SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TPE05E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Construction Projects Planning & Systems	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the project management and different scheduling techniques.
- To expertise in PERT network analysis.
- To learn CPM network analysis and compared with PERT.
- To understand time-cost analysis and resource scheduling.
- To understand the factor for equipment selection and cost of owing and operating and expertise in evaluation and analysis of different equipment life.

Course Content:

UNIT 1: Introduction: Objectives and functions of project management, project feasibility reports, Planning for construction projects: Steps, factors, advantages and disadvantages for different stake holder.

Scheduling: Scheduling Job layout and Line of balance, project management through networking, Bar Chart, Linked bar chart, Work-break down structures, Activity-on-arrow diagrams.

UNIT 2: PERT: Network analysis, critical path, probability of project.

UNIT3: CPM: Network analysis, Critical Path, Difference between CPM and PERT.

UNIT 4: Time-Cost Trade-off, Resource Scheduling

UNIT 5: Time and motion studies, Standard and special equipment, factors affecting selection of construction equipment, cost of owning and operating the construction Equipment, Equipment Life and Replacement Analysis

Text Books:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Srinath,L.S., "PERT and CPM Priniples and Applications ", Affiliated East West Press, 2001
3. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
4. Moder.J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
5. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986.
6. Halpin,D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 1985.

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

- To apply the knowledge in managing and handling of different civil engineering project and also able to schedule the project.

- To do PERT analysis and able to find the project completion time and its probability.
- To do CPM analysis and able to find the project completion time and compare with PERT analysis.
- To do cost and time analysis and also resource allocation, scheduling and crashing for different activities of the network.
- To apply the knowledge in equipment selection and able to find cost of owing and operating and able to find the equipment life, which help in comparisons of different equipments.

SYLLABUS

(SEMESTER-VII)

Subject Code:	CE07TOE02X	CREDITS:3			SESSIONAL - TA			ESE
Subject:	Open Elective -2X	L	T	P	CT 1	CT 2	TOTAL	70
		3	-	-	15	15	30	

Open Elective-2A or Open Elective-2B or Open Elective-2C or Open Elective 2D.	Any one subject to be Selected from the Professional Electives

Open Elective-2 (OE Group-2)	
CE07TOE02A	Artificial Neural Network
CE07TOE02B	Economic Policies in India
CE07TOE02C	History of Science and Engineering
CE07TOE02D	Engineering Risk-Benefit Analysis

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Artificial Neural Network	3	0	0	15	15	30			

Course Learning Objectives:

1. To provide an introduction to the field of artificial neural networks
2. To Study Basic learning algorithms: the back propagation algorithm, self-organization learning etc.
3. Model a Neuron and Express both Artificial Intelligence and Neural Network
4. To promote further independent learning on the topics of artificial neural networks
5. To learn Supervised and unsupervised Learning and Self-organization Feature Map.

Course Content:

UNIT-1 Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction, and Gradient Descent Rule Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.

UNIT–2 Supervised Learning: Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.

UNIT-3 Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.

UNIT- 4 Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

UNIT- 5 Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

Text Books:

1. .E.Rich and K.Knight ,Artificial Intelligence ,Forty Sixth Edition Tata McGrawHill,2007
2. D.W. Patterson,Introduction to Artificial Intelligence and Expert Systems, Tenth Edition ,Prentice Hall of India,2001
3. Klaus Obermayer and Terrence J. Sejnowski, Self-Organizing Map Formation, October 2001
4. Daniel J. Amit , Modeling Brain Function, 1989, Cambridge University Press.

Course Outcomes- The students would have learnt:

CO1: Model Neuron and Neural Network, and to analyse ANN learning, and its applications.
CO2:Able to solve the problem of Supervised Learning.
CO3: can able to apply SVM for image classification .
CO4: Evaluate a practical solution obtained using neural networks.
CO5: Can able to use Self-organization Feature Map.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Economic Policies in India	3	0	0	15	15	30			

Course Learning Objectives: The course seeks to equip students with sector-specific knowledge and skills to analyze key economic issues and policy documents. It will also enable them to relate theoretical frameworks of macroeconomics and microeconomics to the Indian context.

Course Content:

UNIT-1 Macroeconomic policies and their impact: fiscal policy; financial and monetary policies.

UNIT–2 Agriculture: policies and performance; production and productivity; credit; labor markets and pricing; land reforms; regional variations.

