

## Fundamentals of IOT

<i>Instruction</i>	: (3L) hrs per week
<i>Duration of SEE</i>	: 3 hours
<i>CIE</i>	: 30 Marks
<i>SEE</i>	: 70 Marks
<i>Credits</i>	:3

### Course Objectives:

- Discuss fundamentals of IoT and its applications and requisite infrastructure
- Describe Internet principles and communication technologies relevant to IoT
- Discuss hardware and software aspects of designing an IoT system
- Describe concepts of cloud computing and Data Analytics
- Discuss business models and manufacturing strategies of IoT products

### Course Outcomes:

Student will be able to

- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

### Unit - I

#### Introduction to Internet of Things

IOT vision, Strategic research and innovation directions, Iot Applications, Related future technologies, Infrastructure, Networks and communications, Processes, Data Management, Security, Device level energy issues.

## **Unit -II**

### **Internet Principles and communication technology**

Internet Communications: An Overview – IP,TCP,IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addressess, TCP and UDP Ports, Application Layer Protocols – HTTP,HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source.

## **Unit - III**

### **Prototyping and programming for IoT**

Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping, Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Techniques for writing embedded C code: Integer data types in C, Manipulating bits - AND, OR, XOR, NOT, Reading and writing from I/ O ports. Simple Embedded C programs for LED Blinking, Control of motor using switch and temperature sensor for arduino board.

## **Unit- IV**

### **Cloud computing and Data analytics**

Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform.

Introduction to Data Analytics for IoT - Apache hadoop- Map reduce job execution workflow.

## **Unit- V**

### **IoT Product Manufacturing - From prototype to reality**

Business model for IoT product manufacturing, Business models canvas, Funding an IoT Startup,

Mass manufacturing - designing kits, designing PCB,3D printing, certification, Scaling up software, Ethical issues in IoT- Privacy, Control, Environment, solutions to ethical issues.

### **Suggested Readings:**

1. *Internet of Things - Converging Technologies for smart environments and Integrated ecosystems*, River Publishers.
2. *Designing the Internet of Things* , Adrian McEwen, Hakim Cassimally. Wiley India Publishers
3. *Fundamentals of embedded software: where C meets assembly* by Daneil W lewies, Pearson.
4. *Internet of things -A hands on Approach*, Arshdeep Bahga, Universities press.



OE701EE

**NON CONVENTIONAL ENERGY SOURCES  
(OPEN ELECTIVE-II)**

Instruction	:	3Periods/Week
Duration of University Examination	:	3Hours
SEE	:	70Marks
CIE	:	30 Marks
Credits	:	3

**Objectives:**

**Outcomes:**

**UNIT I**

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H<sub>2</sub> O<sub>2</sub> Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

**UNIT II**

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy.

**UNIT III**

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations -Advantages and disadvantages of WECS -Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

**UNIT IV**

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and

disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

## **UNIT V**

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifies.

### **Suggested Reading:**

1. Rai G.D, *Non-Conventional Sources of Energy*, Khandala Publishers, New Delhi, 1999.
2. M.M.El-Wakil, *Power Plant Technology*. McGraw Hill, 1984.

**STARTUP ENTREPRENEURSHIP  
(Open Elective-II)**

<i>Instructions</i>	: (3L) hrs per week
<i>Duration of SEE</i>	: 3hours
<i>CIE</i>	: 30 Marks
<i>SEE</i>	: 70 Marks
<i>Credits</i>	:3

***Course Objectives:***

- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise by creative thinking and shape ideas into reality.
- To understand action driven business plan and learn to prepare project budget.

***Course Outcomes:*** At the end of the course the students will be able to

- Think creatively and transform ideas into reality.
- Differentiate market transforming strategy.
- Create a complete business plan and workout the budget plan.

**Unit I: Creativity & Discovery**

Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Benchmarking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

**Unit II: From Idea to Startup**

Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map

### **Unit III: Innovation career lessons**

Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working Hard.

### **Unit IV: Action driven business plan**

Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is ‘most important’). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

### **Unit V: Startup financing cycle**

Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan – detailed activities and starting and ending dates); and a project budget.

### **Suggested Reading:**

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project – Planning , Analysis, Selection, Implementation and Review”, Tata McGraw-Hill Publishing Company Ltd., 1995.
3. B. Badhai, “Entrepreneurship for Engineers”, Dhanpath Rai & Co., Delhi, 2001.
4. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, “ Entrepreneurship”, Tata McGRaw Hill Edition, 2002.

# **SEMESTER – VIII**

**SCHEME OF INSTRUCTION FOR B.E. (CIVIL ENGG) - VIII SEMESTER**

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1		Professional Elective-III	3	-	-	3	30	70	3
2		Professional Elective-IV	3	-	-	3	30	70	3
3		Professional Elective-V	3	-	-	3	30	70	3
4		Open Elective-III	3	-	-	3	30	70	3
5	MC 01EG	Gender Sensitization*	3*	-	-	3	30	70	3 U
<b>6</b>									
6	PW 961CE	Project Work-II / Internship	-	-	4	4	50	100	8
			<b>12+3</b>	<b>-</b>	<b>4</b>	<b>16</b>	<b>170+30</b>	<b>380+70</b>	<b>20</b>
<b>PROFESSIONAL ELECTIVE-III</b>					<b>PROFESSIONAL ELECTIVE-V</b>				
1	PE 801 CE	Applied Hydrology	1	PE 809 CE	Prefabrication Engineering				
2	PE 802 CE	Principles of Climate Change	2	PE 810 CE	Design of Bridges				
3	PE 803 CE	Computer Aided Analysis and Design	3	PE 811 CE	Advanced Reinforced Concrete Design				
4	PE 804 CE	Advanced Concrete Technology	4	PE 812 CE	Traffic Engineering and Infrastructure Design				
<b>PROFESSIONAL ELECTIVE-IV</b>									
1	PE 805 CE	Retrofitting and Rehabilitation of Structures							
2	PE 8026CE	Designing with Geo-Synthetics							
3	PE 807 CE	Groundwater Management							
4	PE 808 CE	Intelligent Transportation Systems							
<b>OPEN ELECTIVE-III</b>									
1	OE801MT	Statistical Applications in Engineering	5	OE 801 EC	Global and Regional Satellite Navigational Systems				
2	OE 862BE	Human Machine Interface	6	OE 801 EE	Illumination and Electric Traction				
3	OE 801 CE	Road Safety Engineering	7	OE 801ME	Composite Materials				
4	OE 802 CE	Green Building Technologies	8	OE 802 ME	Industrial and financial Management				
5	OE 801 CS	Data Science Using R	9	OE 803 ME	3-D Printing Technology				
<b>* Mandatory Course</b>									

**ON-LINE NPTEL/SWAYAM  
PROFESSIONAL ELECTIVE SUBJECTS  
AND  
OPEN ELECTIVE SUBJECTS**

**Approved Online NPTEL Courses for**  
**PROFESSIONAL ELECTIVES DURING VII & VIII SEMSTERS**  
for B.E. Civil Engineering, University College of Engineering (A), O.U.

