FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(CBCS Curriculum for the Academic Year 2019-2020)

and

Syllabi

B.E. VII and VIII Semester

of

Four Year Degree Programme

In

Civil Engineering

(With effect from the academic year 2019– 2020)

(As approved in the faculty meeting held on 25-06-2019)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2019

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VII - Semester
(CIVIL ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC 701 CE**	Str. Engg. Design and Drawing – II (Steel)	3	1	-	4	30	70	3	3
2	**PC 702 CE**	Estimation Costing & Specifications	3	1	-	4	30	70	3	3
3	**PC 703 CE**	Finite Element Techniques	3	-	-	3	30	70	3	3
4	**PC 704 CE**	Prestressed Concrete	3	-	-	3	30	70	3	3
5	**PC 705 CE**	Foundation Engineering	3	-	-	3	30	70	3	3
6		Open Elective – II	3	-	-	3	30	70	3	3
7		Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	**PC 751 CE**	Computer Application Lab	-	-	2	2	25	50	3	1
9	**PW 761 CE**	Project Work – I	-	-	4	4	50	-	-	2
10	**SI 762 CE**	Summer Internship	-	-	-	-	50	-	-	2
			21	**02**	**06**	**29**	**335**	**540**		**26**

Open Elective – II			**Open Elective – III**		
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	**OE 771 CE****	Green Building Technologies	1	**OE 781 CE****	Road Safety Engineering
2	**OE 772 CS**	Data Science Using R Programming	2	**OE 782 IT**	Software Engineering
3	**OE 773 EC**	Fundamentals of IoT	3	**OE 783 EC**	Principles of Electronic Communications
4	**OE 774 EE**	Non-Conventional Energy Sources	4	**OE 784 EE**	Illumination and Electric Traction systems
5	**OE 775 ME**	Entrepreneurship	5	**OE 785 ME**	Mechatronics

PC: Professional Course PE: Professional Elective
L: Lectures T: Tutorials P: Practical D: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Note-2: * The students have to undergo a Summer Internship of four weeks' duration after VI semester and credits will be awarded in VII semester after evaluation.
** Subject is not offered to the students of Civil Engineering Department.

Course Code	Course Title						Core / Elective
PC 701 CE	**Structural Engineering Design and Drawing – II (Steel)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Steel Structures	**3**	**1**	**-**	**-**	**30**	**70**	**3**

Course 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.

Course Outcomes

After completing this course, the student will be able to

1. Analyse and design the plate girder and gantry girder.
2. Design the railway steel bridges and bridge bearings.

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.

***Suggested Readings*:**

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/

Course Code	Course Title						Core / Elective
PC 702 CE	**Estimation Costing & Specifications**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Building Material and Construction	**3**	**1**	**-**	**-**	**30**	**70**	**3**

Course 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

Course Outcomes

By the end of this course, the students will be able to

1. prepare tender documents
2. prepare estimates for various engineering structures
3. 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.

UNIT – II

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/International bidding. BOT, BOOT and PPP projects. Role of IT in tenders and construction industry.

UNIT – III

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).

UNIT – IV

Estimation of Irrigation Structures: Pipe culvert, slab culvert, simple bridge, irrigation canal including earth work (cutting and banking), retaining walls, overhead water tank and aqueduct.

UNIT – V

Softwares in estimation: Preparation of estimates using computer software/excel sheets/available softwares, introduction to MS Project.

Suggested Readings:

1. Dutta, B.N. (2016). *Estimating and Costing in Civil Engineering: Theory and Practice*. UBS Publishers' Distributers Pvt. Ltd., New Delhi.
2. Chakraborthi, M. (2002). *Estimating, Costing and Specifications in Civil Engineering*. Chakraborthi, Kolkata.
3. Jagjit Singh. (1996). *Estimating and Costing in Civil Engineering.* Galgotia Publications, New Delhi

Course Code	Course Title						Core / Elective
PC 703 CE	**Finite Element Techniques**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Numerical Methods	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the transition from 2D to 3D structural problems (linear and non-linear).
- Analyse all kinds of loads and their respective effects.
- To introduce a high-end computer oriented numerical analysis tool.