UNIT-3 Industry: policies and performance; production trends; small scale industries; public sector; foreign investment, labor regulation

UNIT- 4 Services and trade: trends and performance, trade and investment policy

UNIT- 5 Indian development experience: a critical evaluation of growth, inequality, poverty and competitiveness, pre-and post-reform eras

Text Books:

1. Dutt Rudder and K.P.M Sunderam (2001): Indian Economy, S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2001) "Indian Economy and –Its development experience", Himalaya Publishing House.
3. KapilaUma: Indian Economy: Policies and Performances, Academic Foundation
4. Bardhan, P.K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.

Course Outcomes-

Students will have the capability to understand government policies and will enable informed participation in economic decision making, thus improving their employment prospects and career advancement.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	History of Science and Engineering	3	0	0	15	15	30			

Course Learning Objectives:

Course Content:

UNIT-1 Historical Perspective
The nature of science and technology, Roots of science and technology in India, Science and society, Scientists and society, Science and Faith and the rise of applied sciences.

UNIT–2 Policies and Plans after Independence
Nehru's vision of science for independent independent India, Science and technology developments in the new era science and technology developments during the Five Year Plan Periods and science and technology policy resolutions.

UNIT-3 Research and Development (R&D) in India
Expenditure in R&D, Science and Technology Education, Research activities and promotion of technology development, Technology mission, Programs aimed at technological self reliance, activities of council of scientific and industrial research (CSIR).

UNIT- 4 Science and Technological Developments in Major Areas
Space – Objectives of space programs, Geostationary Satellite Services – INSAT system and INSAT services remote sensing applications, Launch Vehicle Technology
Ocean Development – Objectives of ocean development, Biological and mineral resources, Marine research and capacity building
Defence Research – Spin-off technologies for civilian use,
Biotechnology – Applications of biotechnology in medicine, Biocatalysts, Agriculture, Food, Fuel and Fodder, Development of biosensors and animal husbandry
Energy – Research and development in conservation of energy, India's nuclear energy program, technology spin-offs.

UNIT- 5 Nexus between Technology Transfer and Development
Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques, Appropriate technology, Technology assessment, Technological forecasting, Technological innovations and barriers of technological change.

Text Books:

1. Kalpana Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books (P) Ltd., New Delhi – 58.
2. Srinivasan, M., Management of Science and Technology (Problems & Prospects), East-West Press (P) Ltd., New Delhi.
3. Ramasamy, K.A., and Seshagiri Rao, K., (Eds), Science, Technology and education for Developlemnt, K., Nayudamma Memorial Science Foundation, Chennai – 8.
4. Kohili, G.R., The Role and Impact of Science and Technology in the Development of India, Surjeet Publications.
5. Government of India, Five Year Plans, Planning Commission, New Delhi.

6. Sharma K.D., and Quresh M.A., Science, Technology and Development, Sterling Publications (P) Ltd., New Delhi.

Course Outcomes-

SYLLABUS	(SEMESTER-VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02D	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Engineering Risk-Benefit Analysis	3	0	0	15	15	30			

Course Learning Objectives:

1. Understand the basic concepts of risk analysis and the relationship between probability theory and modeling, risk analysis, and decision analysis
2. Understand how to interpret probability and probabilistic modeling, in the evaluation of risk
3. Learn how to understand and interpret the basic tools of risk analysis – fault trees, event trees, and simulation models
4. Understand the issues surrounding the use of risk analysis in decision making

Course Content:

UNIT 1: Introduction- Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model

UNIT 2: System Definition and Structure: System Definition Models, Hierarchical definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems

UNIT 3: Consequence Assessment-Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, and Consequence Propagation. Engineering Economics: Time Value of Money, Interest Models, Equivalence

UNIT 4: Decision Analysis: Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models

UNIT 5: Data Needs for Risk Studies: Elicitation Methods of Expert Opinions, Guidance

Text Books:

1. Risk Analysis in Engineering and Economics, B. M. Ayyub, Chapman-Hall/CRC Press, 2003.

Reference Books:

1. Probability, Statistics, and Reliability for Engineers and Scientists, Ayyub & Mc Cuen, 2003.
2. Probabilistic Risk Assessment and Management for Engineers and Scientists, by H. Kumamoto and E. J. Henley, Second Edition, IEEE Press, NY, 1996.
3. Bedford, T. and Cooke, R. Probabilistic Risk Analysis: Foundations and Methods. New York: Cambridge University Press, 2001.
4. Normal Accidents, Living with High-Risk Technologies, C. Perrow, Princeton University Press, 1999.