S. No.	Course offered by Department	Subject	Start Date	End Date	Exam Date
1	Agriculture Engineering	Irrigation and Drainage	7/30/2018	10/19/2018	As given in website
2	Civil Engineering	Theory of Elasticity	7/30/2018	10/19/2018	As given in website
3	Civil Engineering	Matrix Method of Structural Analysis	8/27/2018	10/19/2018	As given in website
4	Civil Engineering	Modern Construction materials	7/30/2018	10/19/2018	As given in website
5	Civil Engineering	Integrated Waste Management for a Smart City	7/30/2018	10/19/2018	As given in website
6	Civil Engineering	Glass in buildings : Design and applications	7/30/2018	10/19/2018	As given in website
7	Civil Engineering	Environmental Engineering-Chemical Processes	7/30/2018	10/19/2018	As given in website
8	Civil Engineering	Fire Protection, Services and Maintenance Management of Building	7/30/2018	10/19/2018	As given in website
9	Civil Engineering	Geoenvironmental Engineering (Environmental Geotechnology); Landfills, Slurry Ponds & contaminated Sites	7/30/2018	10/19/2018	As given in website
10	Civil Engineering	Unsaturated Soil Mechanics	7/30/2018	10/19/2018	As given in website
11	Civil Engineering	Introduction to Accounting and Finance for Civil Engineers	8/27/2018	10/19/2018	As given in website
12	Ocean Engineering	Structural Health Monitoring	7/30/2018	10/19/2018	As given in website
13	Ocean Engineering	Hydrostatics and Stability	7/30/2018	10/19/2018	As given in website

Url link address of the courses

<https://onlinecourses.nptel.ac.in>

**Note: Students can register for the above courses online and obtain the certificate from NPTEL.**

**Prof. M. Anjaneya Prasad**  
Chairperson, BOS (A)  
Department of Civil Engineering

**H E A D**  
Department of Civil Engineering  
University College of Engineering (A), O.U.



**Approved Online NPTEL Courses for  
OPEN ELECTIVES DURING VII & VIII SEMSTERS  
 for B.E. Civil Engineering, University College of Engineering (A), O.U.**

S. No.	Course offered by Department	Subject	Start Date	End Date	Exam Date
1	Humanities and Social Science	Developing Soft Skills and Personality (Open Elective)	8/27/2018	10/19/2018	As given in website
2	Humanities and Social Science	Water, Society and Sustainability (Open Elective)	8/27/2018	9/21/2018	As given in website
3	Management	Corporate Social Responsibility (Open Elective)	8/6/2018	9/28/2018	As given in website
4	Management	Corporate Social Responsibility (Open Elective)	8/6/2018	9/28/2018	As given in website
5	Management	Project management for managers (Open Elective)	7/30/2018	10/19/2018	As given in website

Url link address of the courses

<https://onlinecourses.nptel.ac.in>

**Note: Students can register for the above courses online and obtain the certificate from NPTEL.**

**Prof. M. Anjaneya Prasad**  
 Chairperson, BOS (A)  
 Department of Civil Engineering

**H E A D**  
 Department of Civil Engineering  
 University College of Engineering (A), O.U.

**Note:**

1. Students who are planning to go and also selected students for full semester INTERNSHIP during their 8th semester will have to complete the course requirement through online SWAYAM/ MOOC/ NPTEL courses with relevant examinations based on the guidelines stipulated by College.
2. The credits for all the NPTEL courses will be credited for the successful students only during the VIII semester by the Examination Cell, UCE (A), O.U.
3. The Professional Electives, Open Electives and Project work will be offered to regular students. The selected students for full VIII Semester (16 weeks) internship will undertake internship based on the guidelines stipulated by College and submit a report to the Department of their Internship in place of Project work – II of VIII semester.
4. All other students will be taking the Professional Electives or Open Electives along with Project work – II of VIII semester.

# **PROFSSIONAL ELECTIVE COURSES**

## APPLIED HYDROLOGY

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Awareness about flood characteristics and flood forecasting systems
- Description of Flood mitigation, adjustment, and regulation
- Knowledge of Hydrological time series analysis

### Course Outcomes:

Students are expected to have gained knowledge

- On the mathematics of flood forecasting and flood routing and to be able to critically review and interpret scientific information
- Have an advanced understanding of flood plain adjustments issues and the other technologies employed to deal with them

### UNIT - I

***Flood characteristics and forecasting:*** Measureable features of a flood (Elevation, discharge, volume, and duration), flood forecasting (unit hydrograph method, meteorological and snow data, and snow field air temperatures), operation of flood forecasting systems.

***Space-time characteristics of rainfall:*** Policy criteria for design flood of a major and minor reservoir, spillways, diversion dams and barrages, design flood criteria for dams and other hydraulic structures (CWC recommendations ).

### UNIT - II

***Flood routing:*** Mathematics of flood routing, various methods of flood routing, Hydrologic and Hydraulic routing.

### UNIT - III

***Flood mitigation:*** Flood mitigation reservoirs(purpose, location, size and operation) levees and flood walls (location, maintenance and flood fighting), flood ways, channel improvement, evacuation and flood proofing, land management, flood plain management, estimating benefits of flood mitigation.

## **UNIT - IV**

***Flood plain adjustments and regulations:*** Results of controlling floods, alternatives to controlling floods, range of possible adjustments, practical range of choice, critical characteristics of flood hazards, classification of flood plain land, and regulation of flood plain use, river training works (guide banks, approach and afflux embankments, spurs / groynes, artificial cut-offs, bank protection, pitched banks, and miscellaneous methods).

## **UNIT – V**

***Hydrologic Time Series Analysis:*** Independent and Auto-correlated data, structure of hydrologic time series, trend, jump, seasonality, stationarity, Auto-covariance and Auto-correlation Function, Correlogram Analysis, spectral Analysis, Analysis of Multi-Variant Hydrologic series.

### **Suggested Reading:**

1. Ven Te Chow (1964), 'Hand Book of Applied Hydrology', McGraw-Hill Publishers, New York.
2. Linsley, R. K. and Franzini A. W. (1992), 'Water Resource Engineering', McGraw-Hill Publishers, New York.
3. Varshney, R. S. (1979), 'Engineering Hydrology', Nem Chand Publishers, Roorkee.
4. Jaya Rami Reddy, P. (1987), 'A. Text Book of Hydrology', Lakshmi Publishers, New Delhi.
5. Daniel H. Hoggan (1989), 'Computer Assisted Flood Plain Hydrology and Hydraulics', McGraw-Hill Publishers, New York.

## INTRODUCTION TO CLIMATE CHANGE

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- To understand basic concepts of General Circulation Models and their importance.
- To know the features of Indian summer monsoon rainfall (ISMR) and their characteristics
- To understand the downscaling principles of statistical downscaling and dynamical downscaling.

### Course Outcomes:

Students are expected to have gained a knowledge of

- Causes of climate changes and its impact on climate especially hydrology.
- Brief introduction of climate modeling especially using statistical downscaling techniques
- Bias correction methods in climate science.

### Unit – I:

Climate System- Weather and Climate- Overview of earth-atmosphere- vertical structure of atmosphere- - Heat Balance of Earth Atmosphere- Radiation and temperature- Temperature variation- Laws of radiation-Radiation Balance- variation with latitude

### Unit - II:

Introduction of Global water balance- cycling of water on land- role of water cycle- simple water balance- climate variables affecting precipitation- Precipitation and Weather, Humidity, Vapor Pressure- atmospheric stability-causes of instability- classification of clouds-precipitation process

### Unit – III:

Monsoon- -Global wind circulation- clouds- Types of clouds-Indian summer monsoon Rainfall (ISMR)- characteristics- Inter-annual variability- Floods- droughts- drought Indicators- climate extremes.

**Unit – IV:**

Causes of climate change- Impacts of climate change on hydrology-Modeling of climate change—IPCC scenarios- IPCC Assessment Report (AR5)-physical science basis- Coupled Model Inter-comparison Project (CMIP)- CMIP5 data downloading procedure- Reanalysis data products.

**Unit - V:**

General circulation models (GCMs) -Bias correction methods -Downscaling – Types of downscaling- Dynamical downscaling- Regional Climate Models - concepts of statistical downscaling- data reduction techniques -principal component analysis- application of Regression methods.

