SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Civil Engineering) VIII– SEMESTER
AICTE MODEL CURRICULUM (for 2018-2022 & 2019-2023 Batches)

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pro/ Drg	CIE	SEE	
Theory Courses								
1	MC	Gender Sensitization	2	-	-	30	70	-
2	PE	Professional Elective – VI	3	-	-	30	70	3
3	PE	Professional Elective - VII	3	-	-	30	70	3
4	OE	Open Elective -III	3	-	-	30	70	3
Practical/ Laboratory Courses								
5	PW 704 CE	Project Work - II	-	-	12	50	100	**6**
			8	**-**	**12**	**170**	**380**	**15**

Open Elective – III		
1	OE605 EE	Smart Building Systems (Not for EEE & EIE Students)
2	OE606 EE	Programmable Logic Controllers (Not for EEE & EIE Students)
3	OE631 AE	Automotive Maintenance (Not for Mech./Prod./Automobile Engg. students)
4	OE631 ME	Mechatronics (Not for Mech./Prod./Automobile Engg. students)
5	OE603 CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE604 IT	Software Engineering (Not for IT Students)

Professional Elective – 6			**Professional Elective – 7**		
S.No	**Course code**	**Course title**	**S.No**	**Course code**	**Course title**
1	**PE409CE**	Finite Element Techniques	1	**PE413CE**	Concrete Technology
2	**PE410CE**	Principles of Climate Change	2	**PE414CE**	Water and Air quality
3	**PE411CE**	Principle of green buildings	3	**PE415CE**	Intelligent transportation systems
4	**PE412CE**	Construction Equipment and Automation	4	**PE416CE**	Infrastructure Engineering

Course Code	Course Title						Core/Elective
MC901 CE	**GENDER SENSITIZATION**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**-**

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.
- Information about some key biological aspects of genders.
- Reflect critically on gender violence.
- Exposure on egalitarian interactions between men and women.

Course Outcomes

After completing this course, the student will be able to

- Developabetterunderstandingofimportantissuesrelatedtogenderincontemporary India.
- Sensitize to basic dimensions of the biological, sociological, psychological and legal aspects ofgenderthroughdiscussionofmaterialsderivedfromresearch,facts,everydaylife,literatureandfilm.
- Getafinergraspofhowgenderdiscriminationworksinoursocietyandhowtocounterit.
- Better equipped to work and live together as equals.
- 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: RosaParks- the brave heart.

UNIT–II

Gender and Biology: Missing women, sex selection and its consequences, declining sex ratio, demographic consequence, gender spectrum, beyond the binary, two or many, struggles with discrimination, our bodies, our health.

UNIT–III

Gender and Labor: Housework, the invisible labor, 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, no eve teasing, coping with everydayharassment,"Chupulu"domesticviolence,speakingout,ishomeasafeplace?Whenwomenunite,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 Readings:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, Towards a World of Equals: A Bilingual Text book on Gender, Telugu Akademi, Hyderabad, 1st Edition, 2015

PROFESSIONAL ELECTIVES

Course Code	Course Title						Core / Elective
PE 409 CE	**FINITE ELEMENT TECHNIQUES**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Structural Analysis I&II	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course are:

- Understand the numerical finite element modelling of 3D structural problemswith linear and non-linear models.
- Understand the analysis of various loads and displacements relations both for a local element and the global assembly of a structure.
- Perform the numerical analysis for simple problems the procedure for which is same in solving complex problems using high-end computer oriented numerical analysis tools.

Course Outcomes

After completing this course, the student will be able to:

- Formulate the matrix equations for constitutive relationships for 2D and 3D structural elements in plane stress and plane strain problems.
- Formulate the stiffness matrices for various structural elements.
- Formulate global stiffness matrix and load matrix along with assigning appropriate boundary conditions using suitable domain discretization
- Solve for the unknown nodal parameters using Gauss quadrature techniques and interpolating shape functions for Iso-parametric finite elements
- Formulate the Stiffness Matrix, Stress-Strain relationships and boundary conditions for axisymmetric problems.

