For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) VII– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	PC417CE	Estimation and Specification	2	-	-	30	70	2
2	ES310 CE	Disaster Preparedness & Planning	3	-	-	30	70	3
3	PE	Professional Elective –4	3	-	-	30	70	3
4	PE	Professional Elective -5	3	-	-	30	70	3
5	PE	Professional Elective -6	3	-	-	30	70	3
6	OE	Open Elective -II	3	-	-	30	70	3
7	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	30	70	-
Practical/ Laboratory Courses								
8	PC460CE	Estimation and Specification Laboratory	-	-	2	25	50	1
9	PW 702CE	Summer Internship Evaluation	-	-	-	50		2
10	PW 703CE	Project Work – I			6	50		3
			18	**-**	**6**			**23**

*Technical Report and Seminar / based on summer industrial Internship/Mini Project

Professional Elective – 4		
S.No.	**Course Code**	**Course Title**
1	PE 513 CE	Prestressed Concrete
2	PE 514 CE	Highway Construction and Management
3	PE 515 CE	Environmental Impact Assessment of Civil Engineering Projects
4	PE 516 CE	Instrumentation & Sensor Technologies for Civil Engineering Applications

Professional Elective – 5			**Professional Elective – 6**		
S.No.	**Course Code**	**Course Title**	**S.No.**	**Course Code**	**Course Title**
1	PE 517 CE	Structural Engineering Design & Detailing	1	PE 521 CE	Finite Element Method
2	PE 518 CE	Intelligent Transportation Systems	2	PE 522 CE	Urban Transportation Planning
3	PE 519 CE	Water and Air Quality Modelling	3	PE 523 CE	Surface Hydrology
4	PE 520 CE	Principles of Green Buildings	4	PE 524 CE	GIS and Remote Sensing

Open Elective – II		
1	OE603 EE	Non-Conventional Energy Sources (Not for EEE & EIE Students)
2	OE604 EE	Transducers and Sensors (Not for EEE & EIE Students)
3	OE621 AE	Automotive Safety and Ergonomics (Not for Mech./Prod./Automobile Engg. students)
4	OE621 ME	Entrepreneurship (Not for Mech./Prod./Automobile Engg. students)
5	OE602 CE	Green Building Technologies (Not for Civil Engg. Students)
6	OE602 CS	Data Science Using R (Not for CSE Students)
7	OE 603 IT	Cyber Security (Not for IT Students)

ESTIMATION AND SPECIFICATION

PC 417 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 2

Objectives:
1. Acquire knowledge on various types of specifications used in construction
2. Learn to prepare rate analysis for various item of works in construction
3. Evaluate the actual value of land and buildings

Outcomes:
1. Estimate the quantities of materials used in various construction works
2. Compute and prepare bar bending schedules.
3. Prepare rate analysis for various quantities
4. Assess the value of land and buildings

UNIT – I

Specification writing: Definition, purpose and importance of specifications, Types of specification, General and detailed specifications for major items of buildings as per Telangana State Standard Data and Schedule of Rates, modes of measurements, general rules for the measurements and its units of different items of civil engineering work.

UNIT – II

Detailed estimation: Definition, purpose, types of estimates, factors influencing estimation, various methods of approximate estimate of buildings, Detailed estimate for Flat roof building (load bearing and RCC framed) - long and short wall method - centre line method. Detailed estimate of road works for WBM roads, Bituminous and CC road (including earth work), single cell rectangular box culvert, retaining walls, overhead water tank and earth work of irrigation canals (cutting and banking).

UNIT – III

***Estimation of reinforcement quantities*:** Estimation of steel quantities and preparation of bar bending schedule (BBS) - RCC framed works for Slabs, Beams and Columns, Footings (Rectangular, Isolated), Stair Case, Overhead rectangular tank and Retaining wall.

UNIT – IV

Rate analysis of civil work: Preparation of analysis of rates and theoretical requirements of materials as per the Telangana State Standard Data and Schedule of Rates, for major items of works of buildings, bituminous and concrete roads.

UNIT – V

Valuation of Buildings: Introduction, Basic elements - Market Value, Book Value, Salvage Value, Replacement Cost, Earning Value, Potential Value, Written Down Value, Different Methods of Valuation - Land and Building Method - Land tenure - Freehold Land and Leasehold Land, Land Valuation, Replacement Cost of Building, Depreciation, Value as per Land and Building Method, A Typical Example for Valuation by Land and Building Method. Introduction to MS Project.

Suggested Reading:

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

3 Jagjit Singh. *Estimating and Costing in Civil Engineering*. Galgotia Publications, New Delhi, (1996).

4 B. S. Patil," *Civil Engineering Contracts and Estimation*", Orient Black swan Private Ltd; Fourth edition 2015.

5 Gurcharan singh & Jagdish singh, "Estimating Costing and Valuation", Standard Publishers Distributors, 2012.

6 Standard Scheduled Rates and Relevant BIS Codes (SP:27 & BIS: 1200)

For the academic years 2020-2024

DISASTER PREPAREDNESS AND PLANNING

ES 310 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1) To impart knowledge of the basic principles of disaster management.
2) To give knowledge of the various types of disasters.
3) To understand the disaster management cycle and framework.
4) To become aware of the disaster management systems in India.
5) To become aware of the applications of the latest technologies in disaster management

Outcomes:

After completing this course, the student will be able to

1) Define and explain the terms and concepts related to disaster management.
2) Describe the various categories of disasters and their specific characteristics.
3) Explain the pre-disaster, during disaster and post-disaster measures and framework
4) Describe the disaster management acts and frameworks specific to India
5) List and explain the various technological applications to aid disaster management.

UNIT-I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity – Disaster and Development, and disaster management.

UNIT-II

Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

UNIT-III

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation.

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR.

UNIT-IV

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies.

UNIT-V

***Applications of Science and Technology for Disaster Management*:** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its

Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

Suggested Reading:

1. Rajib, S and Krishna Murthy, R. R, *Disaster Management Global Challenges and Local Solutions"* CRC Press, 2009.
2. Navele, P & Raja, C. K, *Earth and Atmospheric Disasters Management, Natural and Manmade. B. S. Publications.2009*
3. Battacharya, T., *Disaster Science and Management*. Tata McGraw hill Company, 2017
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. *An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, New Delhi
6. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. *Disaster Management Act 2005*, Publisher by Govt. of India
9. *Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management*
10. National Disaster Management Policy, 2009, Govt. of India
11. Jagbir singh, Disaster management–Future challenges and opportunities, I.K. International publishing house, 1st edition, 2007.

    Coppala P Damon, Introduction to International Disaster management, Butterworth-Heinemann, 2015.

PROFESSIONAL ELECTIVES - 4

PRESTRESSED CONCRETE

PE 513 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Understand the basic concept of prestressed concrete, learn the analysis of prestress.
2. Learn the design of prestressed concrete continuous beam, study the flexural and shear design of prestressed concrete beam sections.
3. Know the concepts of deflections and end blocks of prestressed concrete sections.

Outcomes:

1. Apply the concept of prestressing and determine the losses of prestress.
2. Analyze the prestressed concrete beam and suggest the cable profile for beam.
3. Analyze the prestressed continuous beam and determine the concordant cable profile.
4. Design the prestressed concrete beam for flexure and shear.
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.

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*:** Advantages of continuous member – codal provisions, 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*:** Principle stresses – codal provisions – cracked and uncracked sections – Design of shear reinforcement.

UNIT – V

***Deflections*:** Importance of deflections, factors influencing deflections, codal provisions – short-term and long-term deflections of pre-stressed concrete beams with uniformly distributed and point loads.

