Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus for

Final Year - B. Tech.

Civil Engineering (Pattern 2020)

Department of Civil Engineering

Vision:

To be a Leading Centre of Education in Civil Engineering through Holistic Development

Mission:

M1: Develop competent Civil Engineers by imparting practical skills imbibed with ethical and societal values.

M2: Provide holistic education empowering students to address real-world challenges in Civil Engineering.

M3: Equip graduates with necessary knowledge and skills to pursue research, higher studies, entrepreneurship.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Graduates will have successful career in the field of Civil Engineering

PEO 2: Graduates will respond to growing demands of society through professional and ethical practices

PEO 3: Graduates will pursue lifelong learning including higher studies in the field of Civil Engineering

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO):

PSO1: Engineering graduates will be able to plan and execute the activities of construction projects

PSO2: Engineering graduates will be able to analyze and design components of Civil Engineering Systems.

FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VII (PATTERN 2020)

MODULE-I

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
CVUA40201	Highway Engineering	TH	2	-	-	20	20	20	40	-	100	2
CVUA40202	Professional Elective-III	TH	2	-	-	20	20	20	40	-	100	2
IOEUA40203	Open Elective-II	TH	2	-	-	20	20	20	40	-	100	2
IOEUA 40204	Open Elective-III	TH	2	-	-	20	20	20	40	-	100	2
CVUA40205	Research Methodology and IPR	CE	2	-	-	-	-	50	-	-	50	2
CVUA40206	Major Project	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	10	-	20	180	80	130	160	50	600	20

Professional Elective – III:

1. CVUA40202A: Design of Prestressed Concrete Structures
2. CVUA40202B: Air Pollution and Control
3. CVUA40202C: Advanced Foundation Engineering

Open Elective -II	Open Elective -III
IOEUA40203A: Introduction to Industry 4.0 and Industrial IOT	IOEUA40204A: Social Media Analytics
IOEUA40203B: Software Testing and Quality Assurance	IOEUA40204B: Organizational Behavior
IOEUA40203C : Data Centric AI	IOEUA40204C : Data Ethics
IOEUA40203D : Computer Vision	IOEUA40204D : Business Intelligence
IOEUA40203E : Project Management: Planning, Execution, Evaluation and Control	IOEUA40204E : Business Analytics
IOEUA40203F : Solar and Wind Energy	IOEUA40204F : Project management and Economics

BoS Chairman **Dean Academics** **Director**

FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VII (PATTERN 2020)

MODULE-II

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
	Semester Internship (Research / Industry)	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
					20	100	-	-	-	50	150	10

Mandatory Course: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

BoS Chairman **Dean Academics** **Director**

FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VIII (PATTERN 2020)

MODULE-III

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
CVUA42201	Professional Elective IV*	TH	3	-	2	20	20	20	40	25	125	4
IOEUA42202	Open Elective IV*	TH	3	-	-	20	20	20	40	25	125	3
IOEUA42203	Open Elective V*	TH	3	-	-	20	20	20	40	25	125	3
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	9	-	2	60	60	60	120	75	375	10

***Course has Oral Exam**

Professional Elective-IV		Open Elective-IV		Open Elective-V	
CVUA42201A	Architectural Town planning	IOEUA42202A	Non-Destructive Techniques and Engineering Diagnosis	IOEUA42203A	Numerical Methods
CVUA42201B	Environmental Impact Assessment				
CVUA42201C	Advanced Design of RC Structures				

Mandatory Course: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

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FINAL YEAR B. TECH (COMMON TO ALL PROGRAMS), SEMESTER VIII
(PATTERN 2020) MODULE IV

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
	Semester Internship (Research / Industry)	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
					20	100	-	-	-	50	150	10

Mandatory Course: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge. Online certification course (minimum two weeks).

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FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VIII (PATTERN 2020)

MODULE-V

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
CVUA40201	Highway Engineering	TH	2	-	-	20	20	20	40	-	100	2
CVUA40202	Professional Elective-III	TH	2	-	-	20	20	20	40	-	100	2
IOEUA40203	Open Elective-II	TH	2	-	-	20	20	20	40	-	100	2
IOEUA 40204	Open Elective-III	TH	2	-	-	20	20	20	40	-	100	2
CVUA40205	Research Methodology and IPR	CE	2	-	-	-	-	50	-	-	50	2
CVUA40206	Major Project	CE-PR/OR	-	-	20	100	-	-	-	50	150	10
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	10	-	20	180	80	130	160	50	600	20

Professional Elective – III:

1. CVUA40202A: Design of Prestressed Concrete Structures
2. CVUA40202B: Air Pollution and Control
3. CVUA40202C: Advanced Foundation Engineering

Open Elective -II	Open Elective -III
IOEUA40203A: Introduction to Industry 4.0 and Industrial IOT	IOEUA40204A: Social Media Analytics
IOEUA40203B: Software Testing and Quality Assurance	IOEUA40204B: Organizational Behavior
IOEUA40203C : Data Centric AI	IOEUA40204C : Data Ethics
IOEUA40203D : Computer Vision	IOEUA40204D : Business Intelligence
IOEUA40203E : Project Management: Planning, Execution, Evaluation and Control	IOEUA40204E : Business Analytics
IOEUA40203F : Solar and Wind Energy	IOEUA40204F : Project management and Economics

NOTE: Students who will register for Module-I in Semester VII have to register either of Module-III or Module IV in Semester VIII. Students who will register for Module-II in Semester VII have to register for Module-V in Semester VIII.

BoS Chairman **Dean Academics** **Director**

MODULE I & V

Highway Engineering (CVUA40201)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Course Objectives:

1. To develop an analytical approach to urban transportation system.
2. To impart knowledge of sustainable transportation system with emphasis on non-motorized mode of transport.
3. To enable the students to design efficient pavement structure.

Course Outcomes: Upon completion of the course, students will be able to

1. Analyze travel demand model and forecasting.
2. Evaluate relative importance of various modes and their capacities.
3. Design facilities required for non-motorized transportation and pedestrians.
4. Estimate basic characteristics of traffic stream and signal design.
5. Design flexible pavements.
6. Design rigid pavements and overlays.

Unit I - Transport System Planning:

Transportation planning process, types of origin: destination surveys. Origin: destination matrix, travel demand forecasting, trip generation: growth factor and synthetic models, modal spilt analysis, trip distribution and route assignment analysis, transportation system management (TSM), application in comprehensive mobility plan (CMP) and detailed project report (DPR). Traffic Stream Models: Greenshield's model and Greenberg's logarithmic model, concept of level of service (LOS) as per highway capacity manual (HCM) and Indo-HCM**.** Concepts of delay and queuing in traffic streams, design of traffic signal by Webster's method and IRC method, overview of IRC SP: 12 – 2015, guidelines for parking facilities in urban areas.

Unit II - Urban Transport Technology and Non-Motorized Transport (NMT):

Classification: light, medium, mass and rapid transit system, introduction to intelligent transportation system (ITS) and its application for urban roads (IRC SP 110:2017), public transport policy (National and Maharashtra State), introduction to BRT, Mono rail, Metro rail, Bullet train and Hyperloop, use of drone, concept of integrated inter model transit system, freight transportation. Environmental impact assessment: EIA requirement of highway projects, procedure and guidelines. Introduction, NMT Systems, NMT in developed countries, data collection techniques, mobility and NMT in sustainable urban development, role of city developers, analysis of NMT, Impacts, pedestrian characteristics, pedestrian level of service, pedestrian facility design (IRC 11-2015): footpath, zebra crossing, underpass, pedestrian actuated signals, bicycle level of service, bicycle facility design.

Unit III- Flexible pavement Design as per IRC:

Analysis and design of flexible pavement as per IRC 37: 2018 (Complete design including the use of IITPAVE), distresses in flexible pavement and recommended rectification as per IRC 82: 2015, surface unevenness and measuring road roughness as per IRC SP: 16 - 2019.

Unit IV - Rigid pavement and Overlay types and their design as per IRC:

Concept of rigid pavement, comparison of rigid pavement over flexible pavement , Stress distribution in layered media, one and two layered system, joints in rigid pavement, longitudinal construction joints, design as per IRC guidelines, design of joints, dowel bars, temperature reinforcement, pavement failure, maintenance strategy strengthening of rigid pavement, types of overlays, flexible over rigid, rigid over rigid, mechanization in pavement construction.