Course Outcomes

After completing this course, the student will be able to

1. Define the behavior of structural elements (2D and 3D).
2. Analyse and evaluate structural frames through stiffness matrices.
3. Model structures using FEM based software's such as ANSYS, ABAQUS, MSC NASTRAN and so on.

UNIT - I

Introduction to Finite Method: Variational approach, Rayleigh-Ritz and Galerkin's methods. Stiffness matrix for two noded bar, truss, and beam elements, problems with three degrees of freedom.

UNIT – II

Stiffness Matrix: Two noded beam element with three degrees of freedom per node. Transformation, generation of stiffness matrix for frames. Strain-displacement and stress – strain relationship in an elastic continuum (linear problems). Equations of equilibrium, and boundary conditions. Plane stress and plane strain problems.

UNIT – III

Formulation of Finite Element Method: Using principle of virtual displacement. Determination of stiffness matrix for three noded triangular element (constant strain triangle), and four noded rectangular element for plane stress and plane strain problems. Convergence criteria for selection of displacement models. Discretisation of continuum. Assembly of global stiffness and load matrices. Displacement boundary conditions.

UNIT – IV

Isoparametric Finite Elements: Direct construction of shape functions for higher order elements using natural co-ordinate system. Shape functions for eight noded parabolic curved iso-parametric element. Determination of element stiffness matrix for four noded quadrilateral element. Use of Jacobian, and Gauss quadrature techniques. Load matrix for eight noded rectangular isoparametric element (for body forces and surface traction).

UNIT – V

Strain Displacement: Stress – strain relation for axisymmetric problems. Stiffness matrix for three noded ring element. Volume co-ordinates and stiffness matrix for four noded tetrahedron element. Exposure to FEM based softwares.

Suggested Readings:

1. O.C. Zienkiewicz and R.L. Taylor, *The Finite Element Method*, Vol. I, McGraw Hill, 1989.
2. K.J. Bathe, *Finite Element Procedures*, Pearson Education, 2006.

3. S. M. Jalaludeen, *Finite Element Analysis*, Anuradha Publications, 2016.
4. S.S. Bhavakatti, *Finite Element Analysis*, New Age International Publishers, 2005.
5. C.S. Krishna Moorthy, *Finite Element Analysis*, McGraw Hill, 1991.
6. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, 2004.

Course Code	Course Title						Core / Elective
PC 704 CE	**Prestressed Concrete**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Reinforced Cement Concrete	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand the basic concept of prestressed concrete and materials used.
- Learn the analysis prestress and load balancing concept.
- Study the flexural and shear design of prestressed concrete beam sections.
- Learn the design of prestressed concrete continuous beam.
- Know the concepts of deflections and end blocks of prestressed concrete sections.

Course Outcomes

After completing this course, the student will be able to

1. Apply the concept of prestressing and determine the losses of prestress.
2. Analyse the prestressed concrete beam and suggest the cable profile for beam.
3. Design the prestressed concrete beam for flexure and shear.
4. Analyse the prestressed continuous beam and determine the concordant cable profile.
5. Estimate the deflection of a prestressed concrete beam and design the end block.

UNIT – I

Introduction to Prestressed Concrete: Historical development, principles of prestressed concrete. Definition, classification and systems of prestressing. Materials for prestressed concrete.

Loss of prestress: Losses of prestress in pre-tensioned and post-tensioned members.

UNIT – II

Analysis of Prestress: Basic assumptions, analysis of prestress, resultant stress, pressure line, kern points, cable profiles, load balancing concept, stress diagrams for prestress, dead load and live load.

UNIT – III

Simply Supported Continuous Beams: concordant cable profile, analysis of continuous prestressed concrete beams.

Design of Sections: Flexural strength design of rectangular, I and T sections using IS code provisions.