UNIT - I

Introduction to Finite Element Method: Introduction**,** Stress and Equilibrium. Boundary conditions. Strain – Displacement relations. Stress – strain relations. One Dimensional Problems: Finite element modeling coordinates and shape functions. Plane stress and plane strain problems.

Unit – II

Stiffness Matrix: Stiffness matrix for two noded bar, truss, and beam elements, problems with three degrees of freedom. Transformation, generation of stiffness matrix for frames

Variational approach, Rayleigh-Ritz and Galerkin's methods.

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. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, 2004.
5. C.S.Krishnamoorthy, *Finite Element Analysis, Tata Mcgraw Hill publishing Company.2014*

Course Code	Course Title						Core / Elective
PE 410 CE	**PRINCIPLES OF CLIMATE CHANGE**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Understand basic concepts of general circulation Models and their importance.
- Know the features of Indian Summer Monsoon Rainfall (ISMR) and their characteristics.
- Understand the downscaling principles of statistical downscaling and dynamical downscaling.

Course Outcomes:

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

- Classify and illustrate the various elements of the climate system.
- Identify the various elements of global water balance and causes of instability.
- Analyze the indicators that affect the monsoon and drought conditions
- Make use ofmodels of climate change using various causative parameters and statistical tools.
- Apply the statistical tools for bias correction and data downscaling on general circulation models of climate change.

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, Vapour 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-Modelling 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: 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
2. RL Wilby, SP Charles, E Zoritaa, B Timbal, PW Hetton, 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.

Course Code	Course Title						Core / Elective
PE 411 CE	**PRINCIPLES OF GREEN BUILDINGS**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Learn the principles of green buildings and the available green rating systems for buildings in India and abroad.
- Understand the principles of sustainable development adopted in green buildings through reduce, recycle and reuse strategy in conserving natural resources and energy.
- Understand the principles of landscape preservation, water conservation, energy efficiency, building resources management and indoor air quality in green buildings

Course Outcomes:

After completing this course, the student will be able to

- Outline the various features and benefits of a green building and classify the various parameters used in green rating systems
- Evaluate a building using the green rating criteria for site selection and water efficiency
- Identify the energy efficiency parameters and methods used in green building practices
- Select materials for sustainable built environment & adopt waste management methods
- Apply the various methods for maintaining indoor environmental quality in green buildings

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,Design principles of ground recharge type and storage type rainwater harvesting methods,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, pozzolona 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 Well being: 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

Course Code	Course Title						Core/Elective
PE 412 CE	**CONSTRUCTION EQUIPMENT AND AUTOMATION**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

•Introduce construction equipment and its effective utilization using scientific principles
•Identify construction equipment and its association with different construction works
•Attain knowledge in equipment selection for various activities involved in construction.

Course Outcomes:

- Apply the working procedures of various excavating and earth moving equipment
- Apply various equipment needed for compaction, erection, drilling and demolition
- Understand working procedures of material handling and production equipment.
- Identify and apply automation systems and fire safety equipment in construction sites
- Analyze the various processes of HVAC & Security

UNIT – I

Equipment for Earthwork: Fundamentals of Earth Work Operations- Earth Moving Operations - Types of Earth Work Equipment –Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Excavating and Earth Moving Equipment – Scrapers, Bull Dozers, Tractors, Hauling Equipment– Dump trucks, Dumpers Loaders, trucks.

UNIT – II

Equipment for Earth Compaction-Tamping Rollers, Smooth Wheel Rollers, Sheeps foot Roller, Pneumatic- tyred Roller, Vibrating Compactors, Vibro compaction methods.

Other construction equipment: Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for Compaction- Erection Equipment- Types of pumps used in Construction-Equipment for Dewatering and Grouting– Foundation and Pile Driving Equipment – Equipment for Demolition, Road making equipment.

UNIT – III

Equipment for material handling - Crushers – Feeders - Screening Equipment – Material handling equipment - Cranes, Hoists, Forklifts and related equipment - Portable Material Bins –Conveyors – Hauling Equipment.