Assignments:

Assignments work shall consist of:

1. Traffic counts using Manual Methods.
2. Design of a flexible pavement using IRC: 37-2012 using IITPAVE.
3. Design of rigid pavement using IRC: 58-2015.
4. Road deflections measurement using Benkelman Beam method.
5. Design of an overlay using IRC: 81-1997.
6. Conduct of distress surveys on a flexible pavement or a rigid pavement and determining its Condition index (PCI).
7. Study of any two software related to transportation engineering.
8. Study of format of household survey and recording sample measurements.
9. Parking survey and analysis.

Text Books

1. Traffic Engineering and Transport Planning, L R Kadiyali, Khanna Publishers.
2. Understanding Traffic System, Michel A Taylor, William Young, Peter W Bonsall.
3. Principles of Urban Transport Systems Planning, B. G. Hutchinson.
4. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das.
5. Introduction to transport planning, M. J. Bruton

Reference Books:

1. Laurence I Hewes & Clarkson H Oglesby, (1958)"Highway Engineering" John Wiley & Sons.
2. L R Kadiyali, (2013), "Traffic Engineering and Transport Planning" Khanna Publishers, Delhi
3.
4. David Croney, Paul Croney, (1997) "The Design and Performance of Road Pavements",McGraw Hill Professional.
5. Michel A Taylor, William Young, Peter W. Bonsall, "Understanding Traffic System", Taylor and Francis Group.
6. B. G. Hutchinson, (1974) "Principles of Urban Transport Systems Planning", Washington, D.C. : Scripta Book Company, : New York ; Montreal : McGraw-Hill Book Company
7. M. J. Bruton, "Introduction to transport planning", Hutchinson Technical Education, London
8. C. Jotin Khisty, B. Kent Lall, (2003) "Transportation Engineering An Introduction", Pearson Publication.

9. C. S. Papacostas, P. D. Prevedouros, (2000) "Transportation Engineering & Planning", Pearson Publication.
10. E.F. Yoder (1975) "Principles of Pavement Design"(John Wiley & Sons, lnc USA),
11. C. S. Papacostas, (1987) "Fundamentals of Transportation Engineering", Prentice Hall.
12. Huang Y H, (1993) "Pavement analysis and Design",Prentice Hall, Englewood Cliff, New Jersey.
13. Morlok E K, "Introduction to Transportation Engg. And Planning", McGraw-Hill company.
14. Drew, (1971) "Fundamentals of Traffic flow Theory", McGraw-Hill book Co.
15. Saxena Subhash, "A course in Traffic Planning and design", Dhanpat Rai &sons, Delhi

15.Taylor M P, "Traffic analysis (New technologies new solutions", Hargreen Pub. Co. New Delhi.

Handbooks:

1. Lay M. G. Gorden, (1978) "Handbook of Road Technology", Breach Science Pub. Newyork.

Codes:

1. IRC 37-2012, "Guidelines For The Design Of Flexible Pavements", Indian Roads Congress, Kama Koti Marg,Sector-6, R.K. Puram, New Delhi-110 022IRC:58-2015, "Guidelines for the design of plain jointed rigid pavements for highways" 4th revision, Indian Roads Congress, New Delhi.
2. IRC 81-1997 IRC 81-1997, "Guidelines For Strengthening Of Flexible Road Pavements Using Benkelman Beam Deflection Technique", Indian Roads Congress, New Delhi
3. IRC 82-2015, "Code Of Practice For Maintenance Of Bituminous Road Surfaces", Indian
    a. Roads Congress, New Delhi
4. IRC 115-2014, "Guidelines. For. Structural Evaluation. And. Strengthening of Flexible Road Pavements Using. Falling Weight Deflectometer (FWD)", Indian Roads Congress, New Delhi

e-Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel

Professional Elective III
Design of Prestressed Concrete Structures (CVUA40202A)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 02 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Prerequisites: Strength of materials, Analysis of structures, Design of structures (Basic Concepts).

Course Objectives: The course will help students

- To understand basic concepts, prestressing systems, losses in prestressed concrete, limit state of collapse and serviceability; and to analyse and design of prestressed concrete structures using limit state method as per specification given in Indian Standard Code 1343-2012.

Course Outcomes: Upon the completion of the course, students will be able to

1. CO-1 **understand** basic concepts, prestressing systems and **evaluate** losses in prestressed concrete.
2. CO-2 **analyse** prestressed concrete members for stresses due to loading and prestressing, flexure and shear.
3. CO-3 **analyse** prestressed concrete members for limit state of serviceability and **design** post tensioned concrete slabs using limit state method as per specification given in Indian Standard Code 1343-2012.
4. CO-4 **design** pre and post tensioned concrete beams including end block using limit state method as per specification given in Indian Standard Code 1343-2012.

Unit I: Introduction to prestressed concrete **(4 Hrs.)**

Basic concept, brief history and materials used in prestressed concrete. Advantages and limitations of prestressing. Prestressing systems. Concept of cable profile and cable zone. Losses in prestressed concrete.

Unit II: Analysis of prestressed concrete members **(8 Hrs.)**

Analysis of member for prestress and bending stresses at various stages. Concepts of prestressing: Pressure Line; Stress, strength and Load Balancing concepts. Analysis of member for flexure and shear.

Unit III: Limit state design of post tensioned concrete slabs **(6 Hrs.)**

Limit state design criteria. Limit state of serviceability for prestressed concrete structures: Short & long term deflections and cracking. Design of prestressed concrete slabs: one way and two way slabs.

Unit IV: Design of pre and post tensioned beams **(6 Hrs.)**

Design of rectangular section pre-tensioned concrete beams. Design of post tensioned flanged girder for flexure, shear and bearing including end block.

Textbooks:

1. Krishna Raju N. Pre stressed Concrete, Tata McGraw Hill Co., New Delhi.
2. Rajagopal N., Prestressed Concrete, Narosa Publishing House.
3. Dayarathnam P., Prestressed Concrete Structures, S. Chand Publishers.
4. Sinha N.C. and Roy S.K., Fundamentals of Pre-stressed Concrete, S. Chand & Company limited.
5. T. Y. Lin, Design of Prestressed Concrete Structures, Wiley India Pvt. Ltd.

Reference Books:

1. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd.1997.
2. Leonhardt F., Wilhelm Ernst and Shon, Prestressed Concrete- Design and Construction –, Berlin.
3. Evans, R.H. and Bennett, E.W., Prestressed Concrete Theory and Design, Chapman and Hall, London.
4. Prestressed Concrete by The Freyssinet Prestressed Concrete Co. Ltd.

IS Codes:

1. IS 1343-2012 Code for Practice for Prestressed Concrete.

Professional Elective III
Air Pollution and Control (CVUA40202B)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 02 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Prerequisites: Applied Physics and Chemistry, Environmental Science, Environmental Engineering.

Course Objectives: The course will help students

- To understand causes, sources and effects of outdoor & indoor air pollution, existing legislation and regulations, meteorological aspects, ambient air sampling and ambient air quality standards, and methods to mitigate air pollution.

Course Outcomes: Upon the completion of the course, students will be able to

5. **understand** air pollution, legislation and regulations
6. **understand** meteorological parameters and **evaluate** air pollutant concentrations as a function of meteorology
7. **interpret** sampling results with prescribed standards
8. **understand** outdoor and indoor pollution mitigation techniques.

Unit I: Air pollution, Legislations and Regulations **(6 Hrs.)**

Air Pollution: Zones of atmosphere, Atmospheric temperature gradient, Definition of air pollution. Classification of air pollutants (Based on sources, origin and state of matter). Sources of air pollution. Effects of air pollution on human being, materials, vegetation, animals. Global effects: Greenhouse effect, acid rain, ozone depletion, global warming. Photochemical smog. Economic effects. Estimation of Carbon footprints (Numerical Included).
Legislations and regulations: Air (Prevention and Control) Pollution Act 1981. The Air Rules 1982, Environmental Protection Act 1986, National Environment Tribunal Act 1995, National Green Tribunal Act 2010.