UNIT – IV

Design for Shear: Basic concept of shear design, shear failure, flexural shear failure, shear compression failure, shear tension failure, shear strength of beams (a) unfrocked in flexure and (b) cracked in flexure.

UNIT – V

Deflections: Necessity of deflection estimation, limitations of deflections. Deflections of pre-stressed concrete beams with uniformly distributed and point loads.

End Block: Types of end blocks and Importance of end block, Analysis and design of end block by Guyon method and IS method for not more than two cables.

Suggested Readings:

1. T.Y. Lin and N.H. Burns, *Design of prestressed concrete structure*, Jon Wiley and Sons, 1982.
2. A.H. Nilson, *Design of Prestressed Concrete*, John Wiley and Sons, 1982.
3. N. Krishna Raju, *Design of prestressed concrete structure*, Tata McGraw Hill Book Co., 1996.
4. G.S. Pandit and S.P. Gupta, *Prestressed Concrete*, CBS Publishers, 1995.

Course Code	Course Title						Core / Elective
PC 705 CE	**Foundation Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Soil Mechanics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Learn the definition, necessity, types and suitability of different foundation systems.
- Understand the procedures of geotechnical design of foundations.
- Understand the necessity and usage of different foundation construction related aspects.
- Learn about different methods of geotechnical investigations and its role in selection and design of foundations.

Course Outcomes

After completing this course, the student will be able to

1. Understand the stress distribution in soils.
2. Calculate bearing capacity of shallow foundation.
3. Design pile foundation and machine foundation.
4. To learn various aspects of foundation.

UNIT – I

Stress Distribution in Soils: Boussinesq's theory – Computation of increment in vertical stress due to application of a point load (its distribution on horizontal, vertical planes), uniformly distributed circular and rectangular areas –Pressure bulb – Significant depth - Construction and use of Newmark's chart – Westergaard's theory – Validity of elastic theories – Contact pressure distribution.

UNIT – II

Introduction to Foundations: Functional requirements – types – differentiation of shallow and deep foundations – suitability

Safe Bearing Capacity of Shallow Foundations: Definitions - (a) Based on theories –Types of shear failures - Terazaghi's theory for safe bearing capacity of shallow foundations – Effect of type of shear failure / shape of the footing / water table – Provisions of IS: 6403-1981 (b) Based on field tests: Plate load test / Standard Penetration test

Allowable Bearing Capacity of Shallow Foundations: Settlement Analysis – Total settlement – Elastic settlement – Consolidation settlement (ultimate & after any given period – correction for construction period) – Permissible uniform & differential settlements – Proportioning of footings.

UNIT – III

Pile Foundations: Necessity – types based on load transfer mechanism / material / method of installation / functional use – Estimation of vertical load carrying capacity of a single pile – static formulae / Dynamic formulae / Pile load tests – Cyclic pile load test for separation of total capacity in to bearing and friction components – Pile groups – necessity – efficiency of Pile groups - estimation of group capacity – Negative Skin friction – Concept of Piled raft foundation.

UNIT – IV

Caissons: Necessity – types – Essential components of open (well) / box (floating) / Pneumatic caissons - suitability – Sinking of caissons – correction for tilt & shift.

Machine Foundations: differentiation with static foundations – vibration characteristics (frequency / amplitude/ resonance) – types of machines and machine foundations – additional design requirements

Geotechnical Investigations: Necessity – Principles of exploration - objectives – Soil profile – collection of disturbed & undisturbed soil samples – samplers & quality of samples - methods – Trial pit / Bore hole method – Log of bore hole details

UNIT – V

Foundation construction related aspects.

Timbered / braced excavations: Necessity - methods – suitability – distribution of pressure – reaction of struts.

Dewatering: Necessity – methods – sumps (ditches) / well point system (single /multi-stage) / deep well system / elector-osmosis method – merits & demerits – suitability **Coffer dams**: necessity – types – suitability

Underpinning: Necessity – methods (pin / pile) - suitability

Geosynthetics: Classification – functions – applications.