Equipment for aggregate production and concreting- Batching and Aggregate Mixing Equipment-Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment–Ready mix concrete equipment, Concrete mixers, Concrete batching and mixing plant, Transportation of concrete mix, Concrete Pouring and Pumping Equipment, Concrete compaction equipment.

UNIT – IV

Introduction to building automation systems (BAS) - Concept and application of Building Automation System, requirements and design considerations and its effect on functional efficiency, architecture and components of BAS.

Fire alarmsystem (FAS) standards- Fundamentals: Fire modes, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. FAS Architectures, loop, Examples. Fire Standards: IS Concept of fire &alarm system..

UNIT – V

Access control security systems-Access Control System: Components, Design. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, Network design, Storage design. Components.Security Systems, Concepts, Components, Technology, Advanced Applications, Security system design.

Heating, ventilation & air conditioning system- HVAC basic processes, Air Properties, Psychometric Chart, Heat Transfer mechanisms, Human comfort zones, Effect of Heat, Humidity, Heat loss. Heating Process & Applications, Cooling Process & Applications, Ventilation Process & Applications. Instrumentation Basics, Field components & use. Air conditioning Components.

Suggested Reading:

1. R.L.Peurifoy, "Construction Planning and Equipment" Tata McGraw-Hill Education; 9th Edition, 2018.
2. Mahesh Varma .Dr., "Construction Equipment And Its Planning And Application", Metropolitan Book Company, New Delhi, 2003
3. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 2008
4. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers Delhi, 2008
5. Gagnon. R. "Design of Special Hazards and Fire Alarm Systems", Thomson Delmar, NY, US, 2007
6. Levenhagen, Spethmann. J.I, Donald . "HVAC Controls and Systems", McGraw-Hill, SG, 1994

Course Code	Course Title						Core / Elective
PE 413 CE	**CONCRETE TECHNOLOGY**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Objectives:

- Understand the behavior of fresh and hardened concrete.
- Learn the design of concrete mixes as per IS, ACI and British Standards
- Know about the precast technology and its uses.

Outcomes:

After completion of this course, the student will be able to:

- Evaluate concrete quality based on its properties at fresh stage and hardened stage
- Interpret the effects of creep and shrinkage on concrete durability and illustrate the microstructure of concrete with all its phases.
- Design the concrete mix using IS code method, British code and ACI code method.
- Identify the use of special concretes based on their properties in different situations.
- Classify the various components of precast technology and the various types of prefabricated components.

UNIT – I

Properties of Fresh Concrete and Hardened Concrete: Review of the physical properties of Concrete, Workability- Factors affecting workability- workability tests. Water/Cement ratio, Segregation and Bleeding of concrete. Mixing and vibration of Concrete. Strength of concrete, Factor effecting strength of concrete. Abram's Law, Gel space ratio. Compressive strength, Flexural Tensile strength, Split tensile strength, Pull out strength , Modulus of Elasticity and Poisson's ratio of Concrete. Method of determining these strength and relevant IS code Provisions.

UNIT –II

Durability of concrete – Factors affecting durability. Creep of concrete- Factors influencing creep- Relation between creep & time- Nature of creep-Effects of creep-Shrinkage-types of shrinkage.

Microstructure of concrete – significance- complexities- Aggregate phase – Hydrated cement phase – Interfacial transition zone – Dimensional stability

UNIT – III

Mix Design: Factors in the choice of mix proportions- Quality Control of concrete- Statistical Quality control- Acceptance criteria- Proportioning of concrete mix – IS method of mix design – British and ACI method of mix design

UNIT - IV

Special Concretes: High strength concrete, Ferro cement mass concrete, light weight concrete, high density concrete, polymer concrete self-compacting concrete, nano concrete recycled aggregate concrete, geo-polymer concrete fiber reinforced concrete shotcrete, reactive powder concrete.

UNIT – V

Introduction To Precast Technology

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

Prefabricated Components

Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Suggested Reading:

1. A. M. Neville , "PropertiesofConcrete,"5th edition, Pearson, 2011
2. M. S. Shetty and A. K. Jain, "Concrete Technology: Theory and Practice," S.Chand& Co., 2018
3. M. L. Gambir, "Concrete Technology: Theory and Practice" Tata Mc Graw Hill Publishers, New Delhi, 2017
4. P. K. Metha and J. M. Monteiro, "Concrete: Microstructure, Properties and Materials," Tata Mc-Graw Hill Education, 2017
5. CBRI, Building materials and components, India, 1990
6. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
7. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009
8. "Handbook on precast concrete buildings," Indian Concrete Institute (ICI), Chennai, 2016.