End Block: Nature of stresses, stress distribution – codal clauses – IS code method of design

Suggested Reading:

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

HIGHWAY CONSTRUCTION AND MANAGEMENT

PE 514 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

1.To understand the various equipment used for road construction and difficulties associated with highway drainage.
2.To analyze the defects in road construction and general pavement failures with remedies.
3.Characteristics of different types of bituminous layers and design of bituminous surfacing along with safety aspects needed for roads
4.To design the base course thickness and selection of materials as base layer for CC pavements.

Course Outcomes:

After completing this course, the student will be able to:
1.Design bituminous surfacing and other layers along with safety aspects needed during construction.
2.Design the base course thickness and select materials for base layer in CC pavements.
3.Analyze the defects in road construction and general pavement failures and propose suitable remedies.
4.Select suitable equipment for preparation of subgrade and preparation stages for base and sub base layers
5.Gain the knowledge on the equipment used for road construction and difficulties associated with highway drainage.

UNIT – I

Flexible Pavement Construction: Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers and their choice.

UNIT – II

Cement Concrete Pavement Layers: Specifications and method of cement concrete pavement construction; Construction of interlocking block pavements, Quality control tests; Construction of various types of joints

UNIT – III

Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil-aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods. Use of additives, Numerical problems on mix design and applications.

UNIT – IV

Pavement Evaluation - Pavement Distress - Functional and structural condition of pavements, Pavement distress survey, Functional condition evaluation of pavements- Roughness, Skid Resistance. Structural evaluation of pavements - nondestructive testing, Benkelman beam and Falling Weight Deflectometer, Pavement strengthening based on deflection as per IRC, Maintenance and rehabilitation techniques.

UNIT – V

Pavement Management Systems - Pavement Management Systems Components, structure, data requirements, Project level and Network level needs, Pavement performance prediction – concepts, modelling techniques– AASTHO, CRRI and HDM models, Budget forecasting for maintenance and rehabilitation, Ranking and optimization methodologies, lifecycle costing.

Suggested Reading:

1. Peurifoy, R.L., and Clifford,J.S "*Construction Planning Equipment and Method*"- McGraw Hill Book Co. Inc
2. Sharma S.C., "*Construction Equipment and its Management*"- Khanna Publishers
3. "*Hand Book on Cement Concrete Roads*"- Cement Manufacturers Association, New Delhi
4. MoRTH "*Specifications for Roads and Bridge Works*"- 2001,IV revision, Indian Roads Congress
5. MoRTH "*Manual for Construction and Supervision of Bituminous Works*"- 2001, Indian Roads Congress
6. MoRTH "*Manual for Maintenance of Roads*"- 1989, Indian Roads Congress

ENVIRONMENTAL IMPACT ASSESSMENT FOR CIVIL ENGINEERING PROJECTS

PE 515 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To impart knowledge on different concepts of Environmental Impact Assessment.
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods.
4. To pre-requisites for ISO 14001 certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

Outcomes:

1. Prepare EMP, EIS, and EIA report
2. Identify the risks and impacts of a project
3. Selection of an appropriate EIA methodology
4. Estimate the cost benefit ratio of a project
5. Know the role of stakeholder and public hearing in the preparation of EIA

UNIT – I

Basic concept of EIA: Elements of EIA-factors affecting EIA-Initial Environmental Examination-life cycle analysis preparation of Environmental Base map-Classification of environmental parameters – role of stakeholders in the EIA preparation –stages in EIA.

UNIT – II

E I A Methodologies: **I**ntroduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis – EIS and EMP.

UNIT – III

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives-application of remote sensing and GIS for EIA. Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures – E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Generalized approach for assessment of Air Pollution Impact.

UNIT – IV

Environmental Audit & Environmental legislation, objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities. The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Civil Engineering Projects.

UNIT – V

Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Suggested Reading:

1. *Environmental Impact Assessment Methodologies*, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad. 2011
2. *Environmental Impact Assessment: Theory and Practice,* by M. Anji Reddy, Butterworth-Heinemann, 2017
3. *Environmental Pollution and Control*, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd., Delhi.
4. *Environmental Science and Engineering*, by Suresh K. Dhaneja – S.K. Katania & Sons Publication, New Delhi.
5. *Environmental Impact Assessment*, Canter Larry W., McGraw-Hill education Edi (1996)
6. *Environmental Science and Engineering*, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers.

For the academic years 2020-2024

INSTRUMENTATION AND SENSOR TECHNOLOGY IN CIVIL ENGINEERING

PE 516 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand measurement units, types of measurement and errors in measurement
2. Evaluate electrical variables, converse various measurements
3. Understand various types of sensors and understand sensors used for temperature measurement

Outcomes:

1. Able to measure the errors in instruments
2. Apply the knowledge of electrical instruments for measurement
3. Apply various sensors used in flow, pressure, level measurement

UNIT – I

Introduction to measurement, instrument types: Introduction, Measurement units, Review of instrument types, Static characteristics of instruments, dynamic characteristics of instruments
Measurement errors Introduction, Gross and systematic errors, absolute errors and relative errors, accuracy precision, resolution and significant figures, measurement error combinations

UNIT – II

Electrical indicating and test instruments: Introduction, Digital Meters, Analog Meters, Cathode ray oscilloscope, Digital storage oscilloscope
Variable conversion elements: Introduction, Bridge circuits, Resistance Measurement, Inductance measurement, capacitance measurement, current measurement, frequency measurement, phase measurement

UNIT – III

Sensor technologies: Introduction, Types of Sensors, Piezo electric Transducers, Ultrasonic Transducers
Temperature measurement: Introduction, Principles of Temperature measurement, Thermoelectric effect sensors, Varying resistance devices, semiconductor devices, Radiation thermometers, thermography, Thermal expansion methods, Intelligent temperature measuring instruments

UNIT – IV

Pressure measurement: Introduction, Diaphragms, Capacitive Pressure sensor, Fibre-Optic Pressure sensor, Bellows, Bourbon tube, Manometers, Resonant Wide devices, Dead-weight gauge, Special measurement devices for low pressures, high-pressure measurement, Intelligent pressure transducers

UNIT – V

Flow measurement & level measurement: Introduction, Mass flow rate, Volume flow rate, Intelligent flow meters, Introduction to level measurement, Dipsticks, float systems, ultrasonic level gauge, radar methods, radiation methods, intelligent level measuring systems

Suggested Reading:

1 Bell D. A., *Electronic Instrumentation and Measurements*, Oxford, LN, UK, 2007.
2 Morris A. S. *Measurement and Instrumentation Principles*, Butterworth Hienemann,LN, UK, 2001.
3 Tumanski S. *Principle of Electrical Measurement*, Taylor & Francis, LN, UK, 2006.
4 Gertsbakh I. *Measurement Theory for Engineers*, Springer, BL, Germany, 2010
5 https://www.sensy.com/en/blog/instrumentation-for-civil-engineeringapplications-b38
6 https://www.iitk.ac.in/nicee/wcee/article/13_1791.pdf

PROFESSIONAL ELECTIVES - 5

STRUCTURAL ENGINEERING DESIGN & DETAILING

PE 517 CE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To understand and designing of Soil Retaining structures
2. To familiarize with the types, suitability, selection, design criteria of various types of RCC& Steel bridges
3. To understand the design of welded plate girder and gantry girders

Outcomes:

1. Analyse and design the RCC Deck slab bridge.
2. Analyse and design of R.C.C Tee beam bridge.
3. Design of welded plate girder
4. Analyze and design Plate girder steel bridge.
5. Analyze and design Bearings of steel bridge.

UNIT – I

Design of RCC Slab Bridges: IRC loadings, Elastic Design and Detailing of RC bridge deck slab using effective width methods.