5. Accident Precursor Analysis and Management - Reducing Technological Risk Through Diligence, National Academy of Engineering, the National Academies Press, Washington, DC, 2004.

Course Outcomes:

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

1. Understand and apply engineering risk analysis in several fields.
2. Evaluate the Reliability Analysis of Systems.
3. Formulate a decision analysis for models and systems

Propose the data requirements for risk analysis in simulation models.

SYLLABUS	**(SEMESTER VII)**					
Subject Code:	CE07PPC08	CREDITS: 2			Internal Assessment (IA)	ESE
Subject:	Seminar	L	T	P	IA	
		-	-	3	50	-

SYLLABUS	**(SEMESTER VII)**					
Subject Code:	CE07PPC09	CREDITS:4			Internal Assessment (IA)	ESE
Subject:	Minor project	L	T	P	IA	
		-	-	6	60	40

SYLLABUS	(SEMESTER VII)						
Subject Code:	CE07PEC10	CREDITS:4			Internal Assessment (IA)	ESE
Subject:	Estimation and Costing	L	T	P	IA	
		3	1	3	30	20

Course Objective

1. Impart the knowledge of estimating and costing for civil engineering structures
2. Prepare and Evaluate the

3. Estimation of building (long wall and short wall method)
2. Estimation of building (centre line method)
3. Analysis of rate for concrete work
4. Analysis of rate for brick work
5. Analysis of rate for plaster work
6. Estimate quantity of reinforcement
7. Preparation for approximate estimate for road project
8. Estimating cost of building on plinth area method

Course Outcome

1. Prepare quantity estimates for buildings, Roads as per specification
2. Draft detailed specifications and work out rate analysis for all the works related to civil engineering projects
3. Ascertain the quantity of material required for civil engineering work as per specifications
4. Prepare cost estimate for civil engineering work.

SEMESTER VIII

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE08TPC18	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Earthquake Resistant Design of Structures	3	0	0	15	15	30			

Course Learning Objectives:

i. To introduce Engineering seismology and functional planning and the effects of configurations of buildings for earthquakes.
ii. To introduce the requirements for conceptual design for earthquake safety and the analysis methods.
iii. To acquaint with IS code-based design lateral forces for earthquake resistant design of structures.
iv. To identify the behavior of structural and nonstructural elements for seismic resistance and impart design of shear walls.
v. Introduce Capacity Design as per IS 13920: 2016, Capacity Design for Beams, Columns, beam column joints and structure as a whole.

Course Content:

UNIT 1: Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT 2: Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete – Masonry, Steel Structures. Design Earthquake Loads – Basic Load Combinations – Permissible Stresses. Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method – Modal Analysis Torsion.

UNIT 3: Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods. RC Buildings – IS Code based Method. - Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear –.

UNIT 4: Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures, Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls.

UNIT 5: Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility-

Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquake- Seismic Evaluation and Retrofitting. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Text Books/References:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd
3. Earthquake Resistant Design for Engineers & Architects by Dowrick, D. J., John Willey & Sons, 2nd Edition; 1987.
4. Earthquake Resistant Design of structures by S. K. Duggal, Oxford University Press.
5. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.
6. Reinforced Concrete Structures by Park, R. &Paulay, T., John Willey & Sons, 2nd Edition; 1975.
7. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros.
8. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial College Press.
9. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
10. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
11. Handbook on Seismic Analysis and Design of Structures by Farzad Naeim, Kluwer Academic Publisher, 2001.

Reference Codes:

1. IS 1893 (Part-1): 2016, "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS 4326: 2013, "Earthquake Resistant Design and Construction of Building", Code of Practice, B.I.S., New Delhi.
3. IS 13920: 2016, "Ductile design and detailing of reinforced concrete structures subjected to seismic forces" – Code of practice, B.I.S., New Delhi.

Course Outcomes:

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

a. Identify the causes of earthquakes, its propagation, and measurement and can quantify the hazard at the location of the structure and quantify the forces based on the source.
b. Adopt a suitable structural system to resist earthquake forces considering safe behavior of structural and nonstructural elements with different material properties and load combinations.
c. Design seismically safe structures in accordance with the provisions of Indian code IS 1893.
d. Implement design of shear wall elements for earthquake safety of structures.
e. Design or retrofitting of structures by detailing the elements, beams, columns, beam-column joints as per capacity-based design adopting ductility provisions as per IS 1893, IS 13920, to mitigate the vulnerability of earthquake damages of elements and structures.