Course Code	Course Title						Core / Elective
PE 414 CE	**WATER AND AIR QUALITY MODELING**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Understand modelling concepts.
- Describe air quality and water quality models.
- Explain computer-based simulation and various software's.

Course Outcomes:

- Classify modelling techniques, models based on mass conservation and mass balance
- Classify and describe the parameters involved in various air quality models
- Formulate the various water quality models.
- Develop linear programming models and other optimization techniques to estimate the air and water quality.
- Gain knowledge of and explain the features of various software related to air and water quality modelling.

UNIT – I

Modeling Concepts: Casual and statistical models-characteristics-steps in model development-importance of model building conservation of mass and mass balance-calibration and verification of models.

UNIT – II

Air Quality Modeling

Modelling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Metrological Modelling – Diagnostic Models -Prognostic Models – diffusion models, modifications of Gaussian plume equation -long term average- receptor oriented and source oriented air pollution models ,Numerical Models, model performance, accuracy and utilization.

UNIT – III

Water Quality Models

Mass balance equation -Mathematics of Pollutant Transport – Advection- dispersion-In-Water Transformation- Waste load allocations – Basic mechanisms of river self-purification, Dissolved Oxygen dynamics Streeter-Phelps and Dobbins models, Pollutant and nutrient dynamics, Temperature dependence and transport, Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants – Ground Water Quality Modelling – Contaminant solute transport equation, Numerical methods.

UNIT – IV

Computer Based Simulation

Formulation of linear optimization models. Linear programming. Sensitivity testing and duality. Solutions techniques and computer programming, Formulation of linear optimization models. Finite difference finite element method of pollutant dispersion- Optimization river pollutant and management models finite element method of pollutant dispersion-optimization river pollutant and management models-Application of models- simulation, parameters estimation of

experiment design. Model uncertainty reliability.

UNIT – V

Software

Air quality Model -ARMOD, CALPUFF. – UNAMAP- BLP-RAM-ISCMPTER-CRSTER- Surface water quality models -HSPF, QUAL2K,.

Suggested Reading:

1.Deaton, M.L and Winebrake, J.J., Dynamic Modelling of Environmental Systems, Verlag, 2000.

2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, 2008.

3.Arthur C. Stern., Air Pollution (Third Ed.) Volume I – Air Pollutants, their transformation and Transport, (Ed.), Academic Press, 2006.

4.Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013

5.Dykes, A.P., Mulligan, M., and Wainwright, J, Monitoring and Modelling dynamic environment, Wiley – Blackwell 2015.

6.Paolo Zanetti, Air Pollution Modelling – Theories, computation Methods and available Software Springer. New York, 1990

7.Benedini G. Tsakiris Water Quality Modelling for Rivers and streams Springer , New York , 2013

Course Code	Course Title						Core / Elective
PE 415 CE	**INTELLIGENT TRANSPORTATION SYSTEMS**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives:

The objectives of this course is to

- Understand ITS & ATIS
- Know the functional areas of ITS such as ATMS, CVO, AVCS and APTS, ARTS
- Study of ITS architecture and its applications

Course Outcomes:

After completing this course, the student will be able to:

- Plan and specify the requirements using ITS
- Plan and management aspects for ITS
- Prepare architecture and application for ITS
- Illustrate the functional areas of ITS and their user needs and services
- Explain the overview of ITS in highway incident management systems

UNIT – I

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT – II

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System.

UNIT – III

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

UNIT – IV

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT – V

Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.Traffic and incident management systems – ITS and sustainable mobility, travel demand management, electronic toll collection.