UNIT – II

Design of RCC T Beam Bridges:. Use of Pigaud's curves for the design of slab. Design and detailing of Cross beams and Tee Beam of a Tee beam bridge.

UNIT – III

Plate Girder: Limit State Design of welded plate girder for static loads – including flange curtailment, connections, Intermediate and bearing stiffeners, web and flange splice.

UNIT – IV

Steel Bridges: Deck and through type bridges - Economical span – Indian standard Railway broad gauge train loadings - permissible stresses – Detailed design and drawing of plate girder

UNIT – V

Bearings: Types of bearings – Rocker and Roller – Elastic Design of bearings for bridges.

Suggested Reading:

1 David Darwin, Charles W. Dolan, Arthur H. Nilson, "Design of Concrete Structures" , 15th Edition, McGraw Hill, 2016.

2 Krishna Raju, N., "Structural Design and Drawing: Reinforced Concrete", Universities Press,1992.2009.

3 Johnson Victor, D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co., New Delhi, Fourth Edition, 1991
4 Bhavikatti, S.S., "Design of Steel Structures", I.K. International Publishing House, Pvt. Ltd., 2010
5 Shiyekar, M.R. "Limit State Design of Steel Structural
6 Duggal, S. K., "Limit State Design of Steel Structures", Tata McGraw-Hill Publications, 2009
7 Subramanian, N, "Limit State Design of Steel Structures", Oxford University Press, 2008

Relevant IS Codes:

1) IS: 456-2000, "Code of Practice for Plain and Reinforced concrete", Bureau of Indian Standards, New Delhi, India.
2) IS- 800-2007 " General Construction in steel - Code of Practice" Bureau of Indian Standards. ,New Delhi, India
3) IRC:6 -2000 "Standard specification and code of practice for Road Bridges" Section II Load and Stresses. The Indian Road Congress
4) Bridge Rule : Third Reprint 2014- Ministry of Railways. Govt. of India

INTELLIGENT TRANSPORTATION SYSTEMS

PE 518 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of
1.To introduce the concept of intelligent transportation systems.
2.To understand the functional area of ITS.
3.To study the ITS architecture and its applications.

Outcomes:

After completing this course, the student will be able to:
1.Plan and specification requirements using ITS
2.Plan and management aspects for ITS
3.Prepare architecture and application for ITS
4. Illustrate the functional areas of ITS and their user needs and services.
5. 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. ITS Hand Book 2000: *Recommendations for World Road Association (PIARC)* by Kan Paul Chen, John Miles.
2. Sussman, J. M., *Perspective on ITS,* Artech House Publishers, 2005.
3. *National IT'S Architecture Documentation,* US Department of Transportation, 2007 (CD-ROM)
4. Joseph, S.S. (2008). "*Perspectives on Intelligent Transportation Systems*", Springer publishers, USA.
5. Chowdhury, M. A., Sadek, A. and Boston, M.A. (2003). "*Fundamentals of Intelligent Transportation Systems Planning*", Artech House, -USA.

WATER AND AIR QUALITY MODELLING

PE 519 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

After completing the course, the students will be knowing the modeling concept of air and water quality and its applicability in the Control of Air and Water pollution

Outcomes:

1. Describe the modeling concepts.
2. Will be able to understand the importance of Diagnostic Models.
3. The students will learn the mass balance equation and knowing the water quality models.
4. The ability to apply the linear programming models and experimental design.
   Will get an unsight on air quality model softwares.

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 Modelling

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

For the academic years 2020-2024

PRINCIPLES OF GREEN BUILDINGS

PE 520 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

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

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, 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

PROFESSIONAL ELECTIVES - 6

FINITE ELEMENT METHOD

PE 521 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives

The objectives of this course is to impart knowledge of:

1. To introduce the transition from 2D to 3D structural problems (linear and non-linear).
2. Analysis of all kind of loads and their respective effects.
3. 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 and3D).
2. Analyse and evaluate structural frames through stiffness matrices.
3. Analyse the Stiffness matrix for 3 noded & 4 noded elements
4. Evaluate the problems in numerical solution, integration jacobian.
5. Model structures using FEM based software's such as ANSYS, ABAQUS, MSC NASTRAN etc

UNIT - I

***Introduction to Finite Element 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. 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*

URBAN TRANSPORTATION PLANNING

PE 522 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of

1. To discuss various urban transportation systems planning process and its components
2. To understand a variety of travel surveys and data collection procedures
3. To review different travel demand forecasting models

Outcomes:

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

1. Describe and evaluate various urban transportation issues and planning methodologies
2. Identify the appropriate data collection methods and its procedures
3. Demonstrate effective way of understanding trip distribution and mode split models
4. Explain various issues related to trip assignment and land use transportation models

UNIT – I

Introduction: Transport and socioeconomic activities - Historical Development of Transport - Role of transportation in the economic development of nations, overview of transport modes, growth trends - Fundamentals of transportation , Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems - Emerging future trends in Transportation Systems.

UNIT – II

***Data Collection and Travel Surveys*;** Collection of data - design of survey format - organization of surveys and analysis - study area definition, zoning system, types and sources of data, road side interview method, home interview survey, in-vehicle surveys, sampling, types, various techniques, expansion factors, logical checks, use of secondary sources of data, planning variables, vehicles ownership, projection of data and statistical techniques.

UNIT – III

Travel Demand Forecasting; Various trends, overall planning process, short and long term planning, travel attributes, traffic analysis zones, trip generation, category analysis, concept of gravity model, trip distribution, model split and trip assignment and land use transportation interaction.

UNIT – IV

***Trip Distribution*:** Gravity Model of Trip Distribution - Calibration of Gravity Model - Growth Factor method, - Uniform factor method - average factor method - time series models - aggregate and disaggregate models.

Mode Split Analysis: Influencing Factors - Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model - Disaggregate Mode-Choice Model, Logit Model of Mode Choice - Binary Choice Situations - Multinomial Logit Model - Model calibration.

UNIT – V

Route Assignment: Description of transport network, Route Choice Behavior, The Minimum Path, Minimum Path Algorithm, Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment.

Suggested Reading:

1 Hutchinson, E.G., *Principles of Urban Transport Systems Planning*, McGraw Hill, New York,1974.
2 Kadiyali, L. R. "*Traffic Engineering and Transport Planning, 2003*."
3 John W.Dickey.(1975). *Metropolitan Transportation Planning*. Mc Graw Hill Book Company, New York.
4 Ortuzar, J. and Williamson, E.G., *Modelling Transport*, Wiley, Chinchestor,1994.
5 Oppenheim, N., *Urban Travel Demand Modelling: From Individual Choices to General Equilibrium*, Wiley, New York,1995.

For the academic years 2020-2024

SURFACE HYDROLOGY

PE 523 CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Objectives:

1. Understand theoretical concepts of water and sediment movements in rivers
2. Understand the hydrologic extremes of floods and the mitigation measures to combat them.
3. Understand the concepts of Statistical methods and its applications in Engineering.
4. Understand the concepts of urbanization and its impact on the natural water cycle

Outcomes:

1. Able to apply the knowledge of soil erosion and sedimentation to estimate the life of the reservoir
2. Develop the flood inundation modeling and suggest suitable flood control measures.
3. Able to estimate the various losses of precipitation, stream flow and runoff.
4. Development of Rainfall-Runoff relationship
5. Able to understand the planning and operation of Urban water management.

UNIT – I

Formation of surface water Resources-Streams, rivers, lakes, swamps, caves, seas and oceans: Definition of river, river basins and water divides, formation of river valleys, fluvial deposits, alluvial fans, meandering of rivers, formation of different types of lakes, deltas and valleys.