Suggested Readings:

1. Bowles, E. (2012). "*Foundation analysis and Design*", McGraw-Hill Publications.
2. Das, B.M. (2012). "*Principles of Foundation Engineering*", Sengrece Publications.
3. Arora, K.R. (2012). "*Soil Mechanics & Foundation Engineering*" Standard Publications.
4. Verghese, P.C. (2012). "*Foundation Engineering*", PHI Publications.

Course Code	Course Title						Core / Elective
OE 771 CE	**Green Building Technologies**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To impart knowledge of the principles behind the green building technologies.
- To know the importance of sustainable use of natural resources and energy.
- To understand the principles of effective energy and resources management in buildings.
- To bring awareness of the basic criteria in the green building rating systems.
- To understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes

After completing this course, the student will be able to

1. Define a green building, along with its features, benefits and rating systems.
2. Describe the criteria used for site selection and water efficiency methods.
3. Explain the energy efficiency terms and methods used in green building practices.
4. Select materials for sustainable built environment & adopt waste management methods.
5. Describe the methods used to maintain indoor environmental quality.

UNIT-I

Introduction to Green Buildings: Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT- II

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT-III

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT-IV

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Suggested Readings:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. *Alternative building materials and technologies* by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. *Non-Conventional Energy Resources* by G. D. Rai, Khanna Publishers.
5. *Sustainable Building Design Manual*, Vol.1 and 2, TERI, New Delhi 2004.
6. Mike Montoya, *Green Building Fundamentals*, Pearson, USA, 2010.
7. Charles J. Kibert, *Sustainable Construction - Green Building Design and Delivery*, John Wiley & Sons, New York, 2008.
8. Regina Leffers, *Sustainable Construction and Design*, Pearson / Prentice Hall, USA, 2009.

Course Code	Course Title						Core / Elective
OE 772 CS	**Data Science Using R Programming**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course 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

Course Outcomes

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

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

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K-Means implementation in R.

Suggested Readings:

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5. Rafael A Irizarry, Introduction to Data Science, Lean Publishing,2016.

Course Code	Course Title						Core / Elective
OE 773 EC	**Fundamentals of IoT**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**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

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

1. Understand the various applications of IoT and other enabling technologies. Comprehend various protocols and communication technologies used in IoT
2. Design simple IoT systems with requisite hardware and C programming software Understand the relevance of cloud computing and data analytics to IoT
3. 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 Addresses, 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 web services 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 Start-up, 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 (Author), 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.

Course Code	Course Title						Core / Elective
OE 774 EE	**Non-Conventional Energy Sources**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To impart the knowledge of basics of different non-conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature

Course Outcomes

On completion of course the student will be able to:

1. Understand the different nonconventional sources and the power generation techniques to generate electrical power.
2. Understand the Solar energy power development and different applications.
3. Understand different wind energy power generation techniques and applications.
4. Design a prescribed engineering sub-system
5. Recognize the need and ability to engage in lifelong learning for further developments in this field.

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 H2 °2 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 gasifiers.

Suggested Readings:

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.

Course Code	Course Title						Core / Elective
OE 775 ME	**Entrepreneurship**						**Open Elective-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise & project management
- To understand the design principles of solar energy systems, their utilization and performance evaluation
- To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes

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

1. Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Apply the concepts of Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques
5. Understand the Behavioural aspects of entrepreneurs, Time Management, Various approaches of time management, their strengths and weakness. The urgency addiction and time management matrix.

UNIT-I

Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

UNIT-II

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

UNIT-III

Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.

UNIT-IV

Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT-V

Behavioural aspects of entrepreneurs: Personality - determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behaviour. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

Suggested Readings:

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. Stephen R. Covey and A. Roger Merrill, *"First Things First",* Simon and Schuster Publication, 1994.
4. G.S. Sudha, *"Organizational Behaviour",* 1996.
5. Robert D. Hisrich, Michael P. Peters, *"Entrepreneurship",* Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 2005.