Suggested Reading:

1. Ghosh, S., Lee, T.S., “Intelligent Transportation Systems: New Principles and Architectures”, CRC Press, 2000
2. Chowdhury, M. A., Sadek, A. and Boston, M.A., “Fundamentals of Intelligent Transportation Systems Planning”, Artech House, Inc., USA, 2003
3. Joseph, S.S., “Perspectives on Intelligent Transportation Systems”, Springer publishers, USA, 2008
4. Sussman, J. M., “Perspective on ITS”, Artech House, Inc., USA, 2005

Course Code	Course Title						Core / Elective
PE 416 CE	**INFRASTRUCTURE ENGINEERING**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives

- Examine the power sector infrastructure requirements including maintenance issues.
- Review various infrastructures needs of roads, railways, water ways and airports
- Discuss various communication systems and postal services infrastructure requirements.

Course Outcomes

- Demonstrate the understanding of the power sector infrastructure needs and maintenance strategies.
- Evaluate the public & private sector role in infrastructure development
- Develop strategies for Infrastructure Planning and its Implementation
- Implementation of environmental laws and regulations

  Demonstrate the understanding of the strategies for successful implementation of infrastructure projects

UNIT-I

An Overview of Infrastructure Engineering: Urban Infrastructure and Rural Infrastructure in general. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages in an Infrastructure Project, Concept of Lifecycle., etc., An Overview of Infrastructure Projects in power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors and Telecommunications.

UNIT-II

Public and Private Sector Role in Infrastructure Development: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization , Challenges in Privatization Water Supply, Power, Infrastructure, Road Transportation Infrastructure in India, BOOT, BOT, DBFOT, PPP,HAM -Case studies preferable.

UNIT-III

Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Core Economic and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure – Case studies preferable.

UNIT-IV

Environmental and Social Impact Assessment Aspects: categories, attributes and parameters, identification of environmental and social impacts over project area and over project cycle. Special considerations involving land and water interrelationships, environmental laws and regulations

UNIT-V

Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects. Governments Role

in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

Suggested readings:

1. Grigg, Neil, "*Infrastructure Engineering and Management*", Wiley, 1988.
2. Hudson, Hasnuddin, *"Infrastructure Management: Integrating Design, Construction,Maintenance, Rehabilitation and Renovation",* McGraw Hill, 1997.
3. Anjaneyulu, Y &Manickam, V, *"Environmental Impact Assessment Methodology"*. B.S.Publications, Hyderabad, 2012.
4. P. Chandra, *"Projects: Planning, Analysis, Selection, Financing, Implementation andReview"*, Tata McGraw-Hill, New Delhi, 2009.
5. A. S. Goodman and M. Hastak, *"Infrastructure Planning Handbook: Planning, Engineeringand Economics",* McGraw-Hill, New York, 2006.

OPEN ELECTIVE III

Course Code	Course Title						Core / Elective
OE405EE	**SMART BUILDING SYSTEMS**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To understand the basic blocks of Building Management System.
- To design various sub systems (or modular system) of building automation
- To integrate all the sub systems

Course Outcomes:

Student will be able to

- Describe the basic blocks and systems for building automation
- Use different subsystems for building automation and integrate them
- Understand basic blocks and systems for building automation
- Design different systems for building automation and integrate those systems

UNIT – I

Introduction: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT – II

Fire Alarm (FA) System: concept of fire, Fire modes, History, Components, and Principles of Operation. Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. Types of FAS Architectures, Examples. Classification of FAS loops, Examples. FAS Design procedure in brief, NFPA 72A, BS 5839, IS, Concept of IP enabled fire & alarm system, design aspects and components of PA system.

UNIT – III

Access Control System: Access Components, Access control system Design.

CCTV: Camera Operation & types, Camera Selection Criteria, Camera Applications, DVR Based system, DVM, Network design, Storage design. Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system. CCTV Applications.

UNIT – IV

Security Systems Fundamentals: Introduction to Security Systems, Concepts.

Perimeter Intrusion: Concept, Components, Technology, Advanced Applications. Security system design for verticals. concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control –DAC, MAC, RBAC.

EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.

UNIT – V

Energy Management: Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples.