Sediment discharge, Sediment transport, Sediment yield of watersheds, suspended load and bed load measurements, reservoir sedimentation-sediment movement and deposition, reduction in reservoir capacity, reservoir sedimentation control.

UNIT – II

Flood Routing- Introduction, basic equation, Hydrologic storage routing, attenuation, Hydrologic channel routing, Hydraulic methods of flood routing.

Flood Control- Structural and non-structural methods, flood control in India, national and state bodies involved for mitigation and management of floods as a natural disaster.

UNIT – III

Stream flow Measurement – Stage and Velocity Measurement – Gauges – Current meter and Doppler flow velocity meter - Discharge measurement – direct methods (Area-Velocity method, Dilution techniques, electromagnetic method, ultrasonic method), indirect methods (Slope-area method, discharge measuring Structures(weirs, flumes and gated structures),Stage-Discharge relationship , Selection of a Stream Gauging Site.

UNIT – IV

Statistics in Hydrology- Introduction, Statistical parameters, central tendency parameters, dispersion characteristics, skewness, probability distribution, discrete and continuous distribution, frequency analysis, log Pearson type III distribution, regression and correlation, standard forms of bivariate equations, multivariate linear regression and correlation, analysis of time series, selection of a design return period, determination of permissible risk.

UNIT – V

Urban Water Management- urban hydrology, major issues in urban storm water management, objectives and limitations, airport drainage design, urban water resource management models, urban storm water management practices, rainwater harvesting.

Suggested Reading:

1. Chow V.T., Maidment D.R., Mays L.W., "*Applied Hydrology*", McGraw Hill Publications, New York, 1995.
2. Subramanya K., "*Hydrology,Tata McGraw Hill Co*., New Delhi, 1994.
3. Patra.K.C, "*Hydrology and Water Resources Engineering*",Narosa Publications, 2008, 2nd Edition, New Delhi.
4. Jay Rami Reddy.P, "*Hydrology*", Laximi Publications, New Delhi, 2004
5Raghunath H.M., "*Hydrology*", New Age International Publishers, New Delhi, 2014.
6. Martin, P. Wanelista and Yousef, A. Yousef., *Storm Water Management*, John Wiley and sons,1993
7. Jay L.Devore, "*Probability and statistics for Engineering and the Sciences*", 5th Edition, Thomson and Duxbury, Singapore, 2002

GIS AND REMOTE SENSING

PE 524 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives: The objectives of the course is to provide

1.Basic concept of Remote Sensing and know about different types of satellite and sensors
2.Comprehend concepts of GIS and its applications
3.Knowledge of GIS software and able to work with GIS software in various application fields

Course Outcomes:
After completing this course, the student will be able to:
1.Explain the basics of Remote Sensing, different types of satellite and sensors
2.Define the principles of satellite remote sensing, able to comprehend the energy interactions with earth surface features, spectral properties of water bodies
3.Demonstratethe basic concept of GIS and its applications, know different types of data representation in GIS
4.Create the spatial data using various techniques
5. Develop models using spatial & Terrain Analysis

UNIT – I
Basics of Remote Sensing: Definition, History, Advantages, Aerial Photography and Satellite Remote Sensing, Components of Remote Sensing System: Energy Source, Energy-Atmosphere Interaction, Energy Interaction with Atmosphere and Surface Materials, Spectral Signatures

UNIT – II
Remote Sensing Platforms: Aircrafts and Satellites, Orbital Characteristics of Sun-synchronous and Geostationary satellites - Special Purpose Satellites; Remote Sensing Sensors: Types of Sensors, Active and Passive; Framing Systems (Cameras) - Scanning System; Sensor Characteristics: Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution.

UNIT – III
Introduction to GIS: History of development of GIS- GeoSpatialData - GIS operations- Standard GIS packages, Applications of GIS;
Datum and Map Projections: Concept of Datum, Coordinate Systems and Map Projections , Transformations

UNIT – IV
Data Models: Spatial and Non-Spatial Data models; Spatial Digital formats
Spatial Data Creation: Scanners, digitizers; Digital Elevation Models; Sources of Errors & Corrections- Rotation and Resampling methods.

UNIT – V
Spatial Data Analysis: Raster data analysis; Vector data analysis - Buffering, Overlay, Union, Intersect, Merging, splitting operations
Terrain Modelling & Analysis: Contouring, Vertical profiling, Hill shading, 3D perspectives; Slope & Aspect analysis, Viewshed & watershed analysis.

Software: Introduction to QGIS or ARCGIS software and its interface to perform spatial analysis

Suggested Reading:

1 Chang, K. T. (2016). Geographic information system. *International Encyclopedia of Geography: People, the Earth, Environment and Technology*, 1-10.

2 Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.

3 Reddy, M. A., & Reddy, A. (2008). *Textbook of remote sensing and geographical information systems* (pp. 4-4). Hyderabad: BS publications.

For the academic years 2020-2024

OPEN ELECTIVE II

NON-CONVENTIONAL ENERGY SOURCES

OE 603 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. Toimparttheknowledge ofbasicsofdifferentnon-conventionaltypesofpowergeneration&powerplants
2. To helptheminunderstandingtheneedandroleofNon-Conventional Energysources particularlywhentheconventionalsourcesarescarcein nature

Outcomes:

Student will be able to
1. Understandthedifferentnonconventionalsourcesandthepowergenerationtechniquestogenerate electricalpower.
2. UnderstandtheSolarenergypowerdevelopmentanddifferentapplications.
3. Understanddifferentwindenergypowergenerationtechniquesandapplications.
4. Designa prescribedengineeringsub-system.
5. Recognizetheneedandabilityto engagein lifelonglearningforfurtherdevelopmentsin thisfield.

UNIT – I
ReviewofConventionalandNon-Conventionalenergysources -Needfornon-conventionalenergysources. Typesof Non-conventionalenergysources-Fuel Cells- Principleof operationwithspecial referenceto H_2O_2Cell-ClassificationandBlockdiagram offuelcellsystems - Ionexchangemembranecell-Molten carbonatecells-Solidoxideelectrolytecells-Regenerativesystem-Regenerative FuelCell-Advantages anddisadvantagesofFuelCells-Polarization-ConversionefficiencyandApplicationsofFuelCells.
UNIT – II
Solarenergy-Solarradiationand itsmeasurements-SolarEnergycollectors-SolarEnergystoragesystems-SolarPond-ApplicationofSolarPond-Applicationsofsolarenergy.
UNIT – III
Windenergy-Principlesofwindenergyconversion systems-Natureofwind-PowerintheWind-Basic components ofWECS-ClassificationofWECS-Siteselectionconsiderations -Advantagesand disadvantages ofWECS-Windenergycollectors-Windelectricgeneratingandcontrolsystems-ApplicationsofWindenergy-Environmentalaspects.
UNIT – IV
EnergyfromtheOceans-OceanThermalElectricConversion (OTEC)methods-Principlesoftidalpower generation-Advantages andlimitationsoftidalpowergeneration-Oceanwaves-Waveenergyconversion devices-Advantagesanddisadvantages ofwaveenergy-Geo-ThermalEnergy-TypesofGeo-Thermal EnergySystems-ApplicationsofGeo-ThermalEnergy.
UNIT – V
EnergyfromBiomass-Biomassconversiontechnologies/processes-Photosynthesis -Photosynthetic efficiency-Biogas generation-SelectionofsiteforBiogasplant-Classification ofBiogas plants-Details ofcommonlyusedBiogasplantsinIndia-Advantagesanddisadvantages ofBiogasgeneration-Thermal gasificationofbiomass-Biomassgasifiers.