Unit II: Meteorological Aspects **(6 Hrs.)**

Meteorology. Scales of meteorology. Meteorological parameters. Wind Rose Diagram. Environmental lapse rate (ELR) and Adiabatic Lapse Rate (ALR). Inversion and its types. Atmospheric stability. Pasquill-Gifford classification. Plume behaviour. Atmospheric dispersion. Horizontal and vertical dispersion coefficients. Dispersion models: Gaussian dispersion equation for point source; assumptions, advantages and limitations (Numerical included). Mixing height. Stack height determination (Numerical included) using CPCB recommendations. Plume rise: estimation using Brigg's formula (Numerical included).

Unit III: Ambient Air Sampling and Standards **(6 Hrs.)**

Ambient Air sampling: Basic considerations of ambient air sampling. Site selection: general requirements and difficulties. Stack sampling. Devices and methods used for stack sampling of particulate air pollutants: sedimentation, filtration, impingement, precipitation (thermal and electrostatic). Devices and methods used for stack sampling of gaseous air pollutants: Absorption, adsorption and condensation. Isokinetic sampling.
Air Quality and Emission Standards: (Indicator, averaging time, form, level), National Ambient Air Quality Standards (NAAQS) 2009 and Emission standards in India, WHO air quality guidelines 2021. Emission inventory: Definition and role in air quality management.

Unit IV: Control of Outdoor and Indoor Air Pollution **(6 Hrs.)**

Control of outdoor air pollution: Natural air controlling processes (Dispersion, gravitational settling, absorption, rainout, adsorption). Control at source: Control by process modification, change of raw materials, fuels, process equipment and process operation. Control of particulates at stationary source using equipments: working principle, construction and operation, advantages and disadvantages of settling chamber, cyclones, fabric filters, Electrostatic precipitator, scrubbers. Control of gaseous pollutants at stationary source: Absorption, adsorption, incineration/ combustion, carbon sequestration for CO2. Control of emissions from mobile sources: Emission sources, Control of emissions from each source.
Indoor air pollution and its control: Pollutants causing, sources and health impacts of indoor air pollution. Sick building syndrome. Mitigating technologies: Source control, cleansing systems, air cleaning. Types of air cleaners. Air cleaning technologies. Practical considerations using portable and in-duct air cleaners, Use of plants for control, Radon removal technique

Textbooks:

6. Air Pollution, M. N. Rao, H. V. N. Rao, McGraw Hill Publications, 2004.
7. Air Pollution: Its origin and control, 3rd Edition, Kenneth Wark, Cecil F. Warner, Wayne T. Davis, Addison-Wesley Longman. 1998.
8. Air Pollution: Health and Environmental Impacts, Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), CRC Press, 2010.

Reference Books:

5. Air Pollution and Control, K.V.S.G. Murali Krishna, University Science Press, 2015.
6. Fundamentals of Air Pollution, Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., Academic Press, 2005.
7. Methods of Air Sampling and Analysis, Lodge, J.P. (Ed.), CRC Press, 1988.

Professional Elective III
Advanced Foundation Engineering (CVUA40202C)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Course Objectives:

- To inculcate necessary engineering skills to analyse and design of different types of foundation systems under different loading and soil conditions.

Course Outcomes: Upon completion of the course, students will be able to

1. Select and appraise suitable regulatory codes for various subsurface investigation related to different civil engineering structures.
2. Analysis and design pile foundation subjected to complex loading.
3. Identify the problematic soil and design of foundation on problematic soil
4. Design shallow foundation subjected to complex loading.

Unit I: Regulatory codes for various subsurface investigation

IS code provision in respect of subsoil exploration for dams, canals, tunnels, and bridges. IRC (IRC:SP:19-2001) provisions for exploration in respect of roads. Case studies of failures of foundation

Unit II: Design of Pile Foundation

Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation. Analysis and design of axially loaded piles, laterally loaded piles, Piles in group, Pile driving analysis various types of pile.

Unit III: Foundation on Problematic Soils

Identification of Problematic soils, Design of under reamed pile foundation. Design of sand drains and stone columns. Design of well foundation

Unit IV: Design of shallow foundation subjected to complex loading

Foundation design framework, Tolerable foundation movement, Bearing capacity and settlement analysis of shallow foundations. Design of isolated and combined footings, Raft foundation.

Site visit and Case study

1. One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
2. Any one case study of failure of foundation from the published literature

Reference Books:

1. Joseph E. Bowels, "Foundation Analysis and Design", TATA Mc-Graw hill
2. Shenbage R Kaniraj, "Design Aids in Soil Mechanics and Foundation Engineerimg", TATA Mc-Grawhill
3. Tamlinson M. J., "Foundation Design & Construction" ELBS publication.
4. G. A. Leonards (1962), "Foundation Engineering", McGraw-Hill,
5. R.B. Peck, W.E. Hanson and T.H. Thornburn (1974), "Foundation Engineering",2nd Edition, John Wiley and Sons.
6. Das B M (1985),"Principles of Foundation Engineering"

I S Codes:

IS: 1892-1979 – "Code of Practice for Subsurface Investigation for Foundation". New Delhi: Bureau of Indian Standards.

IS: 2131-1981 (Reaffiemed 1997), "Method for Standard penetration Test for Soils".New Delhi: Bureau of Indian Standards.

IS: 6403-1981 – "Code of Practice for Determination of B.C. of Shallow Foundation".New Delhi: Bureau of Indian Standards.

IS: 8009 (Part-1) 1976, "Code of Practice for Calculation of settlements of foundations".New Delhi: Bureau of Indian Standards.

IS: 1904-1986, "Code of Practice for Design and Construction of Foundations in Soils, general Requirements".New Delhi: Bureau of Indian Standards.

IS: 2911-1979, "Code of Practice for Design and Construction of Pile Foundation,".New Delhi: Bureau of Indian Standards

IRC:

IRC:SP:19-2001, "Manual for Survey, Investigation and Preparation of Road Projects"

IRC:45-1975, "Recommendation for Estimating the Resistance of Soil below the Maximum Score Level in the Design of Well Foundation of Bridges"

Handbooks

1. Fang , H.Y.,(1991)," Foundation Engineering Handbook", Chapman &Hall,NY.

2. Teng .W.C.(1962), "Foundation Design" , Prentice Hall International.

3. Nayak N. V. (2001), "Foundation Design Manual", Dhanpat Rai & Sons

Open Elective II
Introduction to Industry 4.0 and Industrial IOT (IOEUA40203A)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites: Computer Networks, IoT, Basics of AI

Course Objectives:
To understand fundamentals of Industry 4.0 And Industrial Internet of Things
.
- To understand the IoT aspects in Industry 4.0
- To corelate the role of AR/VR, AI and Big data in IIOT.
- To apply cybersecurity in Industrial processes
- To learn IIoT-Business model and architecture
- To understand Big Data Analytics and Software Defined Networks in IIOT
- To apply IIOT in different a**pplication Domains**

Course Outcomes:
After studying this course, students will be able to:
1. Understand the IoT aspects in Industry 4.0.
2. Understand the correlation of the AR/VR, AI and Big data in IIOT.
3. Apply cybersecurity in Industrial processes.
4. Learn IIoT-Business model and architecture.
5. Explain Big Data Analytics and Software Defined Networks
6. Apply IIOT in different a**pplication Domains**

Unit I – Introduction To IIOT

Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.

UNIT II - Industry 4.0

Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, cyber–Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.

Unit- III – Cybersecurity in Industry 4.0

Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Unit IV - Industrial IoT

Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Unit V – Big Data Analytics and Software Defined Networks

Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Unit VI - Application Domains

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.