Course Code	Course Title						Core / Elective
OE 781 CE	**Road Safety Engineering**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- Introduction to various factors considered for road safety and management
- Explain the road safety appurtenances and design elements
- Discuss the various traffic management techniques

Course Outcomes

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

1. Prepare accident investigation reports and database
2. Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
3. Manage traffic including incident management

UNIT – I

Road Accidents: Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics, Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.

UNIT – II

Safety in Road Design: Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.

UNIT – III

Road Signs and Traffic Signals: Classification, Location of Signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols. Road Marking: Role of Road markings, Classification, visibility. Traffic Signals: Need, Signal face. Illumination and location of Signals, Factors affecting signal design, pedestrians' safety, fixed and vehicle actuated signals. Design of signa1s, Area Traffic control. Delineators, Traffic Impact Attenuators, Road side rest areas, Safety Barriers, Traffic Aid Posts.

UNIT – IV

Traffic Management Techniques: Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Safety cameras, Tests on driver and vehicles, pedestrian safety issues, Parking, Parking enforcement and its influence on Accidents. Travel Demand Management; Methods of Traffic management measures: Restriction of Turning Movements, One-way streets, Tidal Flow Operation Methods, Exclusive Bus Lanes and Closing Side-streets; Latest tools and techniques used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.

UNIT – V

Incident Management: Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Planning effective Incident management program, Best practice in Incident management

programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc. and manmade disasters like sabotage, terrorism etc.

Suggested Readings:

1. Guidelines on Design and Installation of Road Traffic Signals, IRC:93.
2. Specification for Road Traffic Signals, IS: 7537-1974.
3. Principles and Practice of Highway Engineering by L.R. Kadiyali and N.B. Lal.
4. Hand Book of T.E. Myer Kutz, Editor McGraw Hill, 2004.

Course Code	Course Title						Core / Elective
OE 782 CS	**Software Engineering**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- To impart knowledge on various phases, methodologies and practices of software development
- To understand importance of software modelling using UML
- To understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes

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

1. Acquire knowledge about different software development processes and their usability in different problem domains.
2. Understand the process of requirements collection, analysing, and modelling requirements for effective understanding and communication with stakeholders.
3. Design and develop the architecture of real world problems towards developing a blueprint for implementation.
4. Use the UML language to design various models during software development life cycle.
5. Understand the concepts of software quality, testing and maintenance.

UNIT-I

The software Problem: Cost, Schedule and Quality, Scale and change, Software Processes: - Process and project, Component Software Processes, Software Development Process Models, Project management Process.

UNIT-II

Software Requirements Analysis and Specification: Value of a good SRS, Requirements Process, Requirements Specification, Functional Specification with Use Cases, Other approaches for analysis. Software Architecture: Role of Software Architecture Views, Component and connector view, Architectural styles for C & C view, Documenting Architecture Design, Evaluating Architectures.

UNIT-III

Planning a Software Project: Effort Estimation, Project Schedule and staffing, Quality Planning, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling. Design: Design concepts, Function oriented Design, Object Oriented Design, Detailed Design, Verification, Metrics.

UNIT-IV

Coding and Unit Testing: Programming Principles and Guidelines, incrementally developing code, managing evolving code, unit testing, code inspection, Metrics. Testing: Testing Concepts, Testing Process, Black Box testing, White box testing, Metrics.

UNIT-V

Maintenance and Re-engineering: Software Maintenance, supportability, Reengineering, Business process Reengineering, Software reengineering, Reverse engineering; Restructuring, Forward engineering, Economics of Reengineering. Software Process Improvement: Introduction, SPI process, CMMI, PCMM, Other SPI Frameworks, SPI return on investment, SPI Trends.

Suggested Readings:

1. Pankaj Jalote, "Software Engineering- A Precise Approach", Wiley India, 2010.
2. Roger. S. Pressman, "Software Engineering - A Practitioner's Approach", 7th Edition, McGraw Hill Higher Education, 2010.
3. Deepak Jain, "Software Engineering", Oxford University Press, 2008.
4. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning, 2014.
5. Ian Sommerville, "Software Engineering", 10th Edition, Addison Wesley, 2015.