Suggested Readings:

1. RaiG.D,*Non-ConventionalSourcesofEnergy*,KhandalaPublishers,NewDelhi,1999.
2. M.M.El-Wakil,Power*PlantTechnology*.McGrawHill,1984.

For the academic years 2020-2024

TRANSDUCERS AND SENSORS

OE 604 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. To expose the students to various sensors and transducers for measuring mechanical quantities.
2. To understand the specifications of sensors and transducers.
3. To learn the basic conditioning circuits for various sensors and transducers.
4. To introduce advances in sensor technology.

Outcomes:

Student will be able to
1. Familiar with the basics of measurement system and its input, output configuration of measurement system.
2. Familiar with both static and dynamic characteristics of measurement system.
3. Familiar with the principle and working of various sensors and transducers.

UNIT – I
Introduction to measurement system (MS) static characteristics of MS:linearity, Hysteresis, Threshold, Repeatability, Reliability and maintainability, Span, Calibration. ***Sensor Fundamentals***: Basic sensor technology and sensor system Sensor characteristics, system characteristics, instrument selection, data acquisition and readout, and installation.
UNIT – II
Resistive Transducer: Classification of transducers, Basic requirements of transducers, Variable resistance transducers; Potentiometers, Strain gauge (SG), types of Strain Guage.
UNIT – III
Variable capacitive transducers:Capacitance, Principles, Capacitance displacement transducers, Capacitive hygrometer, and capacitive proximity transducers. ***Variable inductive transducers****:* Linear variable differential transformer, Rotary variable differential transformer.
UNIT – IV
Measurement of temperature*:* Standards for calibration of temp. Temperature measuring devices, types of filled in system thermometers — liquid in glass, vapour pressure, bimetallic on solid rod thermometer Resistance temperature detectors, thermostat thermocouple.
UNIT – V
Advance Sensors:Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, Digital displacement sensors, Fibre optic sensor, Semiconductor sensor and Smart sensors.

Suggested Readings:

1. C.S.Rangan, G R Sarma& V S N Mani, *Instrumentation Devices and Systems*-TMH, 2nd Edition2004.
2. B.Nakra&Chowdhari, *Instrumentation Measurement and Analysis*, TMH, 2nd Edition 2003.
3. D.V.S.Murthy, *Transducers and Instrumentation*, PHI, 1995 4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education,2000.
4. Doebelin E.O, *Measurement Systems - Application and Design*, 4th Edition, McGraw-Hill, New Delhi.
5. PatranabisD, *Principles of Industrial Instrumentation*, 2nd Edition, Tata McGraw Hill, New Delhi,1997.
6. Jon Wilson *Sensor Technology Handbook*, Newness PublicationElsevier.

AUTOMOTIVE SAFETY AND ERGONOMICS

OE 621AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. To impart knowledge of automotive safety and ergonomics
2. To understand the basics of vehicle collision and its effects.
3. To understand the various safety concepts used in passenger cars
4. To Gain knowledge about various safeties and its equipment.
5. To understand the concepts of vehicle ergonomics.

Outcomes:

Student will be able to
1. Explain the types and importance of vehicle safety.
2. Describe the various safety equipments used in automobiles.
3. Demonstrate the modern tools used for vehicle safety.
4. Explain the role of automotive ergonomics in automobiles.
5. Demonstrate the best comfort and convenience system in vehicle.

UNIT – I
Introduction:Design of the Body for safety, Energy equations, Engine location, Effects of Deceleration inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of Crumble zone and Safety sandwich construction, Active and passive safety, Characteristics of vehicle structures, Optimization of vehicle structures for crash worthiness, Types of crash / roll over tests, Regulatory requirements for crash testing, instrumentation, High speed photography, image analysis.
UNIT – II
Safety Concepts:Active safety- driving safety, Conditional safety, Perceptibility safety and Operating safety, Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact, pedestrian safety, human impact tolerance, determination of injury thresholds, severity index, study of comparative tolerance, Study of crash dummies.
UNIT – III
Safety equipments:Seat belt, automatic seat belt fastening system, Collapsible steering column, tilt-able steering wheel, Air bags, electronic systems for activating air bags, Frontal design for safety, collision warning system, Causes of rear end collision, frontal object detection, rear vehicle object detection system, Object detection system with braking system interactions. Anti-lock braking system ESP and EBD systems
UNIT – IV
Vehicle Ergonomics:Introduction to human body - anthropometrics and its application to vehicle ergonomics, Cockpit design, Driver comfort – seating, visibility, Man-machine system-psychological factors – stress, attention, Passenger comfort - ingress and egress, spaciousness, Ventilation, temperature control, Dust and fume prevention and vibration, Interior features and conveniences, Use of modern technology for the same
UNIT – V
Comfort and Convenience System: Cabin comfort - in-car air conditioning – overall energy efficiency, Air management, central and Unitary systems, air flow circuits, air cleaning, ventilation, air space diffusion, Compact heat exchanger design, controls and instrumentation, Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system, Automotive lamps, types, design, construction, performance, Light signalling

devices- stop lamp, Rear position lamp, Direction indicator, Reverse lamp, reflex reflector, position lamp, gas discharge lamp, LED, Adoptive front lighting system (AFLS) and Daylight running lamps(DRL).

Suggested Readings:

1. Prasad, Priya and BelwafaJamel, "*Vehicles Crashworthiness and Occupant Protection*", American Iron and Steel Institute,USA.
2. JullianHappian-Smith "*An Introduction to Modern Vehicle Design"* SAE,2002
3. Bosch - "*Automotive Handbook*" - 5th edition - SAE publication -2000.
4. *"Recent development in Automotive Safety Technology*", SAE International Publication. Editor: Daniel J Helt,2013.
5. Keitz H.A.E. "*Light Calculations and Measurements*", Macmillan1971.

ENTREPRENEURSHIP

OE621ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To motivate students to take up entrepreneurship infuture
2. To learn nuances of starting an enterprise & projectmanagement
3. To understand the design principles of solar energy systems, their utilization and performance evaluation
4. To understand the behavioural aspects of entrepreneurs and timemanagement

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 ofenterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and theirsources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technicalanalysis.
4. Apply the concepts of Project Management during construction phase, project organization, project planning and control using CPM, PERTtechniques
5. UnderstandtheBehaviouralaspectsofentrepreneurs,TimeManagement,Variousapproachesofti me 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 managementmatrix.

Suggested Reading:

1. Vasant Desai, *"Dynamics of Entrepreneurial Development and Management",* Himalaya

Publishing House,1997
2. Prasanna Chandra, *"Project-Planning, Analysis, Selection, Implementation and Review",* Tata McGraw-Hill Publishing Company Ltd. 1995.
3. 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., 5^{lh} Ed.,2005.

GREEN BUILDING TECHNOLOGIES

OE 602 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

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

Outcomes:

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.
UNIT – III
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. ***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
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

DATA SCIENCE USING R

OE 602CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

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

Outcomes:

Student will be able to
6. Use various data structures and packages in R for data visualization and summarization.
7. Use linear, non-linear regression models, and classification techniques for data analysis.
8. Use clustering methods including K-means and CURE algorithm

UNIT – I
Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R. **Getting Started With R:** Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration. **Loading and Handling Data In R:** Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using _As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.
UNIT – II
Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.
UNIT – III
Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption. **Logistic Regression:** Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.
UNIT – IV
Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning. **Time Series In R:**Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.
UNIT – V
Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

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

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

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods. Frequent Itemset, Closed Itemset And Association Rules.