Building Management System: IBMS (HVAC, Fire &Securi-ty) project cycle, Project steps BMS, Advantages & Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Readings:

1. Jim Sinopoli, *Smart Buildings*, Butterworth-Heinemann imprint of Elsevier,2nd ed., 2010.
2. Reinhold A. Carlson, Robert A. Di Giandomenico, *Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs),* R.S. Means Company Publishing, 1991.
3. Albert Ting-Pat So, WaiLok Chan, Kluwer, *Intelligent Building Systems*, Academic publisher,3rd ed., 2012.
4. Robert Gagnon, *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar Learning; 2nd edition, 2007.
5. Levenhagen, John I.Spethmann, Donald H, *HVAC Controls and Systems*, McGraw-Hill Pub.
6. Hordeski, Michael F, *HVAC Control in the New Millennium*, Fairmont press, 2001.
7. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

Course Code	Course Title						Core / Elective
OE406EE	**PROGRAMMABLE LOGIC CONTROLLERS**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To be able to understand basics of Programmable logic controllers, basic programming of PLC.
- To make the students to understand the Functions and applications of PLC

Course Outcomes:

Student will be able to

- Develop PLC programs for industrial applications.
- Acquire the knowledge of PLC counter functions and PLC Arithmetic functions and data handling functions.

UNIT – I

PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information- Programming Procedures - Programming Equipment - Programming Formats- Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT – II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT – III

Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

UNIT – IV

Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC repetitive clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT – V

Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Readings:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.
2. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, Mc-Graw Hill, 2019.

Course Code	Course Title						Core / Elective
OE431AE	**AUTOMOTIVE MAINTENANCE**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To study basic types of vehicle maintenance along with its importance
- To understand the trouble diagnosis procedure for electrical and electronic systems in automobiles
- To acquaint with various Trouble shooting, fault tracing practices available in automobile industry
- To understand the maintenance procedure for air-conditioning in automobiles.

Course Outcomes:

Student will be able to

- Demonstrate the maintenance procedure for automotive Engine.
- Illustrate the trouble diagnosis procedure for electrical systems like Battery, Starting Systems
- Identify the trouble diagnosis procedure for steering and suspension system
- Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
- Explain trouble diagnosis procedure for heating system of automobile.

UNIT – I

Maintenance, Workshop Practices, Safety and Tools: Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis.

vehicles, fire safety - First aid. Basic tools –Scheduled maintenance services – service intervals - Towing and recovering.

UNIT – II

Engine and Engine Subsystem Maintenance: introduction engine IC Engine General Engine service- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management. **S**ervice - fault diagnosis- servicing emission controls.

UNIT – III

Transmission and Driveline Maintenance: Clutch- general checks, adjustment and service- road testing, Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT – IV

Steering, Brake, Suspension and Wheel Maintenance: Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage.

UNIT – V

Auto Electrical and Air Conditioning Maintenance: Maintenance of batteries, starting system,

charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

1. Ed May, "*Automotive Mechanics Volume One*", McGraw Hill Publications, 2003.
2. Ed May, "*Automotive Mechanics Volume Two*", McGraw Hill Publications, 2003
3. *Vehicle Service Manuals of reputed manufacturers*
4. *Bosch Automotive Handbook*, Sixth Edition, 2004

Course Code	Course Title						Core / Elective
OE431ME	**MECHATRONICS**						**OE -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

- Model and analyse electrical and mechanical systems and their inter connection
- Integrate mechanical, electronics, control and computer engineering in the design of Mechatronics systems
- Do the complete design, building, interfacing and actuation of a Mechatronics system for a set of specifications
- Be proficient in the use of fluid power systems in various Mechatronics applications
- Demonstrate the use of industrial electronic devices
- 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, PLCprogramming

Suggested Reading:

1. William Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, 6th edition, PearsonEducation
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 InternationalEdition
4. Devdas Shetty, Richard A. Kolk, Mechatronics System Design, CengageLearning
5. S.R. Majumdar, Oil Hydraulic Systems – Principles & Maintenance, McGraw-Hill Publishing Company Limited, NewDelhi
6. Godfrey Onwubolu, Mechatronics: Principles and Applications,Butterworth-Heinemann

Course Code	Course Title						Core / Elective
OE403CE	**ROAD SAFETY ENGINEERING**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Introduce 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 student will be able to

- Prepare accident investigation reports and database
- Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
- Manage traffic including incident management
- Apply crash reduction techniques
- Design of urban Infrastructure considering safety aspects

UNIT – I

Introduction: Road Safety scenario in India and World, Road Accident Characteristics.