Textbooks:

1) S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
Availability: https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1

2) S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
Availability: https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

Reference Books:

3) Research Papers

Open Elective II
Software Testing and Quality Assurance (IOEUA40203B)

Teaching Scheme	**Examination Scheme**						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites: NA	
Course Objectives:	
•	Study and understand software testing terminologies and framework
•	Study and understand test and defect management
•	Study and understand automation testing tools
•	Study and understand automation testing for web application
Course Outcomes:	After completion of the course, student will be able to
1.	Understand complete software testing lifecycle and various terms and technologies used in testing domain
2.	Demonstrate understanding of test and defect management process
3.	Create test script and execute automated tests using Selenium IDE
4.	Create test script and execute automated tests using Selenium Web-driver
Unit I:	**Introduction to Testing**
	Why is testing necessary? What is testing? Role of Tester, Overview of Software Testing Life Cycle, SDLC vs STLC, different stages in STLC, different levels of testing, different types of testing, test design techniques for different categories of tests, Requirement traceability.
Unit II:	**Test and Defect Management**
	Test Management: Documenting test plan and test case, Test Scenario vs Test Cases, Test Management using Tool. Defect Management:Test Execution, defect life cycle, fixing/closing defects, Defect Categorization – Criticality and Priority. Use of bug tracking tool for logging and tracing defects. What is Agile? Why agile? Agile vs Waterfall, Components of Agile.
Unit III:	**Basics of Automation testing**
	Basics of java programming, Introduction to automation testing, why automation, what to automate, Automation testing process, tools available for automation testing, Selecting right tool for automation testing.
Unit IV:	**Automation testing using Selenium**
	Understanding Selenium, Selenium tool suite, using Selenium IDE for automation testing, Challenges with selenium IDE, using Selenium Web driver for automation testing, Features of selenium web-driver, Types of web locators

Reference Books:	
1.	MG Limaye, "Software Testing Principles, Techniques and Tools", Tata Mcgraw Hill,ISBN:97800701399090070139903
2.	Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10:817758121X
3.	NareshChauhan,"SoftwareTestingPrinciplesandPractices",OXFORD,ISBN-10:0198061846.ISBN-13:9780198061847
4.	Dr.K.V.K.Prasad,"SoftwareTestingTools",DreamtechPressISBN:10:81-7722-532-4

Open Elective II
Data Centric AI (IOEUA40203C)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites:	Programming knowledge, basic statistics, machine learning fundamentals.
Course Objectives:	After complete this course, student should be able to:
	Compare Model-Centric and Data-Centric AI, promote paradigm shift.
	To understand Data-Centric AI phases and techniques through case study.
	To explore data acquisition and analysis using social media.
	To understand data preprocessing and cleaning techniques for analysis.
	To explore data augmentation for improving model accuracy.
	To Analyze technical debt and data issues in AI systems.
Course Outcomes:	
1	After studying this course, students will be able to:
2	Analyze model-centric issues, justify shift to data-centric approach.
3	Evaluate customer data and create a recommendation engine.
4	Analyze social media data and evaluate customer sentiment.
5	Apply data preprocessing to clean and standardize medical records.
6	Improve model accuracy by augmenting traffic sign images.
7	Evaluate and mitigate technical debt and data issues in AI systems.

PART 1
Model Centric AI Paradigm
Introduction to Model Centric AI, Model-centric trends in AI world, Types of Learning techniques in AI, Models in Supervised Learning, Unsupervised learning and Reinforcement Learning, Problems in Model Centric AI, Need for Paradigm Shift. **Case study**: Building a predictive model to forecast student enrollment in a university program.
Data Centric AI Paradigm
Introduction to Data Centric AI, Phases of Data Centric AI, Data Acquisition, Data Labeling, Data Crowdsourcing, Data Preprocessing, Data Cleaning, Data annotation, Data Augmentation, Data Deployment **Case Study**: Creating a recommendation system for course selection based on students' academic records and interests
Data Acquisition
Sources of Data, Processes to acquire data, Authenticity of Data acquired, Data Storage and Retrieval, Data Integration and Aggregation, Data Fusion and Multi-Modal Data Analysis , Data

Integration and Standardization in Multi-Source Data Acquisition Case Study: Collecting and analyzing social media data to understand student sentiment towards online learning
PART II
Data Preprocessing
Need for Data Preprocessing, Data Cleaning, Data Labeling, Data annotation, Tools and Techniques for Data Labeling for Large Data **Case Study**: Cleaning and standardizing a large dataset of student demographic and academic records for analysis
Data Augmentation
Introduction to Data Augmentation, Need for Data Augmentation, Relationship between AI Model score and Data Augmentation, Tradeoff for Data Augmentation **Case Study**: Augmenting images of mathematical equations to improve accuracy of a handwriting recognition model for grading students' papers
Data Deployment
Technical Debt in Software Development and AI, Data Accuracy, Statistical Significance of Data for Quality Training, Deplorable Data. **Case Study**: Addressing Technical Debt, Data Accuracy, Statistical Significance, and Deplorable Data in an AI System for Predicting Students' Course Performance
Text Books:
1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
2. "Data Science from Scratch: First Principles with Python" by Joel Grus (for Unit III and IV)
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
Reference Books:
1. "Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning" by Benjamin Bengfort, Rebecca Bilbro, and Tony Ojeda
2. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei
3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop
Online Resources
https://www.dask.org/get-started
Reference Assignments:
Developing a machine learning model to predict students' course performance using demographic information and past academic records.
Creating an image recognition model to classify different types of vehicles with high accuracy.
Designing a machine learning model to predict academic performance by incorporating demographic information, past academic records, and other relevant factors.
Building a recommendation system to suggest products to online shoppers based on their browsing and purchase history.
Developing a sentiment analysis model to classify student feedback and reviews into positive, negative, or neutral categories, using crowdsourced data and data augmentation techniques.
Preprocessing and cleaning a large dataset of student academic records to standardize it for analysis.
Integrating and aggregating data from different sources using Python for analysis.
Performing image data augmentation in Python to improve the accuracy of an image recognition model.
Managing technical debt in AI projects and ensuring data accuracy, statistical significance, and deployable data.

Open Elective II

Computer Vision (Open Elective –II)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): - Practical (P): -	20	20	20	40	--	--	100

Prerequisite: Readers/students are expected to know the following concepts:
1. Machine Learning

Course Objectives:

Course Outcomes: At the end of this course, students will be able to
1. Apply concepts of geometric transformations in Image formation
2. Apply image transforms in gray and color image preprocessing.
3. Analyze the extracted features for computer vision model fitting.
4. Understand deep learning models for use in computer vision applications.
5. Estimate the depth of the objects in the environment.
6. Design the computer vision models for applications like object tracking , segmentation of medical images .

Unit- I : Introduction to Computer Vision and Image formation

Introduction and Goals of Computer Vision, Image formation: Geometric transformations, Geometric Camera Models, Single camera setup of image formation. Image formation in a stereo vision setup, Photometric image formation, The digital camera

Unit- II : Fundmentals of Image Processing

Concepts Image enhancement : Contrast enhancement ,image filtering , Image transforms , colour models and transformations, Introduction to image segmentation

Unit –III : Image Descriptors and Features

Points and patches, Edges and contours, Lines and vanishing points, Texture Descriptors, Colour Features, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Scale Invariant Feature Transform.

Unit IV: Overview of Deep Learning

Supervised learning, Unsupervised learning, Deep neural networks, Convolutional neural networks, Model zoos, complex models.

Unit V: Motion Estimation and Depth estimation

Translational alignment, Parametric motion, Optical flow, Layered motion, Epipolar geometry, Sparse correspondence, Dense correspondence Dense correspondence, Multi-view stereo, 3D reconstruction

Unit VI : Applications of Computer Vision

Object detection and tracking , Semantic segmentation (Medical Image Segmentation, Video understanding, Vision and language, Face and Facial Expression Recognition, Image Fusion, Geasture recognition.

Text Books :

1. Szeliski, Richard. *Computer vision: algorithms and applications*. Springer Nature, 2022.

2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.

Reference Books:

1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.

Open Elective II
Project Management: Planning, Execution, Evaluation and Control (IOEUA40203E)

Teaching Scheme	**Examination Scheme**						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Course Objective(s):

- To impart knowledge of project life cycle.
- To construct CPM, PERT network for a project.
- To introduce students to Steps in Risk Management, Risk Identification, Risk Analysis and Reducing Risks
- To introduce students to process of project Performance Measurement, Evaluation and closeout.

Course Outcomes:

Upon completion of the course, students will be able to

1. Understand what a Project is, Essential of Project Management.
2. Learn and Apply project planning and controlling techniques.
3. Identify risks in a project and strategies for managing the project risks
4. Understand the process of project Performance Measurement, Evaluation and closeout.

Basics of Project Management

Introduction to Project Management, Basic Concepts, and Project Life Cycle Management
Organization Strategy, Project Analysis and Project selection, Project Management Organization structure and organization culture, Project Definition, Activities, Work Breakdown structure.

Project Planning and controlling

Project time and cost estimation, Time Management. Developing Project Plan; Network Analysis using PERT/ CPM technique.
Resource Management and Cost Management: Resource levelling, Scheduling and allocating project resources and costs.
Reducing Project duration - Crashing project activities to speed up a project.