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

Suggested Readings:

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

For the academic years 2020-2024

CYBER SECURITY

OE 603 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyber laws
3. To study the defensive techniques against these attacks

Outcomes:

Student will be able to
4. Understand different types of cyber-attacks
5. Understand the types of cybercrimes and cyber laws
6. To protect them self and ultimately the entire Internet community from such attacks

UNIT – I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance –Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.
UNIT – II
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.
UNIT – III
Logical Design: Blue print for security. Security Policy, standards and Practices, Design of Security Architecture. ***Physical Design:*** Security Technology, Physical Design of Security SDLC Firewalls, Dialup Protection, Intrusion Detection Systems, Scanning and analysis tools, and Content filters.
UNIT – IV
Cryptography: The basic elements of cryptography: symmetric (Symmetric Key-DES, IDEA, and AES), and public key cryptography (Public Key Encryptions-RSA).
UNIT – V
Message digest (MD-5, SHA), and digital signatures. ***SSL and SET:*** SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "*Principles of Information Security*", Thomson, 2003.
2. William Stallings, "*Cryptography and Network Security*", Pearson Education, 2000.
3. Nina Godbole, "*Information System Security*", John Wiley & Sons, 2008.

For the academic years 2020-2024

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC 803 PY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: Non-credit-----

Objectives:

The course will introduce the students to

1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

Outcomes:

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

UNIT – II

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.
Indian languages and Literature-II: Northern Indian languages & Philosophical & cultural & literature.

UNIT – III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India(selected movements only)

UNIT – IV

Indian Fine Arts & Its Philosophy (Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture
(ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – V

***Education System in India*:** Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Suggested Reading:

1 Kapil Kapoor, "*Text and Interpretation: The India Tradition*'', ISBN: 81246033375, 2005
2 "*Science in Samskrit*", Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007

3 NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X, 2006
4 S. Narain, "*Examination in Ancient India*", Arya Book Depot, 1993
5 Satya Prakash, "*Founders of Sciences in Ancient India*", Vijay Kumar Publisher, 1989
6 M. Hiriyanna, "*Essentials of Indian Philosophy*", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990,2014
7 Chatterjee. S & Dutta "*An Introduction to Indian Philosophy*"

ESTIMATION AND SPECIFICATION LABORATORY

PC 460 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. Acquire knowledge on various types of specifications used in construction
2. Learn to prepare rate analysis for various item of works in construction
3. Evaluate the actual value of land and buildings

Outcomes:

1. Estimate the quantities of materials used in various construction works
2. Compute and prepare bar bending schedules.
3. Prepare rate analysis for various quantities
4. Assess the value of land and buildings

List of Experiments:

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
    a. Ground plus three storied RCC Framed structure building with block work walls
    b. Bridge with minimum 2 spans
    c. Factory building
    d. Road work
    e. Cross drainage work
    f. Single storied building with load-bearing walls
    g. Cost of finishes, MEP works for (2.6) above
3. Assignments on rate analysis, specifications and simple estimates
4. Preparation of bar bending schedule of RCC Framed structure building**.**
5. Preparation of valuation report in standard Government form.

***Note:** At least **ten** experiments should be conducted in the Semester*

Suggested readings:

1. Dutta, B.N. *Estimating and Costing in Civil Engineering* Theory and Practice. UBS Publishers' Distributers Pvt. Ltd., New Delhi. (2016).
2. Chakraborthi, M. *Estimating, Costing and Specifications in Civil Engineering*. Chakraborthi, Kolkata. (2002).
3. Jagjit Singh. *Estimating and Costing in Civil Engineering*. Galgotia Publications, New Delhi, (1996).
4. B. S. Patil," *Civil Engineering Contracts and Estimation*", Orient Black swan Private Ltd; Fourth edition 2015.
5. Gurcharan singh & Jagdish singh, "Estimating Costing and Valuation", Standard Publishers Distributors, 2012.
6. Standard Scheduled Rates and Relevant BIS Codes (SP:27 & BIS: 1200)

For the academic years 2020-2024

SUMMER INTERNSHIP EVALUATION

PW 702 CE

Instruction: 2 periods per week (Contact)
CIE: 50 marks
Credits: 2

Internship Guidelines (S*election of Summer Internships)*

1. Students should opt for summer internship that would provide to gain ample field knowledge in the relevant field of engineering such that theoretical knowledge gained in the class can be applied to solve the practical/ field problem.
2. Students should take a challenging task, may be small portion, and apply the knowledge gained to solve it. Summer internship can also involve data collection from different sources including generating experimental data, collection of data from field etc. Later on the student is required to analyze the data collected and arrive at meaningful conclusions.
3. Summer internship shall be aimed at solving some of the problems of the society/ local region that should have practical applications and benefit the society.
4. Students should devote full 3-4 weeks for summer internship. If any student undergoes internship duration is less than 3-4 weeks, such interns shall not be considered. If any credits are given to the internship program then student must register as per the course registration process.
5. Different central and state government organizations, CSIR labs, premier institutions like IITs and IIMs, DRDO, public sector undertaking organizations, top IT companies, skill enhancement centers recognized by state or central governments, research labs and Industries (small scale to large scale) can be considered for summer internships.
6. Students of individual institutions/colleges are permitted to undertake internships in their own campuses. However, in house (own campuses) internships are permitted with the prescribed guidelines.
7. Head of the department should allocate faculty members as advisors for all VI students at the end of V semester for advising the students in selecting proper summer internship. Entire process should complete by 31st March of every year.
8. Head of the department should depute faculty members for monitoring the student summer internship by communicating to the company guide.
9. The internship done by the student is assessed in two stages. i) External evaluation for 30 marks and internal evaluation for remaining 20 marks. HoD should constitute summer internship evaluation committee consisting of department faculty members that may include one faculty from other dept. The evaluation committee should involve in the evaluation process. Committee can take decision to reject the student summer internship if it doesn't meet the requirements of summer internships. Such students have to repeat the summer internship.
10. Individual department should send the recommended student list to the academic section/training and placement cell of the individual institution/college by second week of March for further proceedings. The list should contain the student basic details, concern faculty details, research areas, expected outcome of the internships. For this to happen, the students should submit the request letter through single window application processing system for further proceedings from the department and academic section/ training and placement cell.
11. It is the responsibility of the concern faculty to monitor the day-to-day academic activities of their students. If any student found misbehaving, misconduct during summer internships (particularly during academic hours) and upon receipt of the complaint, immediately the disciplinary action shall be initiated against the student and faculty concerned should submit a report.
12. Maximum number of students allowed per faculty shall be decided by the individual department in consultation with Academic section.

PROJECT WORK – I

PW 703 CE

Instruction: 3 periods per week
CIE: 50 marks
Credits: 3

Course Objectives:

1. To develop skills in doing literature survey, technical presentation and report preparation.
2. To encourage students to work with innovative and entrepreneurial ideas
3. To enable project identification and execution of preliminary works on final semester project

Course Outcomes:

1. Analyze a current topic of professional interest and present it before an audience
2. Identify an engineering problem, analyze it and propose a work plan to solve it
3. Develop awareness of design methodologies & its implementation
4. Acquire skills in technical report writing

Course Plan

Seminar:
Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class.

Project preliminary:
Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the internal departmental committee comprising of Head of the Department, faculty coordinator, faculty supervisor(s) and at least two faculty members (excluding the external expert) and get it approved by the committee.
The preliminary work to be completed:
(1) Literature survey
(2) Formulation of objectives
(3) Formulation of hypothesis/design/methodology
(4) Formulation of work plan (5) Seeking funds
(6) Preparation of preliminary report

Note: The same project initiated in Project Work-I should be continued and completed in the VIII semester as Project Work –II by the same project team.