Traffic Safety Analysis: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT – II

Accident Analysis: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction. Application of computer analysis of accident data.

UNIT – III

Road Safety in planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT – IV

Traffic Signals & Road signs: Traffic Signals, Factors affecting signal design, street lighting, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, signs.

UNIT – V

Traffic Management safety audit: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

References:

1. L.R. Kadiyali and N.B. Lal, “Principles and Practice of Highway Engineering”, New Delhi, 2006
2. Myer Kutz, “Hand Book of Transportation Engineering”, Editor McGraw Hill, 2004.
3. Kadiyali, L. R. "Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi, 2006
4. Guidelines on Design and Installation of Road Traffic Signals, IRC: 93.
5. Specification for Road Traffic Signals IS: 7537-1974.

Course Code	Course Title						Core / Elective
OE404IT	**SOFTWARE ENGINEERING**						**OE -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
- To impart knowledge on various phases, methodologies and practices of software development
- To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics

Course Outcomes:

Student will be able to

- Acquired working knowledge of alternative approaches and techniques for each phase of software development
- Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS.
- Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
- Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns.

UNIT – I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models

UNIT – II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

Suggested Readings:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009

2. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, OxfordUniversity Press, 1996

3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008

Course Code	Course Title						Core / Elective
PW402CE	**PROJECT WORK - II**						**CORE - PROJECT**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	**-**		**12**	**50**	**100**	**6**

Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Outcomes:

- Analyse the specific problem using engineering knowledge to arrive at a solution methodology
- Formulate an investigation procedure and analyze, interpret, and synthesize the obtained data using a laboratory procedure and/or modern engineering software and tools.
- Draw valid conclusions and engineering solutions including design, recommendations, or estimations, keeping in view the safety norms and regulations in codes of practice.
- Discuss and communicate in oral and written forms, the technical contents of the project, observing professional ethical principles of documentation.
- Demonstrate individual and teamwork skills in carrying out and managing the project work

CoursePlan

1. In depth study of the topic assigned in the light of the preliminary report prepared in the VII semester
2. Review and finalization of the approach to the problem relating to the assigned topic
3. Preparing a detailed action plan for conducting the investigation, including team work
4. DetailedAnalysis/Modelling/Simulation/Design/ProblemSolving/Experimentasneeded
5. Final development of product / process, testing, results, conclusions and future directions Preparing a paper for Conference presentation/Publication in Journals, if possible
6. Preparing a report in the standard format for being evaluated by the Internal Departmental Committee
7. Final project presentation and viva voce by the faculty coordinator including external expert

Internal Evaluation

Maximum Marks: 50

Evaluation of Project-1 should be based on the progress reported by the student and certified by the supervisor. Evaluation is done based on the students presentation, twice in the semester ie. mid semester evaluation and end semester evaluation. Sessional marks are awarded by the evaluation committee comprising of two faculty members and the supervisor. Marks are allotted based on the students presentation, Report preparation and students ability to answer the questions raised by the examiners.

Distribution of marks	Activity	Weightage
Mid semester evaluation (25)	Supervisor	**10**
	Examiners	**15**
End semester evaluation (25)	Supervisor	**10**
	Examiners	**15**

Distribution of marks for the Project final is as follows:
(i) Two progress assessments:**20 marks** by the faculty supervisor(s)
(ii) Assessmentsandfinalprojectreport:**30marks**bytheinternalfacultycoordinator/reviewcommittee

ExternalEvaluationbyUniversityappointedexternalexaminerMax imumMarks: 100

Distribution of marks for the Project final is as follows:

(i) Project presentation and viva voce : 50 marks
(ii) Project Report Assessment : 50 marks

Note: All the three evaluations are mandatory for course completion and forwarding the final grade.