**Suggested Reading:**

1. Bonon G B (2008) - Ecological climatology- Cambridge University Press Edition- II - ISBN-1107268869, 9781107268869.
2. RL Wilby, SP charles, E Zoritaa, B Timbal, P WHetton, LO Mearns (2004) - Guide lines for use of climate science from Statistical Modeling models.
3. Physical science basis of AR 5 report of IPCC (2013)- working group I contribution to Assessment Report- <https://ipcc.ch/report/ar5/wg1/>
4. Rasmus E Benestad, Inger Hanson Baver, Delinag Chen (2008) Empirical Downscaling World Scientific Publishing Co. Ltd.
5. Vente Chow (1964)- Hand Book of Applied hydrology- - Mc Graw Hill Co.

**COMPUTER AIDED ANALYSIS AND DESIGN**

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

**Course Objectives:**

- To learn the software developing skills for structural design
- To understand the computing techniques in the field of structural design
- To study the different software packages for analysis and design

**Course Outcomes:**

- To apply the software skills in the structural design
- To apply computing techniques for analysis and design
- To analyze and design different structural elements with an aid of different software packages

**UNIT - I**

Introduction to computer aided analysis and design using different software packages.

**UNIT - II**

Analysis and design of reinforced concrete slabs, beams, columns and footings using different software packages.

**UNIT - III**

Analysis and design of multi-storied reinforced concrete building using different software packages.

**UNIT - IV**

Analysis and design of industrial roof steel trusses, beams, columns, column bases, plate girders, gantry girders and connections using different software packages.

**UNIT - V**

Analysis and design of multi-storied industrial steel structure using different software packages.

**Suggested Reading:**

1. C. S. Krishnamoorthy and S. Rajeev, Computer Aided Design and Analytical Tools, Narora, 1993.

2. N. Bicanic, Harald Mang, Computer Aided Analysis and Design of Concrete Structures, 1990.
3. F. Damjanic, Computer-aided analysis and design of concrete structures, Pineridge Press, 1984.
4. S. R. Karve, V. L. Shah, Illustrated Design of Reinforced Concrete Buildings, Structures Publications.
5. Srinivasa Prakash Regalla, Computer Aided Analysis and Design, 2010.



**ADVANCED CONCRETE TECHNOLOGY**

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

**Course Objectives:**

- Learn the microstructure characterization of concrete.
- Design high strength concrete mix and various special concretes.
- Study the different factors influencing durability of concrete.

**Course Outcomes:**

- Comprehend the durability concept and crack propagation in structures.
- Study different types of special concrete and their importance.
- Familiarize with the types of non destructive testing methods

**UNIT-I**

Introduction to micro structure of concrete- Hydrated Cement Paste-calcium silicate hydrate and calcium hydroxide, Aggregate Phase, Voids, Water-capillary water, adsorbed water, interlayer water, Interfacial Zone- significance, Relationship between microstructure and properties of concrete.

Micro structure variation with time, Micro structural aspects of special concretes.

**UNIT-II**

Durability of concrete- Durability concept, factors affecting, reinforcement corrosion,; fire resistance, frost damage, sulfate attack, chloride attack, creep and shrinkage, deterioration of concrete, alkali silica reaction, concrete in sea water, quality control, acceptance criteria as per BIS code

Cracks- Reasons, classification, and repair methods of cracks in RCC structures.

**UNIT - III**

Mix design- IS method, DOE method, ACI method, Erntroy and Shacklock's method, Mix design of special concretes- Geopolymer concrete, Self compacting concrete, Self curing concrete, Fibre reinforced concrete, Polymer concrete.

Special processes and technology for particular types of structure - Sprayed concrete; underwater concrete, mass concrete; slip form construction, Prefabrication techniques, Precast concrete and its ingredients.

#### **UNIT - IV**

Special concrete- Fiber reinforced concrete, Self-Compacting-Concrete, Geopolymer concrete, Bacterial concrete, Reactive powder concrete, condensed micro silica concrete, Sulphur impregnated concrete, Ready mix concrete, its- ingredients, fresh properties, mechanical properties, durability properties, practical applications  
Admixtures for high strength, high performance concrete and special concretes.

#### **UNIT - V**

Non-destructive testing of concrete: Need and importance of NDT tests, different type of tests- Rebound hammer, Ultrasonic pulse velocity, core cutting , Infra red thermography camera, Ground penetrating radar, corrosion analyser, bar locating instruments, etc.- Test procedures and analysis of NDT tests.

1. John Newman, Ban Seng Choo, Advanced Concrete Technology Constituent materials- volume 1, - Amsterdam- London , Elsevier, Butterworth-Heinemann, 2003, London.
2. P. Kumar Mehta, Paulo J.M. Monteiro, Concrete, Microstructure, properties, materials, TaTa Mc Graw Hill, 2006.
3. J. Prasad, C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, McGraw Hill Education, 2011.
4. B K Marsh, Design of normal concrete mixes, Construction Research Communications Ltd, BRE publications, 1997.
5. A. M. Nevellie, Properties of concrete, Pearson Education Limited, 2011.
6. M. S. Shetty, Concrete Technology, S. Chand Publishers, 2013.

PE 805 CE

## RETROFITTING AND REHABILITATION OF STRUCTURES

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Understand the basic concepts of deterioration of structures
- Understand the corrosion aspect of steel structures
- Learning the principle of retrofit techniques

### Course Outcomes:

- Will be able to diagnosis and suggest methods to repair of cracks in structures.
- Will be able to diagnosis and suggest methods to prevent deterioration of structures
- Will be able to diagnosis and suggest methods to Strengthen of Existing Structures

### UNIT - I

*Introduction* - Need for study, types of maintenance, routine maintenance works in buildings, inspection, structural appraisal, economic appraisal, general causes of deterioration, general steps for repair and rehabilitation.

*Cracks in Buildings* - Cracks due to moisture changes, thermal variations, elastic deformation, creep, chemical reactions, foundation settlement and vegetation, diagnosis and repair of cracks.

*Moisture Penetration* - Sources and effects of dampness, reasons for ineffective damp proof course, remedies for damp masonry walls, leakage of RCC roofs and pitched roofs, causes and remedial measures, Ferro cement overlay, chemical coatings, flexible and rigid coatings.

### UNIT - II

*Reinforced Concrete Structures* - Causes of deterioration, diagnosis of causes, corrosion of reinforcement and its control, repair of cracks, repair of spalling and disintegration, repair of floors and pavements, conventional methods of repair, special methods, use of polymers, epoxy resins, classification of retrofit techniques – global and local retrofit methods.

### **UNIT - III**

*Steel Structures* - Causes and types of deterioration, mechanism of corrosion, prevention of deterioration, influence of design details, design and fabrication errors, stresses due to erection, methods of repair, plating.

### **UNIT - IV**

*Masonry Structures* - Causes of deterioration, biocidal treatment, preservatives, repair of crack in masonry walls, mortar joint repair, and removal of stains from masonry walls, classification of retrofit techniques – global and local retrofit methods.

### **UNIT - V**

*Strengthening of Existing Structures* - Relieving existing load, strengthening of superstructure, conversion to composite construction, post stressing, jacketing, bonded overlays, addition of reinforcement, strengthening of substructure, underpinning, design for rehabilitation.