Evaluation
(Evaluation of Project-1 should be based on the progress reported by the student and certified by the supervisor)

Maximum Marks: **50**

Seminar: 25 marks	**Activity**	**Weightage**
Distribution of marks	Presentation	**10**
	Ability to answer questions	**8**
	Report	**7**
Project preliminary: **25 marks**	Progress evaluation by the supervisor	**10**
Distribution of marks	Progress evaluation by the internal departmental committee excluding external expert	**15**

***Note**:* Two progress evaluations, mid semester and end semester, are mandatory
All evaluations are mandatory for course completion and for awarding the final grade.

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SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) VIII– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	MC 801 PO	Constitution of India	2	-	-	30	-	-
2	PE	Professional Elective – 7	3	-	-	30	70	3
3	OE	Open Elective -3	3	-	-	30	70	3
Practical/ Laboratory Courses								
4	PW 704 CE	Project Work - II	-	-	8	50	100	4
			8	**-**	**8**			**10**

Professional Elective – 7		
S.No.	**Course Code**	**Course Title**
1	PE 525 CE	Advanced Reinforced Concrete Design
2	PE 526 CE	Ground Improvement Techniques
3	PE 527 CE	Principles of Climate Change
4	PE 528 CE	Repair and Rehabilitation Techniques

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)

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CONSTITUTION OF INDIA

MC 801 PO

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: Non-credit

Objectives:

1. To create awareness among students about the Indian Constitution.
2. To acquaint the working conditions of union, state, local levels, their powers and functions.
3. To create consciousness in the students on democratic values and principles articulated in the constitution.
4. To expose the students on the relations between federal and provincial units.
5. To divulge the students about the statutory institutions.

Outcomes:

After completing this course, the student will

1. Know the background of the present constitution of India.
2. Understand the working of the union, state and local levels.
3. Gain consciousness on the fundamental rights and duties.
4. Be able to understand the functioning and distribution of financial resources between the centre and states.
5. Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.

UNIT – I

Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.

UNIT – II

***Union Government*:** Executive-President, Prime Minister, Council of Minister
State Government: Executive: Governor, Chief Minister, Council of Minister
***Local Government*:** Panchayat Raj Institutions, Urban Government

UNIT – III

Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties

UNIT – IV

Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

UNIT – V

Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

Suggested Reading:

1. D.D. Basu, *Introduction to the constitution of India*, Lexis Nexis, New Delhi
2. Subhash Kashyap, *Our Parliament*, National Book Trust, New Delhi
3. Peu Ghosh, *Indian Government &Politics*, Prentice Hall of India, New Delhi
4. B.Z. Fadia & Kuldeep Fadia, *Indian Government &Politics*, Lexis Nexis, New Delhi

PROFESSIONAL ELECTIVES - 7

ADVANCED REINFORCED CONCRETE DESIGN

PC 525 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To enhance competence in design of advanced reinforced concrete structures.
2. To Understand the design of curved beams in plan & portal frames
3. To impart knowledge regarding the analysis and design of various types of RCC tanks for storage of liquids

Outcomes:

1. Analyse and Design the beams curved and plan and design of Deep beams.
2. Analyse and design of portal frames and Multistoried building frames
3. Design of Flat slab system and retaining walls
4. Design of raft foundations.
5. Design underground and overhead RCC Rectangular and circular tanks.

UNIT – I

***Beams curved in plan*:** Introduction – Design Principles – Structural Design of beams curved in plan of circular and rectangular types

***Deep Beams*:** Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of Deep beams

UNIT – II

***Building Frames*:** Analysis and design of rectangular portal frames and Multistoried building frames subjected to vertical loading including hinges at the base- Detailing of frames.

UNIT – III

Flat slabs: Introduction, Components- I.S. Code Provisions – Design methods, Design for flexure and shear – Openings in Flat slabs

Retaining Walls*:* Retaining Walls. Types of retaining walls.

Analysis and Design of Cantilever Retaining walls and counterfort retaining wall

UNIT – IV

Raft Foundations: Definitions, Types – Mat and Raft Foundation. – Structural analysis and design of Raft foundation for buildings with column grids up to three bays and two row of columns.

UNIT – V

Water Tanks: Elastic Design and Detailing for RCC circular and Rectangular ground level and overhead tank. Intze tanks.

Suggested Reading:

1 N.Krishna Raju, *Advanced Reinforced Concrete Design*, CBS Publishers 2016

2 H.J. Shah, *Reinforced Concrete*, Charoat Publishers.

3 P.C.Varghese, *Advanced Reinforced Concrte Design*, PHI, 2001.

4 B. C. Punmia, "*Reinforced concrete structures*", 7th Edition, Laxmi Publications, 1992.

5 *Reinforced Concrete Structures* by Dr.I.C.Syal & Dr.A.K.Goel

6 IS: 456-2000, "*Code of Practice for Plain and Reinforced concrete*", Bureau of Indian Standards, New Delhi, India

7 IS: 3370-2009 Part (I to IV), "*Concrete Structures for Storage of Liquids – Code of Practice*", Bureau of Indian Standards, New Delhi, India.

GROUND IMPROVEMENT TECHNIQUES

PE 526 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To understand the objectives, necessity and scope of ground improvement
2. To learn different methods of insitu densification of cohesive / cohesion less grounds
3. To learn different methods of insitu densification of cohesive / cohesion less grounds

Outcomes:

1. Ability to understand the causes and to identify the scope for ground improvement.
2. Selection of ideal ground improvement technique appropriate for a given ground conditions
3. Competence in dealing with the applications of ground improvement in Infrastructure Engineering projects
4. Competence in the design of applications of grouting in ground improvement and Concept reinforced earth
5. Acquiring knowledge about genesis and classification of Geosynthetic products

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

Grouting: Aspects of grouting – Types of grouting materials – grouting procedure – Applications of grouting in ground improvement Soil Stabilization: Types and suitability of stabilization methods - Mechanical, Cementing methods – Aggregates and dispersants – Stabilization procedure – quality control in Soil Stabilization.

UNIT – V

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

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

Suggested Reading:

1. H.R. Hausmann, *Principles of Ground Modification*, Mc-Graw Hill Publications
2. Hausman, M. R. (1990). " *Engineering Principles of Ground Modification*" McGraw-Hills
3. P.Nicholson, *Soil Improvement and Ground Modification Methods*, Butterworth-Heinemann Ltd.
4. Purushothama Raj, P. (2014). "*Ground Improvement Techniques*". Lami Publishers (P), Ltd. New Delhi
5. R.M.Koerner, *Designing with Geosynthetics*, Prentice Hall Inc.
6. Fang.H.S., (1985), *Foundation Engineering Hand Book*, CBS Publications

For the academic years 2020-2024

PRINCIPLES OF CLIMATE CHANGE

PE 527 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 4

Objectives:

1. To understand basic concepts of General Circulation Models and their importance.
2. To know the features of Indian Summer Monsoon Rainfall (ISMR) and their characteristics.
3. To understand the downscaling principles of statistical downscaling and dynamical downscaling.

Outcomes:

1. Define the impacts of climate change on natural environment
2. Explain the fundamentals of global water balance.
3. Explain about climate changes and its impact on climate especially hydrology
4. Brief introduction of climate modelling especially using statistical downscaling techniques.
5. Bias correction methods in climate science.

UNIT – I

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

UNIT – II

Introduction of Global water balance: cycling of water on land- role of water cycle-simple water balance climate variables affecting precipitation- Precipitation and Weather, Humidity, 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.

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REPAIR AND REHABILITATION TECHNIQUES

PE 528 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand the basic concepts of building maintenance.
2. Understand the causes, mechanisms and prevention of deterioration of structures.
3. Understand the methods of condition assessment of structures.
4. Learning the materials, methodology and techniques of repair.
5. Learning the methods and strategies of retrofitting of structures.