Project Risk Management

Project Risk Management - Identification, quantification, and mitigation of risks.
Project Outsourcing, Negotiation, and Managing inter-organizational Relations.
Project Procurement and Contract Management.

Project Monitoring and Evaluation

Project Evaluation, Project progress and Performance Management
Project Closure, and Project Oversight
Familiarization with Project Management software (e.g., MS Project®)

Textbooks:

1. Premkumar Gupta and D.S.Hira, "Operations Research", S. Chand Publications (2014)
2. K Nagrajan, "Project Management",New age International Ltd.
3. Ahuja H.N, "Project Management", John Wiely, New York.
4. Rory Burkey, "Project Management-Planning and Control", 4th ed.—Wiley,India.
5. Project Management: A Managerial Approach, Meredith, J.R. and Mantel, S.J., Wiley, PMBOK® Guidelines Book

Reference Books:

1. Bruce Barkley, "Project Risk Management", McGraw-Hill, 2004

Open Elective II
Solar and Wind Energy (IOEUA40203F)

Teaching Scheme	**Examination Scheme**						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr. Practical (P): 0 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Basic Mechanical Engineering, Basic Electrical and Electronics Engineering and Heat Transfer

Course Objectives:

- To understand fundamentals of solar and wind energies.
- To understand constructions, working principle and design procedure of solar and wind power plants.
- To apply basic engineering principle to design a simple solar and wind power system.

Course Outcomes:

After successful completion of the course, student will be able to

1. Understand and apply solar radiation and geometry principles.
2. Apply specifications of Solar Cell for different applications.
3. Recognize design process of solar pv system for domestic purpose.
4. Acknowledge Wind Data for site selection.
5. Identify and Design types of Wind Plant for a given application.
6. Classify the Wind Turbine Generators for Power Transmission.

Unit I : Solar Energy Basics

Renewable Energy Scenario in India, Benefits and Limitations on Use of Renewable Energy, Present solar energy scenario in India, governing bodies (self-study), solar radiations and its measurements, (Instruments) Issues and Challenges for Growth of Renewable Energy at in India, Concept of Solar Parks, Recent Solar Applications

Unit II: Solar Cell Operation

Solar Spectrum, Solar Radiation Spectrum, Worked Problem - Total Irradiance,
Solar Cell Fundamentals, Worked Problem - The I-V Characteristic, Solar Cell Types and Technologies, Multi-junctions. Conversion Efficiency Limitations, Worked Problem, From Cell to Module, **Energy Audit of Home/Residence**

Unit III: Design of Solar PV Systems

PV Sizing and Output, Orientation and Tilt, Temperature Dependent Output, Module and array conditions, Shading calculations using PV Watts, PV Sizing and output under different conditions, Inverter Sizing and Selection, Case Studies

Unit IV: Wind Energy and its assessment

Principle of wind energy conversion; wind data and site selection considerations, wind energy potential and installation in India., Basic components of wind energy conversion systems; Analysis of aerodynamic forces acting on wind mill blades **and estimation of power output;**

Unit V: Wind Power Plants

Different Components in Wind Turbine Power Plant, Types of Wind Power Plants (WPPs): Small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades , Market **Survey and Specifications, Performance Analysis and Numerical,**

Case study on designing miniature wind mill for domestic purpose referring existing system.

Unit VI: Wind Turbine Generators and Power Transmission

Types of Wind Turbine Generators, DC Generator, AC Synchronous Generator, AC Asynchronous Generators, Switched Reluctance Wind Turbine Generator, Issues occur while integrating wind energy with power grids, reactive power compensation, HVDC and HVAC Transmission, onshore and offshore wind power and benefits of Wind Energy

List of Practical:

1: Design of solar food drier for domestic purpose referring existing systems.
2: Measurement of Solar Insolation at Residence. (Instruments)
3: Design of Solar Pump for Farm Irrigation.
4: Design of solar photovoltaic system for domestic/ commercial building purpose.
5. Design of Solar Operated home appliance.
6. Case study on designing miniature wind mill for domestic purpose referring existing system.
7. Visit to Solar PV System/wind power system used in commercial building.
8. Mini Project on Solar/Wind Energy.

Text Books:

1. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill
2. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002

Reference Books :

1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill
3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd
4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey
5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan.
6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis
7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning

Open Elective III

Social Media Analytics (IOEUA40204A)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites: Social Science , DBMS

Course Objectives:

To understand foundations of Social Media Analytics.

- To Visualize and understand the data mining aspects in social networks.
- To solve mining problems by different algorithms.
- To understand network measures for social data.
- To understand behavioral part of web applications for Analysis.
- To analyze the data available on any social media applications.

Course Outcomes:

After studying this course, students will be able to:

1. Understand the basics of Social Media Analytics.
2. Understand the visualization of social networks and the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Evaluate the performance of centrality measures on social graph.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Facebook, LinkedIn and Twitter kind of applications.

Unit I – Introduction To Social Media Analytics

Social media, History of Social media, Need for SM; Types of Social Media, Social Media Data, standard datasets, Data Formats -CSV Files, JSON Files, XML Files, HTML Files , Tar Files, GZip Files, Image Files: Rasterized, Vectorized, and/or Compressed. Significance of SMA, Application of SMA.

UNIT II - Data Visualization

Social Network theory , measure of network, Data visualization, Techniques of data Visualization ,phases , benefits of data visualization, tools in data visualization , data visualization in Social Media.

Unit- III – Mining In Social Networks

Algorithm-decision trees, K-means for cluster data analysis, Naive Bayes Algorithm, Apriori algorithm for time series data mining,

Unit IV - Network Measures

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank,
Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity

Unit V – Behavior Analytics

Individual Behavior Analysis & modeling, Individual BehaviorPrediction, Collective Behavior Analysis & Modeling, Collective Behavior Prediction

Unit VI - Case Study

Mining Twitter: Overview, Exploring Twitter's API, Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social GraphConnections.

Textbooks: Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.
3. Matthew Ganis, Avinash Kohirkar Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media,Pearson publications,2016

Reference Books: 1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0. 2.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

Open Elective – III
Organizational Behavior (IOEUA40204B)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites :	
•	NA
Course Objectives :	
•	Understand nature, scope, challenges and models of the organizational behaviour
•	Develop self-awareness, interpersonal skills, communication abilities, and leadership qualities
•	Equip students with the knowledge and skills necessary to effectively work in teams, manage conflicts, solve problems, conduct organizational training, and assess and predict employee performance
•	Provide knowledge and skills necessary to understand and manage organizational culture, change, and development
Course Outcomes:	
	After completion of the course, student will be able to
1.	Outline the nature, scope, challenges and models of the organizational behavior. (Understand)
2.	Discuss about techniques for Personality Development, Communication and Leadership, within the scope of an organization (Analyze)
3.	Demonstrate capability of managing people at work. (Apply)
4.	Demonstrate ability to manage organizational culture, change, and development (Apply)

Unit I :	**Introduction**
Introduction: Nature and scope, challenges, Approach to organizational behaviour - Models of organizational behaviour.	
Unit II :	**Personality Development, Communication and Leadership**
Personality Development: Nature – Stages- Determinants of personality, - Johari Window - Transactional analysis; Learning process – theories; Inter-Personal Communication: Listening-feedback- Collaborative processes in work groups, Leadership and motivating people - Leadership theories; Attitudes and values	
Unit III :	**Managing People at Work**
Team building, Team decision making, Group dynamics – Conflict resolution in groups and problem-solving techniques. Organizational Training- Overview, Types of Training. Performance Assessment: Evaluation & Appraisal - Objective & Subjective Techniques Performance Prediction	
Unit IV :	**Organizational Culture and Development**
Organizational Culture- Definition and characteristics, Creating and sustaining culture, Stress in	

organizations- Organizational change - Change dimensions- Over coming resistance to change. Organizational development: Goals- Processes- Nature- interventions, OD techniques.	
Text Books :	
1	Aswathappa K, "Organizational Behavior-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2008.
2	Stephen B Robbins: "Organisational Behavior", PHI, NewDelhi,2008
Reference Books :	
1	Schultz, D. & Schultz, S. E. (2013). Psychology and Work Today: An Introduction to Industrial and Organizational Psychology. 7th Edition. Pearson Education: New Delhi.
2	Gregory Moorhead, Ricky W.Grif fin: "Organizational Behavior", Biztantra, New Delhi, 2009.
3	Jai B.P.Sinha: "Culture and Organizational Behavior", Sage Publication India Private Limted, New Delhi, 2008.
4	Nelson, Quick, Khandelwal, "An Innovative Approach to Learning and Teaching Organisational Behaviour" Cengage Learning, 2012

Open Elective – III
Data Ethics (IOEUA40204C)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	20	20	40	-	-	100

Prerequisites:	
	Data Science Basics
	Fundamentals of Computer Science
Course Objectives:	
	To introduce and understand the fundamental concepts of Data Ethics.
	To familiarize students with the concepts of Algorithmic bias, Privacy and how to achieve thrust.
	To understand how Data Governance is becoming more important.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the basic concepts related to Data Ethics.
2.	Describe the Data driven Business model.
3.	Familiarize students with the concepts of Algorithmic Bias and Fairness.
4.	Discuss and Explain Privacy in relation to Data Ethics.
5.	Understand Digital Trust and Explain different ways to achieve it.
6	Explain the importance of Data Governance.