### **Suggested Reading**

1. Johnson.S.M., (1980), Deterioration, Maintenance and Repair of Structures, Krieger Publishing, Melbourne, Florida.
2. Guha. P.K., (1998), Maintenance and Repairs of Buildings, New Central Book Agency Ltd., Kolkata.
3. SP: 25-1984, (1999), Handbook on Causes and Prevention of Cracks in Buildings, BIS, New Delhi.
4. Richardson. B.A., (1980), Remedial Treatment of Buildings, Construction Press, London.
5. Chudley. R., (1981), The Maintenance and Adaptation of Buildings, Longman Group Ltd., New York.
6. Agarwal. P., and Shirkhande. M., (2006), Earthquake Resistant Design of Structures, Prentice Hall India, New Delhi.
7. Macdonald.S, (2003), Concrete – Building Pathology, Blackwell Science Ltd., Oxford.
8. Gambhir. M.L, (2004), Concrete Technology, Tata McGraw-Hill, New Delhi, 2004.
9. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand & Co. Ltd., New Delhi.
10. Strecker. P.P., (1987), Corrosion Damaged Concrete – Assessment and Repair, Butterworths, London.
11. Peter H. Emmons, (2001), Concrete Repair and Maintenance Illustrated, Galgotia Publications, New Delhi.

PC 806 CE

## DESIGNING WITH GEOSYNTHETICS

<i>Instruction</i>	<i>: 3 periods per week</i>
<i>Duration of Semester End Examination</i>	<i>: 3 hours</i>
<i>CIE</i>	<i>: 30 marks</i>
<i>SEE</i>	<i>: 70 marks</i>
<i>Credits</i>	<i>: 3</i>

### Objectives:

- To understand the necessity for use of geosynthetics
- To appreciate different types of geosynthetic products and the functions served by each
- To understand the applications of geosynthetics in various civil engineering fields
- To learn the design of geosynthetic applications – concept of “Design by function”
- To understand the construction practices

### Outcomes:

- Able to design with geosynthetics
- Able to design with geomembranes
- Able to design with geocomposites

### UNIT-I

**An overview of Geosynthetics :** Introduction – Classification & basic description of Geosynthetics – manufacturing process – Over view of Geotextiles, Geogrids, Geonets, Geomembranes and Geocomposites.

**Design methods** – Design by cost & availability – Design by specification – Design by function.

### UNIT-II

**Geotextile Properties and Test methods** – Physical, Mechanical, Hydraulic, Endurance and Degradation properties.

**Designing with Geotextiles :** Geotextile functions and mechanisms – Designing for separation – Designing for reinforcement – Designing for stabilization – Designing for filtration – Designing for drainage – designing for multi functions.

### UNIT-III

**Geogrid Properties and Test methods** – Physical, Mechanical, Endurance and Environmental properties.

**Designing with Geogrids :** Designing for geogrid reinforcement

**Geonets Properties and Test methods** – Physical, Mechanical, Hydraulic, Endurance and Environmental properties.

**Designing with Geonets** : Designing for geonet drainage

#### **UNIT-IV**

**Geomembrane Properties and Test methods** – Physical, Mechanical, chemical, biological, thermal and Identification properties.

**Designing with Geomembranes** – Liquid containment liners – Covers for reservoirs – Canal liners – Landfill liners – Caps & closures – Underground storage tanks etc.

#### **UNIT-V**

**Designing with Geocomposites** – Geocomposites for separation – reinforcement – filtration – drainage – liquid/ vapour barriers.

**Construction methods & techniques using Geosynthetics.**

#### **Suggested Reading**

1. Robert, M. K. (1990). “Designing with Geosynthetics.” Prentice Hall, Englewood Cliffs, New Jersey.
2. Venkatappa Rao, G and G.V.S.S.Raju (1990). “Engineering with Geosynthetics.” McGraw Hill Publishing Company Ltd, New Delhi.
3. Hang, Tsang, and Fai. “Foundation Engineering Hand Book.” CBS Publications, New Delhi.
4. Purushotham Raj. “Ground Improvement Techniques.” Laxmi Publications, New Delhi.

## GROUNDWATER MANAGEMENT

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Discuss the characteristic of groundwater flow and storage parameters
- Understand the concept the socio-economic aspects of groundwater hydrology
- Develop numerical solutions for groundwater flow models

### Course Outcomes:

- Able to perform Geophysical methods for ground water exploration
- Able to compute flow from a ground water aquifer.
- Ability to identify ground water contamination sources.

### UNIT - I

**Introduction:** Ground water in hydrologic cycle, Distribution of subsurface water, ground water potential in India and A.P, occurrence of Ground water in hydrogeologic formations, components of groundwater studies, Darcy's law and its validity. Geophysical methods in groundwater Exploration: surface geophysical methods; Electrical resistivity method, seismic method, magnetic method, determination of aquifer thickness.

### UNIT - II

**Governing Equations of Groundwater Flow in Aquifers:** 3-D Ground water flow equations in Cartesian and polar coordinates. Equations for steady radial flow into a well in case of confined and unconfined aquifers, Equations for effect of uniform recharge in a fully penetrating unconfined aquifer, well flow near aquifer boundaries. Equations for unsteady radial flow into a well in case of confined aquifer, determination of S and T by Thei's graphical method, Cooper- Jacob's and Chow's method.

### UNIT - III

**Sources and Types of Groundwater Contamination:** Introduction underground storage tanks, landfills, surface impoundments, waste disposal of injection wells, radioactive contaminants, classification of organic compounds, inorganic compounds in ground water. Mechanism of salt water intrusion, Ghyben-Herzberg relation ,

slope and shape of the interface, prevention and control of seawater intersion, case studies involving sea water intrusion.

#### **UNIT - IV**

**Contaminant Transport:** Introduction, advection process, diffusion and dispersion process, mass transport equation governing flow and transport equations, analytical methods, tests for dispersivity. Non aqueous phase liquids (NAPL'S): Types general processes, transport; fate of NAPL'S in subsurface.

#### **UNIT - V**

**Models in Groundwater Analysis:** major applications of ground water models, sand models, viscous fluid models, membrane models, thermal models, electric-Analog models, numerical modeling of ground water systems.

#### **Suggested Reading**

1. Rastogi, A.K. (2007). "Numerical Groundwater Hydrology." Penram International Publishing (India) Pvt Ltd.
2. Ven-Te-Chow. (1964). "Hand book of Applied Hydrology." McGraw Hill Company, New York.
3. Todd, D.K.(1980). "Groundwater Hydrology." John Wiley and Sons, New York.
4. Karanth, K. R. ( 1987). "Groundwater Assessment, development and Management." Tata McGraw-Hill publishing company New Delhi. aghunath H.M (1982). "Ground Water." Wiley Eastern Ltd, New Delhi.



## INTELLIGENT TRANSPORTION SYSTEMS

<i>Instruction</i>	<i>: 3 periods per week</i>
<i>Duration of Semester End Examination</i>	<i>: 3 hours</i>
<i>CIE</i>	<i>: 30 marks</i>
<i>SEE</i>	<i>: 70 marks</i>
<i>Credits</i>	<i>: 3</i>

### Course Objectives

- To introduce the concept of intelligent transportation systems.
- To understand the functional area of ITS.
- To study the ITS architecture and its applications.

### Course Outcomes:

- Able to plan and specification requirements using ITS
- Able to plan and management aspects for ITS
- Able to prepare architecture and application for ITS

### UNIT- I

**Fundamentals of Intelligent Transportation System(ITS):** Basics of ITS s, The historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

### UNIT-II

**Data Requirements for ITS:** Importance of telecommunications in the ITS system. Information Management, Traffic management Centers (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centers; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL) , Automatic Vehicle Identification (AVI), GIS, data collection using videos.

### UNIT-III

**Functional Areas of ITS:** Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation System (APTS), Advanced Rural Transportation Systems (ARTS). ITS User Needs and Services – Travel and Traffic Management, Public Transportation management, Electronic Payment, Commercial Vehicle Operations, Emergency management, Advances Vehicle safety systems, information Management.

#### **UNIT-IV**

**ITS Architecture:** Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and Safety, and ITS Security ITS as a technology deployment program, research, development and business models/modules , ITS Planning.