Outcomes:

After completing this course, the student will be able to

1. Distinguish between various definitions related to building repair and maintenance.
2. Differentiate the types of defects, damage and explain the various deterioration mechanisms in structures.
3. Classify and explain the various non-destructive tests and condition assessment procedures.
4. Describe various repair materials and techniques.
5. Explain the various retrofitting and rehabilitation procedures.

UNIT –I

Introduction to Building Maintenance: Definitions of repair, renovation, remodelling, restoration, retrofitting and rehabilitation. Need for maintenance, types of maintenance, routine maintenance works in buildings.

***Types of Defects and Damages in Structures*:** During pre-construction stage, construction stage and post construction stage. Cracks – Types, Causes and Characteristics

UNIT –II

Mechanisms of Deterioration of Structures & Their Prevention: Concrete Structures: Defects in fresh concrete- Early frost damage, plastic shrinkage, plastic settlement (subsidence), subgrade settlement, formwork movements. Deterioration in hardened concrete: (a) Physical causes - aggregate shrinkage, drying shrinkage, crazing (b) Chemical causes: acid attack, sulphate attack, chloride attack, carbonation, alkali aggregate reaction, corrosion of reinforcement, (c) Thermal causes: Freeze-thaw, temperature variations, differential thermal expansions, humidity influences, (d) Structural causes: improper design loads, accidental overloads, creep

Steel Structures: Causes and types of deterioration, mechanism of corrosion, prevention of deterioration.

UNIT –III

Condition Assessment and Non-destructive Testing & Evaluation: Definition, objectives and stages of condition assessment Destructive and partially destructive tests. Non-destructive tests (NDTs). Classification of NDT procedures, Visual Inspection, Ultrasonic Testing methods (Impact echo, Pulse velocity, Pulse echo), Rebound hammer (IS 13311), Windsor probe test, Half-cell potential measurement, Electrical resistivity measurement, Carbonation depth measurements, Petrographic Analysis, Electromagnetic methods for Rebar detection, Ground Penetrating radar, Infrared thermography, Radiography, Radio isotope gauges, Remote viewing, Hammer sounding, Chain drag techniques.

UNIT – IV

Repair Materials and Techniques: Repair Methodology, Repair materials (cement-based, polymer-based, resin based, microcrete, composites, etc.), compatibility considerations, Repair techniques: Using mortars, dry pack, epoxy bonded pack, pre-placed aggregate concrete, gunite, shotcrete, grouting, polymer impregnation, resin injection, routing & sealing, stitching, surface patching, overlays & surface coatings, autogenous healing, gravity filling, drilling and plugging

UNIT – V

***Retrofitting & Rehabilitation Procedures*:** Strengthening of Existing Structures – Overview, general procedures, Techniques: section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, methods of strengthening in beams, slabs, columns (plate bonding, RC jacketing, FRP methods, concrete overlays, etc.) strengthening of substructure (shoring, underpinning)

Suggested Readings

1. Hand book on *"Repair and Rehabilitation of RCC Buildings"*, Published by Director General, CPWD, Govt. of India, 2002.
2. Varghese P. C. (2015), *Maintenance, Repair & Rehabilitation & Minor Works of Buildings*, PHI Learning Pvt. Ltd, Delhi.
3. Modi P.I. and Patel C.N. (2016), *Repair and Rehabilitation of Concrete Structures*, PHI Learning Pvt. Ltd, Delhi.
4. Peter H. Emmons and Gajanan M. Sabnis (2001), *Concrete Repair and Maintenance Illustrated*, Galgotia Publications, New Delhi.
5. SP: 25-1984, (1999), *Handbook on Causes and Prevention of Cracks in Buildings*, BIS, New Delhi.
6. Guide Book on *Non-destructive Testing of Concrete Structures*, Training course series No. 17, International Atomic Energy Agency, Vienna, 2002.

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OPEN ELECTIVE III

SMART BUILDING SYSTEMS

OE605EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Describe the basic blocks and systems for building automation
2. Use different subsystems for building automation and integrate them
3. Understand basic blocks and systems for building automation
4. 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.

For the academic years 2020-2024

PROGRAMMABLE LOGIC CONTROLLERS

OE606EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Develop PLC programs for industrial applications.
2. 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.

For the academic years 2020-2024

AUTOMOTIVE MAINTENANCE

OE 631AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Demonstrate the maintenance procedure for automotive Engine.
2. Illustrate the trouble diagnosis procedure for electrical systems like Battery, Starting Systems
3. Identify the trouble diagnosis procedure for steering and suspension system
4. Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
5. 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

For the academic years 2020-2024

MECHATRONICS

OE 631ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

Student has to understand the
1. How to identify, formulate, and solve engineeringproblems
2. The design a system, component, or process to meet desired needs within realisticconstraints
3. The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
4. The use of drive mechanisms and fluid powersystems
5. The use of industrial electronicdevices
6. The demonstrate the design of modern CNC machines, and Mechatronicselements

Outcomes:

At the end of the course, the students will be able to
1. Model and analyse electrical and mechanical systems and theirinterconnection
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 Mechatronicsapplications
5. Demonstrate the use of industrial electronicdevices
6. Demonstrate the design of modern CNC machines, and Mechatronicselements

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

ROAD SAFETY ENGINEERING

OE 603 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. Introduction to various factors considered for road safety and management
2. Explain the road safety appurtenances and design elements
3. Discuss the various traffic management techniques

Outcomes:

Student will be able to
1. Understand the fundamentals of traffic safety analysis
2. Analyze Accident data
3. Remember the concepts of road safety in urban transport
4. Apply crash reduction techniques
5. 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.

Suggested Readings:

1. KadiyaliL.R,.*Traffic Engineering and Transport planning*, 9th Edition, Khanna Tech Publishers, 2013.
2. C.E.G. Justo, A. Veeraragavanand S. K. Khanna, *Highway Engineering*, 10th Edition, Nem Chand Publishers, 2017.
3. Donald Drew, *Traffic Flow Theory Chapter 14 in Differential Equation Models*, Springer, 1983
4. C. Jotinkhisty and B. Kent Lall, *Transportation Engineering – An Introduction, 3rd Edition, Pearson publications, 2017*
5. Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson, *Handbook of Road Safety measures, second Edition, Emerald Publishing, 2009.*
6. Highway Research Programme (NCHRP) Synthesis 336.*A synthesis of Highway Research Board, Washington D.C, 2016*.

SOFTWARE ENGINEERING

OE 604 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

6. To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
7. To impart knowledge on various phases, methodologies and practices of software development
8. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics

Outcomes:

Student will be able to
5. Acquired working knowledge of alternative approaches and techniques for each phase of software development
6. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS.
7. Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
8. 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.
UNIT – IV
Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design. ***Modeling Component-Level Design:***Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components. ***Performing User Interface Design:***The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.
UNIT – V
Testing: Strategies:A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software. ***Tactics:***Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods. ***Debugging:***Debugging Techniques, The Art of Debugging. ***Product Metrics:*** A Framework for Product Metrics, Metrics for each phase of software development. ***Software Quality:***Definition, ***Quality Assurance:***Basic Elements, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

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*, Oxford University Press, 1996
3. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, 2008

PROJECT WORK – II

PW 704 CE

Project Work: 08 periods per week *Duration of SEE: Viva-voce 30 mins*
CIE: 50 marks *SEE: 100 marks*
Credits: 4

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:

- Think innovatively on the development of components, products, processes or technologies in the engineering field
- Apply knowledge gained in solving real life engineering problems

Course Plan

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. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
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
Distribution of marks for the Project final is as follows:
(i) Two progress assessments: **20 marks** by the faculty supervisor(s)
(ii) Assessments and final project report: **30 marks** by the internal faculty coordinator / review committee

External Evaluation by University appointed external examiner
Maximum Marks: 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 for awarding the final grade