PART I

INTRODUCTION TO DATA ETHICS

What is data ethics? Oops, we're all public, Personal data becomes commercially valuable, Big data religion, Surveillance revelations, Why Data Ethics are Important for Your Business, Why Should Companies Care about Data Ethics? What Are the Important Aspects of Data Ethics? A Framework for Applying Data Ethics, Best Data Ethics Practices, What ethically significant harms and benefits can data present? Common ethical challenges for data practitioners and users, Data Ethics Tools for Companies and Organizations

Case Study: Facial recognition technology by the New York Police Department (NYPD) in the wake of protests against police brutality and racial injustice in 2020.

THE DATA DRIVEN BUSINESS MODEL

Data as payment, good data, Data at risk, Data brokers in a grey area, a need for new business models, what customers want: general concern for digital surveillance, who do internet user's trust? targeted ads and prices, teens want privacy, demand for data control, consumers are beginning to act, blocking cookies and using vpn, false data on the rise, obfuscation, from lack of knowledge to resignation, pay for privacy, Best practices for data ethics

Case Study: COVID-19 Vaccine Distribution and Equity

Algorithmic Bias & Fairness		
What is Algorithm Fairness? Why is algorithm faimess important? The reasons for unfairness, Analyzing and measuring unfairness, Introduction, Sources of Bias, Dealing with Bias, Mitigating Bias, Further Considerations, Bias, addressing different types of bias, Examples of algorithmic biases, causes of bias, bias detection strategies **Case study:** Aequitas - A Toolkit for Auditing Bias and Fairness in Machine Learning Models		
PART II		
Privacy		
Social privacy, which is which? more (perceived) security, more sharing, user friendliness, privacy products are not new, anonymity tech, privacy is a commitment, privacy embedded in innovation: surveillance capitalism, declarations of independence, anti-surveillance social revolutionaries, privacy by design, a business philosophy. **Case study:** Facebook's Data Privacy Controversies		
Data Ethics and Trust		
What is digital trust, the Snowden effect, the sharing economy, how trust is achieved in various ways, made in Europe, privacy branding, HOW TO BUILD DIGITAL TRUST? The Digital Trust Label, Digital Trust in Context, working towards Digital Trust: The Digital Trust Framework, why is digital trust important? How to build digital trust **Case study:** Why digital trust truly matters - Mcksinsey Globay Digital Trust Survey		
Data Governance and Regulation		
What Data Governance involve, Why Data Governance is becoming more important, Examples of Data Governance in action, The Business value of Data Governance, why data Governance is easier in the public cloud, Ingredients of Data Governance: Tools **Case study:** The Volkswagen (VW) emissions scandal		
Text Books:		
	1	Data Ethics by Gry Hasselbalch & Pernille Tranberg
	2	Data Ethics Building Trust by Christoph Stückelberger / Pavan Duggal
	3	An Introduction to Data Ethics, by Shannon Va1lor,Wi11iam J. Rewak
Reference Books:		
	1	Big Data and Social Science Data Science Methods and Tools for Research and Practice Ian Foster, Rayid Ghani, Ron S. Jarmin, Frauke Kreuter and Julia Lane
	2	Data Governance: The Definitive Guide: People, Processes, and Tools to Operationalize Data Trustworthiness by Evren Eryurek, Jessi Ashdown, Anita Kibunguchy, Uri Gilad, Valliappa Lakshmanan
Online Resources:		
	1	https://www.mckinsey.com/capabilities/quantumb1ack/our-insights/why-digital-trust-truly-matters
	2	https://dataethics.ewtools/
	3	https://ethics.fast.ai/videos/?lesson=2
	4	https://towardsdatascience.com/a-gentle-introduction-to-the-discussion-on-aluorithmic-fairness-740bbb469b6
	5	https://app.snowflake.com/marketplace/?_ga=2.25927037.1719291217.1684583586-1817963815.1682484988

Reference Assignments:	
1	Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions: 1. What are the ethical implications of data collection in this scenario? 2. Who are the stakeholders and what are their interests? 3. What are the potential consequences of data use in this scenario?
2	Choose a real-world scenario related to social media, healthcare, education, or any other domain where data is collected, analyzed and used. Write a report that addresses the following questions: 1. Who might be harmed and who might benefit? 2. What ethical principles should guide the collection, analysis, and use of data in this scenario? 3. How can these principles be implemented in practice? 3. What are your recommendations for improving the ethical considerations in data collection, analysis, and use in this scenario?
3	What are the potential sources of bias in data analysis and how can they be mitigated?
4	Discuss the challenges and opportunities of implementing thrust in practice, including the role of regulations, ethical frameworks, and stakeholder engagement. Provide examples of organizations that have demonstrated thrust in their data practices, and analyze the impact of their actions on society.
5	Research and analyze the different types of data governance and regulation frameworks that exist (e.g., marketplace ,GDPR, CCPA, HIPAA, etc.)
6	Research and analyze recent data privacy violations and their impact on individuals and society (e.g., Facebook-Cambridge Analytic scandal, Equifax data breach, etc.)

Open Elective – III
Business Intelligence (IOEUA40204D)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): - Practical (P): -	20	20	20	40		--	100

Prerequisite: Readers/students are expected to know the following concepts:
2. Data Structures

Course Objectives:

- To study and understand the importance of Business Intelligence and need of data preparation for Business Intelligence.
- To study and understand the different components of analytics landscape and project cycle aligned with these components
- To study and understand different data transformations, data modelling steps and visualize the data on the data models
- To study and understand the ways of adding custom calculations needed and understanding the applications of different statistical concepts.
- To study and understand the BI deployments, administration cycle of BI implementations using Power BI

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Interpret the importance of Business Intelligence and need of data preparation for Business Intelligence (Apply level)
2. Identify, describe, relate to the concepts of different components of analytics landscape and project cycle aligned with these components.(Analyse Level)
3. Design and develop different data transformations, data models, analyse and visualize the data.(Create).
4. Design and develop custom calculations based on business and technical needs and demonstrate and implement different statistical concepts (Create)
5. To compare and interpret Author BI deployments, BI environments.(Analyse)
6. Describe and compare industrial BI implementations, use cases and current and future trends.(Analyse)

.