#### **UNIT-V**

**ITS Applications :** Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road –pricing; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the world – Overviews of ITS implementation in developed countries, ITS in developing countries.

#### **Suggested Reading:**

1. Joseph, S.S. (2008). “Perspectives on Intelligent Transportation Systems.” Springer publishers,USA.
2. Chowdhury, M. A., Sadek, A. and Boston, M.A. (2003). “Fundamentals of intelligent transportation Systems planning.” Artech House, -USA.
3. Kan Paul and Chen Jhon Miles (2007). “Intelligent Transportation System: Hand Book 2000: Recommendations for World Road Association (PIARC).
4. USDT. (2007). “National ITS Architecture Documentation.” U.S. Department of Transportation, USA.

## PREFABRICATION ENGINEERING

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- To understand prefabrication use in civil Engineering
- To understand various elements of prefabrication
- To understand various prefabrication manufacturing aspects

### Course Outcomes:

- Ability to design simple prefabrication elements
- Ability to design and detailing of precast unit for factories
- Ability to design single storied simple frames

### UNIT - I

*General Principles of Prefabrication* - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization.

### UNIT - II

*Prefabricated Load Carrying Members*-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames.

### UNIT - III

*Prefabricated Elements* - Roof and floor panels, ribbed floor panels, wall panels, footings

*Joints* - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

### UNIT - IV

*Production Technology* - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening.

*Hoisting Technology* - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

## **UNIT - V**

*Applications* - Designing and detailing of precast unit for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span single storied simple frames, single storied buildings, slabs, beams and columns.

### **Suggested Reading:**

1. Mokka. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.
2. Proceedings of the Advanced Course on Design and Construction of Prefabricated Residential Buildings, (1974), Organized by SERC, Madras.
3. Glover.C.W., (1965), Structural Precast Concrete, Asia Publishing House, India.
4. Koncz. I.T., (1968), Manual of Precast Concrete Construction, Vol. I, II, III & IV, Berlin.
5. Lewicki. B., (1966), Building with Large Prefabricates, Elsevier Publishing Co., London.
6. Structural Design Manual – (1978), Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag.
7. Murashev.V, Sigalov. E, and Bailov. V, (1968), Design of Reinforced Concrete Structures, Mir Publishers.
8. CBRI, (1990), Building Materials and Components, India.
9. Gerostiza. C.Z., Hendrickson. C, and Rehat. D. R, (1989), Knowledge Based Process Planning for Construction and Manufacturing, Academic Press, Inc.
10. Warszawski. A, (1990), Industrialization and Robotics in Building – A Management Approach, Harper & Row.

## DESIGN OF BRIDGES

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- To understand various loading standards for Bridges
- To understand various materials for Bridges
- To understand various construction techniques for Bridges

### Course Outcomes:

- Ability to plan and layout of bridges
- Ability to design substructures of bridges
- Ability to design continuous box girders.

### UNIT - I

*Introduction* - Types of bridges, materials of construction, codes of practice (Railway and Highway bridges), aesthetics, loading standards (IRC, RDSO, AASHTO), recent developments, box girder bridges, historical bridges (in India and overseas), planning and layout of bridges, hydraulic design, geological and geotechnical considerations, Developments in road and urban infrastructure.

### UNIT - II

*Concrete Bridges* - Materials and infrastructure requirements, precast systems and materials used for precast and cast in-situ bridges. Bridge deck and approach slabs, design of bridge deck systems, slab-beam systems design philosophies.

### UNIT - III

*Composite Bridges* - Importance of composite bridges, Orthotropic decks, box girders, composite steel structures, concrete bridges, analysis and design of composite sections.

### UNIT - IV

*Sub-structures* - Infrastructure materials required for sub structure, design of Piers, columns and towers, analysis and design, shallow and deep foundations, caissons, abutments and retaining walls.

*Bridge components* - Introduction, Expansion joints, design of joints, types and functions of bearings, design of elastomers bearing, railings, drainage system, lighting.

#### **UNIT - V**

*Long Span Bridges* - Introduction, design specifications, Design principles of continuous box girders, curved and skew bridges, cable stayed and suspension bridges, seismic resistant design, seismic isolation and damping devices.

*Construction Techniques* - Cast in-situ, prefabricated, incremental launching, free cantilever construction, inspection, maintenance and rehabilitation, current design and construction practices. Innovative materials, construction techniques and methodologies.

#### **Suggested Reading :**

1. Wai-Fah Chen Lian Duan, Bridge Engineering Handbook, CRC Press, USA, 2000.
2. R. M. Barker, and J. A. Puckett, Design of Highway Bridges, John Wiley & Sons, New York, 1997.
3. P. P. Xanthakos, Theory and Design of Bridges, John Wiley & Sons, New York, 1994.

PE 811 CE

## ADVANCED REINFORCED CONCRETE DESIGN

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course objectives:

1. Understand the design of curved beams in plan.
2. Understand the analysis and design of portal frames.
3. Know the complete analysis and design of an interior panel of substitute frame.
4. Arrive the procedures of design of flat slabs and raft slabs.

### Course Outcomes

- Able to design curved and deep beams
- Able to design portal frames.
- Able to design flat slabs and raft foundations

### UNIT - I

**Beams Curved in Plan:** Introduction- design principles – structural design of beams curved in plan of circular and rectangular types. Analysis of bending and torsional moment's circular beams. Moments in semicircular beams supported on three columns.

**Deep beams:** Introduction - flexural and shear stresses in deep beams. IS codal provisions-design of deep beams. Detailing and design of shear walls

### UNIT-II

**Portal Frames:** Introduction – definition, IS codal provisions, analysis and design of rectangular portal frames for vertical loading including hinges at the base.

### UNIT - III

**Building Frames:** Substitute frame method of analysis for building frames. Analysis and design of frames with single bay two stories and two bays single storied high rise buildings.

### UNIT - IV

**Flat Slabs:** Introduction, need for flat slab, general notes on flat slabs, advantages and disadvantages of flat slabs components, IS code provisions, design methods, design for flexure and shear, openings in flat slabs.

## **UNIT - V**

**Raft Foundations:** Introduction to raft foundation, need for raft foundation-definitions, types, analysis and design of raft foundation for building with column grids up to three by two.

### **Suggested Reading:**

1. Krishna Raju, N. (1986). "Advanced reinforced concrete Design." CBS publishers.
2. Shah, H, J. (2002). "Reinforced Concrete." Charotar publishers.
3. Varghese, P. C. (2001). "Advanced Reinforced concrete Design" Prentice Hall of India.
4. Punmia, B. C. (1998). "Compressive RCC designs." Laxmi Publications.
5. Prakash Rao, D. S. (1995). "Design Principles and Detailing of Concrete Structures." Tata McGraw-Hill publishing company.
6. Krishna Raju, N. (2009). "Structural Engineering, Design and Drawing." Universities press.



## TRAFFIC ENGINEERING AND INFRASTRUCTURE DESIGN

<i>Instruction</i>	<i>: 3 periods per week</i>
<i>Duration of Semester End Examination</i>	<i>: 3 hours</i>
<i>CIE</i>	<i>: 30 marks</i>
<i>SEE</i>	<i>: 70 marks</i>
<i>Credits</i>	<i>: 3</i>

### Course Objectives:

- To provide an overview of concepts involved in geometric design of Highways, horizontal & vertical alignment of roads & pedestrian facilities.
- Identify key design elements for intersections.
- Describe usage of traffic control devices

### Course Outcomes:

Students who successfully complete this course will be able to:

- Understand the concepts and applications of the elements involved in Highway Infrastructure Design.
- Design intersections, bus bays, cycle tracks, subways

## UNIT –I

**Geometric Design of Highways:** Functional classification of Highway system; Design controls - Topography, Driver characteristics, Vehicle characteristics. Traffic, Capacity and Level of Service, Design speed. Objectives of Geometric Design. Road Margins - design specifications; Pavement surface characteristics - Skid Resistance, measurement of skid resistance; Road roughness, measurement of Road roughness; Camber design and standards.