Course Code	Course Title						Core / Elective
OE 783 EC	**Principles of Electronic Communications**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	**Credits**
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**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

1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. 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 Readings:

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

Course Code	Course Title						Core / Elective
OE 784 EE	**Illumination and Electric Traction Systems**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

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

Course Outcomes

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

1. Design the resistive and inductive heating and calculate the requirements of heating power for an industrial need
2. Analyse the type of motor control required and select the type and rating of motor.
3. Understand and Design illumination for different application
4. Understand the traction and use of DC machines
5. Analyse the traction mechanics to arrive at a rating of drive.

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, Rousseau'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, DC series motors, AC series motors 3-phase induction motors, DC 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 Readings:

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.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L. Theraja, A Text Book of Electrical Technology, S. Chand & Company Ltd, Vol —I.

Course Code	Course Title						Core / Elective
OE 785 ME	**Mechatronics**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

Student has to understand the

- How to identify, formulate, and solve engineering problems
- The design a system, component, or process to meet desired needs within realistic constraints
- The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
- The use of drive mechanisms and fluid power systems
- The use of industrial electronic devices
- The demonstrate the design of modern CNC machines, and Mechatronics elements

Course Outcomes

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

1. Model and analyse electrical and mechanical systems and their interconnection
2. Integrate mechanical, electronics, control and computer engineering in the design of Mechatronics systems
3. Do the complete design, building, interfacing and actuation of a Mechatronics system for a set of specifications
4. Be proficient in the use of fluid power systems in various Mechatronics applications
5. Demonstrate the use of industrial electronic devices
6. Demonstrate the design of modern CNC machines, and Mechatronics elements

UNIT-I

Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development

UNIT-II

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors

UNIT-III

Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro pneumatic circuits

UNIT-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to microprocessor & micro controller, Temperature measurement interface and LVDT interface, Systems response

UNIT-V

Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLC programming

Suggested Readings:

1. William Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, 6th edition, Pearson Education
2. HMT Ltd, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998
3. Michaels Histand & David G, Alciatore, Introduction to Mechatronics and Measurement Systems, Tata McGraw-Hill International Edition
4. Devdas Shetty, Richard A. Kolk, Mechatronics System Design, Cengage Learning
5. S.R. Majumdar, Oil Hydraulic Systems – Principles & Maintenance, McGraw-Hill Publishing Company Limited, New Delhi
6. Godfrey Onwubolu, Mechatronics: Principles and Applications, Butterworth-Heinemann

Course Code	Course Title						Core / Elective
PC 751 CE	**Computer Application Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Understand the application of softwares in civil engineering.
- Analysis and design of structural members using software techniques.
- Use of software knowledge for solving fluid mechanics related problems.
- Solving geotechnical problems using software.

Course Outcomes

After completing this course, the student will be able to

1. To use software skills to solve civil engineering related analysis and design.
2. To analyse and design of RCC beam using limit state design.
3. To analyse and solve problems related to hydraulic structures using software.
4. To compute bearing capacity and other geotechnical related problems using software.

List of Experiments to be performed:

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 Φ-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 Muskigham'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 fulfil 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.

Course Code	Course Title						Core / Elective
PW 761 CE	**Project Work - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**50**	**-**	**2**

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

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. 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.

Course Code	Course Title						Core / Elective
SI 762 CE	**Summer Internship**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Knowledge of Civil Engineering	**-**	**-**	**-**	**-**	**50**	**-**	**2**

Course Objectives

- To identify the topic and make a visit to the industry.
- To observe the salient features of the activity.
- To interact with the plant team and get clarity about the operations.
- To present a comprehensive report on the visit.

Course Outcomes

After completing this course, the student will be able to

1. Learn how to approach an industry and get permission.
2. Make technical visit to that plant/site.
3. Learn the Civil Engineering aspects of that plant/site.
4. Prepare a report on the visit covering all salient features of that plant/site/activity.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessionals are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.