Unit I:	**Need Of Analytics And Data Preparation**
Introduction to Analytics: What is Analytics?, Need of Analytics, Why Microsoft Power BI?, Types of Business Analytics **Data Sources:** Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation **Need of Data Preparations:** What is Data Preparation?, Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing **Setting up Power BI:** Installation and configuration of Power BI Desktop, Setup of required connector	
Unit II:	**Data Landscape And Project Cycle**
Understanding Data and Databases: What is a database?, What is a DBMS?, What is SQL?, What are	

tables?, Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Cross-database Joins, Type of Data: Structured, Unstructured and Semi-structured data

Data Architecture: BI Architecture, Data Security and Governance, Administration

Analytics Project Lifecycle: Requirements Understanding, Data Understanding, Wireframes, Data Preparation, Data Visualization, Deployment, Documenting, Project Team and Roles, Challenges in Projects

Unit III:	**Data Modelling And Visualization**

Data Integration and Data Warehouses: What is Data Integration?, Need of Data Integration, ETL, What is Data Warehouse?, Need of Data Warehouse, Facts and Dimensions , Star Schema and Snowflake Schema, Data Marts

Data Transformation [Basics]: Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data

Data Modelling: Setting Relationships, Creating Data Models

Data Visualization: What are KPIs?, Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Creating Hierarchies, Groups, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations, Aggregations: SUM, MAX, AVG, MIN

Unit IV :	**Custom Calculations And Analytics**

Data Transformations [Advanced]: Tabular Model at database level, Cross-database joins

Calculations: Calculated Fields, Calculated Measures, Time-intelligent Functions, Moving Averages and Running Total, What-if Analysis, Conditional formatting

Statistical Analytics: Mean, Mode, Median, Variance and Standard Deviation,Simple Regression, Multiple Regression

Unit V :	**Power BI Deployment, Administration And Mobility**

Power BI Deployment: Overview of Power BI Service, Publishing to Power BI Service. Understanding the Power BI Service Workspaces, Apps, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, Authoring reports within Power BI Service, Sharing dashboards across your organization, Configuring Gateways, Scheduling automated refresh of your reports using Data Gateway

Power BI Advanced Features: Using NLP to creating dashboards, Influencers, Delivering Insights, Explain Analysis

Mobile Analytics: Creating Dashboards for Mobiles, Using dashboards and reports using Mobile App

Unit VI :	**Industry Analytics Landscape**

Working with Tableau: Introduction to Tableau, Installation and Setup of Tableau Desktop, Visualizing with Tableau

Advanced Concepts: Web Analytics, Sentiment Analysis, Big Data, Data Lakes, IoT

Applications of Business Analytics: Manufacturing Use Cases, EPC Use Cases, Retail Use Cases, Future Trends of Analytics

Text Books :

1. "Business Intelligence Guidebook: From Data Integration To Analytics" by Rick Sherman, Elsevier Inc.
2.Successful Business Intelligence, Second Edition: Unlock The Value Of BI & Big Data" by Cindi Howson, McGraw Hill Edition
3"Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get

Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch

4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Koganpage Publicaitons, Auva Press

Reference Books:

3. "Performance Dashboards – Measuring, Monitoring, And Managing Your Business" by Wayne Eckerson, John Wiley & Sons, Inc
4. "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications" by Larissa T. Moss & Shaku Atre, Addison-Wesley information Technology Series
5. "Artificial Intelligence: Building Intelligent Systems" by Dr. Parag Kulkarni, Dr. Prachi Joshi, PHI publication (for understanding of concepts)

Open Elective III
Business Analytics (IOEUA40204E)

Teaching Scheme	**Examination Scheme**						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Prerequisite course(s): Database Management System, MS-Excel

Course Objective(s):

1. To study and understand the importance of Business Analytics and need of data Visualisation for Business Analytics
2. To study and understand the different components of analytics landscape and project cycle aligned with these components
3. To study and understand different data transformations, data modelling steps and visualize the data on the data models

Course Outcomes:

Upon completion of the course, students will be able to

1. Describe the importance of Business Analytics and need of data visualisation and analysis for Business
2. Identify, describe, relate to the concepts of different components of analytics landscape and project cycle aligned with these components
3. Design and develop different data transformations, data models, analyse and visualize the data
4. Design and develop custom calculations based on business requirements and understand Tableau Products

Unit-I: Introduction to Analytics and Data Visualization

Introduction to Analytics: What is Analytics? Need of Analytics, Types of Analytics, Role of Analytics in Business

Data Sources: Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation

Power BI Desktop: Need of visualisation, Different Visualisation tools, Why Microsoft Power BI? Installation and configuration of Power BI Desktop, Setup of required connector

Data Visualization: What are KPIs? Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations

Unit II: Data & Analytics Landscape and Project Cycle

Understanding Data and Databases: What is a database? What is a DBMS? What is SQL? What are tables? Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Type of Data: Structured, Unstructured and Semi-structured

BI Architecture: BI Architecture, Data Security and Governance, Administration

BI Project Lifecycle: Requirements Understanding, Data Understanding, Data Integration and Data warehouse, Reporting and Analysis, Dashboard development, Deployment, Documenting, Project Team and Roles, Challenges in Projects

Data Integration and Data Warehouses: What is Data Integration? Need of Data Integration, ETL, what is Data Warehouse? Need of Data Warehouse, Facts and Dimensions

Star Schema and Snowflake Schema, Data Marts.
Unit III: Data Preparation and Data Modelling
Need of Data Preparations: What is Data Preparation? Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing **Data Transformation [Basics]:** Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data **Data Modelling:** Setting Relationships, Creating Data Models **Data Transformations [Advanced]:** Split data, Handling inconsistent data, Conditional Column,Custom column
Unit IV: Calculations, Power BI Deployment and Industry Analytics Landscape
Calculations: Introduction to DAX, Calculated Column, Calculated Measures, M-Query calculations, YTD, QTD, MTD calculations **Power BI Deployment:** Overview of Power BI Service, Publishing reports to Power BI Service, Understanding the Power BI Service User Interface, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, authoring reports within Power BI Service, sharing dashboards across your organization, **Power BI Mobile:** Creating Dashboards for Mobiles, using dashboards and reports using Mobile App. **Tableau Overview:** Introduction to Tableau, Tableau Products, Tableau architecture, Installation and Setup of Tableau Desktop, Visualizing with Tableau, Tableau online and Tableau server, Publish and share reports on Tableau online.

Open Elective -III
Project Management & Economics (IOEUA40204F)

Teaching Scheme	**Examination Scheme**						
Credits:2 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): – hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	--	100

Prerequisite: Basic Concepts of Statistics and Probability

Course Objectives:

- To provide students a strong foundation in engineering projects for entry-level to mid-level professionals.

To learn the basics of economics and cost analysis relevant to engineering so as to take economically sound decisions.

Course Outcomes:

Upon completion of the course, students will be able to

1. Demonstrate the understanding of project management and project evaluation techniques
2. Allocate project resources considering risk management.
3. Identify HRM issues in project procurement and material management
4. Calculate rate of return, interest rate and tax.
5. Perform cost analysis.
6. Critically examine present worth and future worth.

Unit I: Introduction to Engineering Projects

Project Fundamentals, Project overview, Project Feasibility Analysis, Project identification, Sources of Project ideas, Project Evaluation Techniques, Monitoring and control of projects.

Unit II: Project Resource Allocation

Project scheduling with unlimited Resources, Project scheduling with limited Resources, Risk Identification, Enterprise Resource planning.

Unit III: Project Human Resource Management

Project Organization Structure, Leadership Style, Managing Conflicts, Human Resource Management issues, Project Total Quality Management, Project Contract Management.

Unit IV: Introduction to Economics

Engineering Decision-Makers, Engineering Economics, Intuition and Analysis, Tactics and Strategy. Law of demand and supply, Law of returns,
Interest and Interest factors: Interest rate, Simple interest, Compound interest,
Personal loans and EMI Payment, Tax concepts, Income tax.

Unit V: Fundamentals of Finance and Costing

Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, Marginal cost, Selling price. Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account.

Unit VI: Net Worth Comparisons

Present-Worth Comparisons: Conditions, Basic Present worth comparisons, Present-worth

equivalence, Net Present worth, Future-worth comparison, Pay-back comparison, Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life.
Text Books:
1. Total Project Management – The Indian Context by P. K. Joy, Macmillan Publishers India Ltd., ISBN No.: 0333-92624-2 2. Chan S. Park "Contemporary Engineering Economics", 3rd Edition,PHI Publications.
Reference Books :
1. Chandra, P., Projects, Planning, Analysis, Financing, Implementation and control, Tata McGraw Hill, Fifth Edition 2. Maylor, H., Project Management, Pitman Publication, Second Edition. 3. Ghattas, R.G. &McKee, S.L., Practical Prokject Management, Pearson Education Asia. 4. Pinto, P.K., Project Management, Pearson Education, First Edition 5. Wyzocki, R.K. &Mc Gary R., Effective Project Management, Wiley. First Edition 6. Leland T. Blank and Anthony J. Tarquin , "Engineering Economy" 4th Edition ,McGraw Hill Publication . Dr.K.K.Dewett and M. H. Navalur ," Modern Economic Theory"Revised Edition,S Chand Publication.