## UNIT - II

**Horizontal and Vertical Alignment:** Sight Distance - SSD, OSD and ISD. Horizontal curves, Super elevation; computing of super elevation; attainment of super elevation; Extra widening on curves; Transition curves - Objectives and Design. Gradients - Types of Gradients, Design Standards; Summit Curves, Valley curves and Design criteria. Combination of Vertical and Horizontal curves - Grade Compensation. Importance of Sight Distances for Horizontal and Vertical curves.

## UNIT- III

**Design of Intersections:** Types of Intersections; Design Principles for Intersections; Design At-grade Intersections – Channelisation, Objectives; Traffic Islands and Design standards Rotary Intersection - Concept, Advantages and Disadvantages; Grade separated Interchanges - Types, warrants and Design standards as per IRC.

## UNIT-IV

**Traffic Signs and Road Markings:** Types of Road Signs; Guidelines for the provision of Road Signs; Caution Signs, Regulatory signs. Information signs - Design standards. Road markings - Objectives of Road markings; Types of Road Marking, Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Marking Highway Appurtenances-Delineators, Traffic Impact Attenuators, Safety Barriers.

## UNIT – V

**Pedestrian Elements :** Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks - Guidelines and Design standards; Bus bays-Types and Guide lines-Design of On street and Off street parking facilities - Guidelines for lay out Design. Design of Subways and foot over bridges.

### Suggested Reading:

1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna Publications.
2. Traffic Engineering and Transportation Planning, L.R.Kadiyai, Khanna Publications
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers
4. IRC Codes for signs, Markings and Mixed Traffic Control in Urban Areas.

## PROJECT WORK-II

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 50 marks
<i>SEE</i>	: 100 marks
<i>Credits</i>	: 6

### Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic literature survey and documentation
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas

### Outcomes:

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

The aim of project work –II is to implement and evaluate the proposal made as part of project - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments.

The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

- Re-grouping of students - deletion of inters hip candidates from groups made as part of project work-I
- Re-Allotment of internship students to project guides
- Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1<sup>nd</sup> week of VIII<sup>th</sup> semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

# **MANDATORY COURSE**

Course Code: PC901SOC

## **GENDER SENSITISATION**

Instruction	3L per week
Duration of SEE:	3 hours
CIE:	30 Marks
SEE:	70 Marks

### **Course Objectives:**

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

### **Course Outcomes:**

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.

### **UNIT - I**

UNDERSTANDING GENDER: Why Should We Study It? Socialization: Making Women, Making Men: Introduction-Preparing for Womanhood-Growing up male-First lessons in caste-Different Masculinities; Just Relationships: Being Together as Equals: Mary Kom and Onler- Love and acid just do not mix-Love Letters-Mothers and Fathers-Further reading: Rosa Parks-The brave heart.

### **UNIT - II**

GENDER AND BIOLOGY: Missing Women: Sex Selection and Its Consequences - Declining sex ratio- Demographic Consequences; Gender Spectrum: Beyond the Binary - Two or many? - Struggles with discrimination; Our Bodies, Our Health.

### **UNIT - III**

**GENDER AND LABOUR:** Housework: the Invisible Labour :“My mother doesn’t work”- “Share the Load”; Women’s Work: Its Politics and Economics: Fact and fiction-Unrecognized and unaccounted work- Wages and conditions of work.

### **UNIT - IV**

**ISSUES OF VIOLENCE:** Sexual Harassment: Say No! : Sexual harassment- not eve-teasing- Coping with everyday harassment- “Chupulu”; Domestic Violence: Speaking Out : Is home a safe place? When women unite-Rebuilding lives- New forums for justice; Thinking about Sexual Violence: Blaming the victim-“I fought for my life.” - The caste face of violence.

### **UNIT - V**

**GENDER STUDIES:** Knowledge- Through the Lens of Gender - Point of view- Gender and the structure of knowledge- Unacknowledged women artists of Telangana; Whose History? Questions for Historians and Others: Reclaiming a past- Writing other histories- Missing pages from modern Telangana history.

#### **Suggested Reading:**

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, “Towards a World of Equals: A Bilingual Textbook on Gender” Telugu Akademi, Hyderabad, 1st Edition, 2015.
2. [www. halfthesky.cgg.gov.in](http://www.halfthesky.cgg.gov.in)

# **OPEN ELECTIVE SUBJECTS**



**HUMAN-MACHINE INTERFACE  
(OPEN ELECTIVE-III)**

<i>Instruction</i>	<i>3 Periods per week</i>
<i>Duration of University Examination</i>	<i>3 Hours</i>
<i>University Examination</i>	<i>70 Marks</i>
<i>Sessionals</i>	<i>30 Marks</i>
<i>Credits</i>	<i>3</i>

**Objectives:**

- To stress the importance of a good interface design.
- To understand the importance of human psychology in designing good interfaces.
- To motivate students to apply HMI in their day – to – day activities.
- To bring out the creativity in each student – build innovative applications that are user friendly.
- To encourage students to indulge into research in Machine Interface Design.

**Outcomes:** Learner will be able to...

- To design user centric interfaces.
- To design innovative and user friendly interfaces.
- To apply HMI in their day-to-day activities.
- To criticise existing interface designs, and improve them.
- To Design application for social and technical task.

**UNIT-I:**

Introduction - Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields.

The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error

**UNIT-II:**

Understanding goal directed design - Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals.

**UNIT-III:**

GUI - benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.

**UNIT-IV:**

Design guidelines - perception, Gestalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.

#### **UNIT-V:**

Interaction styles - menus; windows; device based controls, screen based controls.

Communication - text messages; feedback and guidance; graphics, icons and images; colours.

#### **Suggested Reading:**

1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale “Human Computer Interaction”, Prentice Hall.
2. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication.
4. Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.
5. Donald A. Normann, “Design of everyday things”, Basic Books; Reprint edition 2002.

## GREEN BUILDING TECHNOLOGIES

<i>Instruction</i>	: 3 periods per week
<i>Duration of Semester End Examination</i>	: 3 hours
<i>CIE</i>	: 30 marks
<i>SEE</i>	: 70 marks
<i>Credits</i>	: 3

### Course Objectives:

- Exposure to the green building technologies and their significance.
- Understand the judicial use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

### Course Outcomes:

- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Know the Sun-earth relationship vis-a-vis its effect on climate.
- Be acquainted with the end-use energy requirements.
- Be familiar with the audit procedures of energy.

### UNIT I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

### UNIT II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

### UNIT III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

## **UNIT IV**

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through

the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

## **UNIT V**

Energy management options: Energy audit and energy targeting - Technological options for energy management.

### **Suggested Reading:**

1. Michael Bauer, Peter Möhle and Michael Schwarz, “Green Building – Guidebook for Sustainable Architecture”, Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, “Heating, Cooling, Lighting - Sustainable Design Methods for Architects”, Wiley, New York, 2015.
3. Mike Montoya, “Green Building Fundamentals”, Pearson, USA, 2010.
4. Charles J. Kibert, “Sustainable Construction - Green Building Design and Delivery”, John Wiley & Sons, New York, 2008.
5. Regina Leffers, “Sustainable Construction and Design”, Pearson / Prentice Hall, USA, 2009.
6. James Kachadorian, “The Passive Solar House: Using Solar Design to Heat and Cool Your Home”, Chelsea Green Publishing Co., USA, 1997.

**DATA SCIENCE USING R**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	70 Marks
Sessional	30 marks
Credits	3

**Objectives:**

- To learn basics of R Programming environment : R language , R- studio and R packages
- To learn various statistical concepts like linear and logistic regression , cluster analysis , time series forecasting
- To learn Decision tree induction, association rule mining and text mining

**Outcomes:**

- Use various data structures and packages in R for data visualization and summarization
- Use linear , non-linear regression models, and classification techniques for data analysis
- Use clustering methods including K-means and CURE algorithm

**UNIT-I**

**Introduction To R:** Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

**Getting Started With R:** Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

**Loading and Handling Data In R:** Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using ‘As’ Operator To Change The Structure Of The Data, Vectors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI’s For Data Input, Using R With Databases And Business Intelligence Systems.

**UNIT-II**

**Exploring Data In R:** Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the

Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

### UNIT- III

**Linear Regression Using R:** Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

**Logistic Regression:** Introduction, What Is Regression? Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

### UNIT - IV

**Decision Tree:** Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

**Time Series In R:** Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

### UNIT-V

**Clustering:** Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

**Association Rules:** Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

**Text Mining:** Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.

Frequent Itemset, Closed Itemset And Association Rules.

Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis

### Suggested Reading:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. The R book, Crawley, Michael J. John Wiley & Sons, Ltd

**GLOBAL AND REGIONAL SATELLITE NAVIGATION SYSTEMS**

<i>Instruction</i>	: (3L) hrs per week
<i>Duration of SEE</i>	: 3 hours
<i>CIE</i>	: 30 Marks
<i>SEE</i>	: 70 Marks
<i>Credits</i>	:3

**Course Objectives:**

- *To explain the basic principle of GPS and its operation.*
- *To make the students to understand signal structure.*
- *To make the students understand the GPS errors.*
- *Highlight the importance of integrating GPS with other systems.*
- *To make the students understand about various GRNSS.*

**Course Outcomes:**

*Student will be*

- *Able to understand the principle and operation of GPS.*
- *Able to understand the GPS Signal structure and services.*
- *Able to understand about various errors.*
- *Able to use of GPS in various fields such as navigation, GIS etc.*
- *Able to understand principle of Operation of various GRNSS.*

**UNIT - I**

Introduction to Satellites, their properties, Orbits and Launch vehicles, Kepler's Laws, GPS fundamentals: Principle of Trilateration, Transit, GPS Operating Principle, Architecture: Space, Control and User Segments and its Frequencies.

**UNIT - II**

GPS Signal structure: C/A and P-Codes, SPS and PPS services, GPS Coordinate Systems: Significance, Types of GPS receivers, Selective Availability, Spoofing and Anti-spoofing.

### **UNIT - III**

GPS Errors: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; Dilution of Precision (DOP).

### **UNIT - IV**

GPS Modernization: Future GPS satellites, New signals and their benefits, New Control Segment, Principle of operation of DGPS, architecture and limitations, GPS Applications: Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular.

### **UNIT - V**

Other GRNSS: GLONASS, GALILEO, QZNSS, CNSS and IRNSS System: Principle of Operation, Features and their Current Status.

#### **Suggested Reading:**

1. Ahmed El-Rabbany, “*Introduction to GPS*”, Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty,” *Understanding GPS principles and applications*”, Artech House Publishers, 2/e Boston & London 2005.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, “*GPS Theory and Practice*,” Springer Verlag, 5/e, 2008.



**ILLUMINATION AND ELECTRIC TRACTION**  
(OPEN ELECTIVE-III)

<i>Instruction</i>	: 4 Periods per week
<i>Duration of University Examination</i>	: 3 Hours
<i>University Examination</i>	: 70 Marks
<i>Sessional</i>	: 30 Marks
<i>Credits</i>	: 3

**Course Objectives:**

- 1) To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.,
- 2) To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- 3) To understand the concept of electrification of traction system.

**Course Outcomes:**

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

- 1) Understand the advantages and disadvantages of different methods of electric heating
- 2) Understand different control techniques used in the operation of three phase induction motors.
- 3) Decide the type and ratings of lights used for different purposes like residential, street lighting, factories etc.
- 4) Understand the electric traction system, type of motors and their speed control.

**UNIT- I**

**Industrial Heating:** Advantages and methods of electric heating. Description, operation and performance of resistance ovens — Design of elements. Core type, Coreless type furnaces, High frequency eddy current heating, Dielectric heating. Arc furnace. Electric welding, Resistance welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

## UNIT- II

### **Schematic Utilization and Connection Diagrams for Motor Control:**

Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

## UNIT- III

**Illumination:** Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations — Determination of M.S.C.P, Rouseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps — Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects — Neon signs, Application to factory lighting, Street lighting and Flood lighting.

## UNIT- IV

**Electric Traction:** System of Electric Traction — Transmission of drive — Systems of track electrification — Traction mechanics — Speed time curves — Tractive effort — Power of Traction motor — Specific energy consumption — Mechanics of train movement— Coefficient of adhesion.

**Traction Motors:** Desirable characteristics, d.c series motors, a.c series motors 3-phase induction motors, d.c motor series & parallel control, Energy saving.

## UNIT - V

**Train Lighting:** Systems of train lighting — Special requirements of train lighting — Methods of obtaining unidirectional polarity — Methods of obtaining constant output — Single battery system — Double battery parallel block system — Principal equipment of double battery system — Coach wiring — Dynamo.

**Batteries:** Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

### **Suggested Reading:**

1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating and Costing, Wiley Eastern Ltd., 1991.
2. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
3. B.L. Theraja, A Text Book of Electrical Technology, S.Chand & Company Ltd, Vol —I.

OE801MT

**STATISTICAL APPLICATIONS IN ENGINEERING  
(Open Elective-III for EEE, MECH, CIVIL)**

<i>Instructions</i>	: 3 hours per week
<i>Duration of SEE</i>	: 3 hours
<i>CIE</i>	: 30 Marks
<i>SEE</i>	: 70 Marks
<i>Credits</i>	: 3 Semester 8

**Course Objectives :**

- To Introduce the basics of Probability
- To provide the knowledge of various distributions like Normal Weibull, Log normal etc
- To provide the knowledge of tests of significance like F-test, t-test and Chi-square test

**Course Outcomes:** At the end of the course students will be able to

- Explain what is meant by a statistic and its sampling distribution
- Apply various probability distributions to solve practical problems
- Estimate unknown parameters of populations and apply the tests of hypothesis
- Judge the independence of attributes of given data.

**Unit I :**

**Basic Probability:** Introduction- Random experiments and events, Mutually exclusive events, Probability of an event, Addition law of Probability, Conditional Probability, Independent events and Independent experiments, Baye's theorem .

Random Variables-One dimensional Random Variable, Discrete Random Variable, Continuous Random Variable.

**Unit II :**

**Basic Statistics :** Measures of Central tendency (Mean, Median, Mode), Moments, Skewness, Kurtosis.

Probability distributions, Binomial, Poisson-Evaluation of statistical parameters for these two distributions.

### **Unit III :**

**Continuous Distributions:** Exponential, Gamma, Normal distribution, Wei-bull distribution,  $\chi^2$  - distribution, t-distribution, F-distribution, Lognormal distribution , Evaluation of statistical parameters for these distributions.

### **Unit IV :**

**Applied Statistics:** Sampling, Standard Error, Test of significance for large samples, Null hypothesis, Alternate hypothesis, Critical region, Critical values, Level of significance, Confidence interval, Test of significance, Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, Difference of standard deviations.

### **Unit V:**

**Test of Significance for Small samples :** Tests of Significance for small samples Test for single mean, Difference of means, Test for ratio of variances ( F- test, t-test), Chi-square test for goodness of fit and independence of attributes.

### **Suggested Reading:**

1. R.K.Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> Edition, 2016.
2. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
3. S.C. Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2014.
4. Peter V. O' Neil., Advanced Engineering Mathematics 7<sup>th</sup> Edition, Cengage Learning.
5. Kanti B. Dutta., Mathematical Methods of Science and Engineering Cengage Learning.
6. N.P . Bali and M. Goyal, " A text book of Engineering Mathematics", Laxmi Publications, 2010.
7. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons ,9<sup>th</sup> Edition, 2012.
8. P.N. Arora,Sumeet Arora, S. Arora, Comprehensive Statistical Methods, S.Chand & Company Ltd, 2008.

## COMPOSITE MATERIALS (Open Elective-III)

<i>Instructions</i>	<i>: (3L) hrs per week</i>
<i>Duration of SEE</i>	<i>: 3hours</i>
<i>CIE</i>	<i>: 30 Marks</i>
<i>SEE</i>	<i>: 70 Marks</i>
<i>Credits</i>	<i>:3</i>

### **Course Objectives:**

- To know the properties of fiber and matrix materials used in composites, as well as some common manufacturing techniques.
- To know the various moulding process and architecture of composite laminates
- To know how to estimate the laminate properties from lamina properties.
- To understand the strength of an orthotropic lamina and measurement of basic composite properties.

**Course Outcomes:** At the end of this course student is expected reach the following outcomes.

- Understand the distinction of composites , its advantages, classification and applications
- Predict the properties of composite lamina and laminate
- Understand the testing of composites and design the structure using the appropriate design criteria.

**Unit - I:** Introduction to composite materials, general characteristics, Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites

**Unit - II:** Molding Processes: hand layup, vacuum molding, compression molding, pultrusion molding, centrifugal molding, filament winding, prepegs and molding compounds and architecture of composite materials: laminates, sandwich composites and other architectures.

**Unit - III:** Micromechanics of Composites: Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

**Unit - IV:** Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

**Unit - V:** Strength of an orthotropic lamina: Maximum stress theory, maximum strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials. Measurement of constituent material properties: Fibre tests, Matrix tests. Measurement of basic composite properties: Tensile test, compressive test, a plane shear test, interlaminar shear test, flexure test.

***Suggested Reading:***

1. Jones, R.M., "Mechanics of Composite Materials", McGraw Hill Co., 1967.
2. Ronald F. Gibson, "Principles of Composite Materials Mechanics", McGraw-Hill, Inc., 1994.
3. Krishan, K. Chewla, "Composite Material", Springer - verlag, 1987.
4. Carl. T. Herakovich, "Mechanics of Fibrous Composites", John Wiley Sons Inc., 1998.

## INDUSTRIAL AND FINANCIAL MANAGEMENT (Open Elective-III)

<i>Instructions</i>	<i>: (3L) hrs per week</i>
<i>Duration of SEE</i>	<i>: 3hours</i>
<i>CIE</i>	<i>: 30 Marks</i>
<i>SEE</i>	<i>: 70 Marks</i>
<i>Credits</i>	<i>:3</i>

### **Course Objectives:**

- To understand various types of organizational structures, manufacturing processes and importance of plant layout and the role of scheduling function in optimizing the utilization of resources
- To understand the importance of quality, inventory control and concepts like MRP I and MRP II
- To understand the nature of financial management and concepts like breakeven analysis, depreciation and replacement analysis

**Course Outcomes:** At the end of this course student is expected reach the following outcomes.

- Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources
- Understand the Fundamental concepts of quality control, process control, material control and appreciate the importance of MRP-I and MRP –II.
- Know the different terminology used in financial management and understand the different techniques of capital budgeting and various types of costs involved in running an industrial organization.

### **Unit-I**

Types of organizations, organizational structures. Designing Products, Services and Processes: New product design and development. Product life cycle: phasing multiple products. Manufacturing process Technology: Product, job shop, batch, assembly line and continuous process technology; flexible manufacturing systems. Design of Services, service process technology operations capacity; capacity planning decisions, measuring capacity; estimating future capacity needs.

## **Unit-II**

Locating production and services facilities, effects of location and costs and revenues, factor rating, simple median model (linear programming) Layout planning; process layout; product layout — Assembly lines; line balancing manufacturing cellular layout. Scheduling systems and aggregate planning for production and services; loading assignment algorithm; priority sequencing and other criteria.

## **Unit-III**

**Quality planning and Control:** basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives. Economics of quality and measurement of the cost of quality. Quality considerations in design.

**Process control:** machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan. Acceptance sampling: single, double and multiple sampling, operating characteristic Curve - calculation of producers risk and consumers risk.

## **Unit-IV**

**Inventory control:** deterministic and stochastic inventory models; variable demand; lead time, specific service level, perishable products and service.

Inventory control in application; concepts for the practitioners; saving money in inventory systems; ABC classifications. Inventory control procedures; Quantity - reorders versus periodic inventory systems; material requirement planning (MRP); MRP as a scheduling and ordering system; MRP system components; MRP computational procedure; Detailed capacity planning; MRP - limitation and advantages; Manufacturing Resources Planning (MRP-II).

## **Unit-V**

Elements of cost, overheads, breakeven analysis, depreciation, replacement analysis. Nature of financial management-time value of money, techniques of capital budgeting and method, cost of capital, financial leverage.

### **Suggested Reading:**

1. Buifa and Sarin, "Production and operations management" - Wiley Publications.
2. I.M. Pandey, "Elements of Financial Management" Vikas Publications, New Delhi, 1994.
3. James C. Van Home & John, M. Wachowicz, Jr., "Fundamentals of Financial Management", Pearson Education Asia, 11<sup>th</sup> ed. 2001.



### 3D PRINTING TECHNOLOGY (Open Elective-III)

<i>Instructions</i>	<i>: (3L) hrs per week</i>
<i>Duration of SEE</i>	<i>: 3hours</i>
<i>CIE</i>	<i>: 30 Marks</i>
<i>SEE</i>	<i>: 70 Marks</i>
<i>Credits</i>	<i>:3</i>

#### Course Objectives:

- To understand the fundamental concepts of 3D Printing, its advantages and limitations.
- To classify various types of 3D Printing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as Mechanical, Bio-medical, Aerospace, electronics etc.

**Course Outcomes:** Upon completion of this course the student will be able to:

- Understand the significance of 3D Printing and compare it with conventional manufacturing process.
- Classify various types of 3D PRINTING processes, rapid tooling and understand the working principle and applications of them with case studies.
- Know the various types of errors that creep up while saving the .STL file format and also will be able to appreciate the features of various types of software's used in 3D Printing.
- Appreciate the diversified applications of 3D PRINTING in various fields like biomedical, aerospace, automobile, defence, architecture etc.

#### UNIT-I

**Introduction:** Prototyping fund3D Printintentials, Historical development, Fund3D Printintentials of 3D PRINTING, Advantages and Limitations of 3D PRINTING , Commonly used Terms, Classification of 3D PRINTING process, 3D PRINTING Process Chain: Fund3D Printintental Automated Processes, Process Chain.

#### UNIT-II

**Liquid-based 3D Printing Systems:** Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and

Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies  
**Solid-based 3D Printing Systems:** L3D Printing  
Inerted Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

### UNIT-III

**Powder Based 3D Printing Systems:** Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS), Electron Be3D Printing Melting.

### UNIT-IV

**3D Printing Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

### UNIT-V

**Applications of 3D Printing :** Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Printed electronics, Biopolymers, Packaging

### Suggested Reading:

1. Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.
2. D.T. Ph3D Printing and S.S. Dimov, Rapid Manufacturing, Springer, 2001.
3. TerryWohlers, Wohlers Report 2000, Wohlers Associates, 2000.
4. PaulF.Jacobs, Rapid Prototyping & Manufacturing ASME Press, 1996.