Research Methodology and IPR (CVUA40205)

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week	-	-	50	-	-	-	50

Course Objectives:

- Explain the formulation of Research Problem
- Explain the importance of ideas, concept and creativity.
- Transfer the knowledge about the IPR required for Engineer's.
- Describe the how IPR creates National wealth.
- Teach National and International IP System

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Formulate the research problem with appropriate objectives
2. Understand the right of ownership, scope of protection as well as the ways to create and to extractvalue from IP.
3. Identify different types of Intellectual Properties (IPs)
4. Discover how IPR are regarded as a source of national wealth and mark of an economic leadership incontext of global market scenario.
5. Analyze national & International IP system.

Unit I: Introduction to Research problem

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, Research ethics.

Unit II: Introduction to Intellectual Property

Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights Understanding the types of Intellectual Property Rights: - Patents, Designs, Trademarks (Registered and unregistered trademarks), Copyright, Traditional Knowledge, Geographical Indications, Trade Secrets, Idea Patenting, (Case Studies)

Unit III: (6Hrs) Introduction to Patents

New Developments in IPR, Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Indian Patent Office and its Administration.

Unit IV: (6Hrs) Patent Acts and Licensing

Administration of Patent System – Patenting under Indian Patent Act, Patenting under PCT ,Patent Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification

Text Books:

1. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
2. Resisting Intellectual Property by Halbert, Taylor& Francis Ltd ,2007.
3. Industrial Design by Mayall, Mc Graw Hill.
4. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley

Reference Books :

1. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
2. Intellectual Property Rights under WTO by T. Ramappa, S. Chand
3. Introduction to Design by Asimov, Prentice Hall

MODULE III

Professional Elective IV
Architecture and Town Planning (CVUA42201A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	25	-	125

Prerequisite course(s): Introduction to Infrastructure Engineering, Transportation Engineering.

Course Objectives

- To impart basic knowledge of Architecture and Planning as an important and integral field of Civil Engineering to the students.
- To introduce acts, laws, rules as well as some modern techniques relevant to town planning.
- To make the students prepare a neighbour-hood plan.

Course Outcomes:

Upon completion of the course, students will be able to

1. Demonstrate principles and elements of architecture as well as explain the role of urban planner/ designer and architect in Civil engineering discipline.
2. Apply the concepts of beautification of cities, urban planning and renewal for sustainability.
3. Describe planning hierarchy in India, legislative procedure, significance and contents of Maharashtra Regional and Town Planning Act 1966; and Develop neighborhood plan.
4. Explain various surveys role and organizational structure of planning agencies and organizations with reference to town planning.
5. Examine acts, laws and rules relevant to town planning.
6. Discuss special provisions related to town planning such as SEZ, CRZ, Smart City, AMRUT guidelines, modern techniques in planning.

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7. Apply the knowledge in preparing planning of town/city.

Unit I: Fundamentals of Architecture

Meaning, Necessity and Objectives of Architecture, Principles and elements of Architecture, Seven Lamps of Architecture (Only significance & necessity).
Role of Urban Planner/ Designer and Architect for conservation and preservation, spatial organization, utility, demand of the area and supply.
Characteristics of Architecture: Simplicity, user friendly, contextual, eco-friendly, maintaining special character/ identity of the areas, utility of spaces, future growth .

Unit II: Human Psychology, Beautification of cities and Sustainability

Meaning, Need of breathing spaces in modern urban areas and their uses, Necessity of beautification of cities and applications, Livability in Urban Areas, Considerations for Human Psychology and Quality of Life. Urban planning and renewal: Development and sustainability.

Unit III: Planning Hierarchy in India

Meaning and History of Town and Country Planning (Only brief overview). Necessity and Objectives of Town and Country Planning, Advantages of Town Planning. and Principles and components of Town Planning. New Town Development.
Levels (Hierarchy) of Planning in India. Regional Planning, Development Plan, Town Planning, Town Planning Schemes and Neighborhood planning.
Legislative procedure and contents of Maharashtra Regional and Town Planning Act 1966.

Unit IV: Surveys, Planning Agencies and Urban Transportation

Meaning, Necessity and Objectives of Surveys for Town Planning: Land-use, Housing, Demography, Industry, Transportation, Water Supply, Drainage and Sanitation (Including Treatment Plants)
Planning Agencies and Organizations at various Levels of Planning such as CIDCO, HUDCO, MIDC, MHADA, SRA, MMRDA/PMRDA,Purpose, Relevant Acts, Their Organizational structures (Constitution), and working.
Urban transportation Management: Hierarchy of urban roads, traffic management systems, BRT, Details of Intelligent Transport System, Parking.

Unit V: Acts, Laws and Rules Relevant to Town Planning

D.C. Rules. Land Acquisition Act 1896, Land Acquisition Rehabilitation and Resettlement Act.
URDPFI Guidelines for Land-use and Infrastructure.
Real Estate (Regulation and Development) Act 2016 and MAHA-RERA

Unit VI: Special Provisions Relevant to Town Planning

New and Special towns, township development with study of minimum one case study each.
SEZ, CRZ, Smart City, AMRUT Guidelines.
Modern Techniques in Planning: Application of GIS, GPS, Drones, remote sensing, in planning.

Term Work:

Any four exercises from Sr. No. 5 through 11 as allotted (Decided) by concerned faculty member.

1) **Group work (Compulsory Exercise):**Study and analysis of Development Plan of any city/ town (Available either on website OR procures from relevant Office) with respect to land-use, services, infrastructure, Transportation, housing.
2) **Individual work (Compulsory Exercise):** Neighborhood Planning (Area and major features/ characteristics to be provided by concerned faculty member)
3) **Individual work (Compulsory Exercise):** Study and report writing for Smart City or AMRUT guidelines with report on one case study.
4) **Group work (Compulsory Exercise):**e- learning and individual report writing for MAHA- RERA. (https://maharera.mahaonline.gov.in)
5) **Group work*:**Study and individual report writing for an existing town planning scheme.
6) **Group work*:**Study and individual report writing for the salient features of urban renewal/ TP scheme.
7) **Group work*:**Study and individual report writing of urban conservation and/or housing and changes in housing over a decade or so.
8) **Group work*:**Study and individual report writing for application and success/ failure of BRT and/or Intelligent Transport System.
9) **Group work*:**Study and individual report writing for Any Relevant Act/ Laws/ Rules with respect to planning.
10) **Individual Exercise*:**Report on the brief life-sketch and contribution of Engineer/ Planner/ Architect in post-independence India.
11) **Individual Exercise*:**Study and report on an existing new town and planned town like New

Mumbai, Gandhinagar, PCNTDA,Mainly with reference to Infrastructure and disaster management).
Textbooks:
1. G K Hiraskar, (2018), "Fundamentals of Town Planning", Dhanpat Rai Pubications 2. S Rangwala, (2009),"Town Planning", Charoter Publishing House Pvt Ltd 3. Arvind Krishnan, "Climate Responsive Architecture", Tata McGraw-Hill Publishing Company 4. Michael Laurie, "Introduction To Landscape Architecture" Elsevier,Publishing company New York
Reference Books:
1. Gallion and Eisner, "The Urban Pattern: City planning and design" Van Nostrand Reinhold, Publishing company 2. Edmond bacon, "Design of cities" Thames and Hadson, Publishing company 3. MRTP Act 1966 4. Sustainable Building Design Manual 5. UDPFI Guidelines 6. CIDCO, HUDCO, MIDC, MHADA, SRA, MMRDA/PMRDA, Acts and their websites. 7. LARR Act 2013
e-Resources:
https://maharera.mahaonline.gov.in

Professional Elective IV
Environmental Impact Assessment (CVUA42201B)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	25	-	125

Prerequisite: Environmental Engineering I & II at UG level

Course Objectives

1. To create awareness among the students for environmental impact assessment technique
2. To prepared the students for EIA norm and provisions.

Course Outcomes:

Upon completion of this course, students will be able to –

1. Understand the concept of EIA
2. Analyse components and methods of EIA
3. To impart the knowledge of EIA for water quality.
4. To impart the knowledge for EIA in various industries.
5. Study provision of EIA.
6. Study a project for EIA.

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7. Understand the concept of EIA, methods and EIA project.

Unit I : Introduction

Environmental impact assessment (EIA),environmental impact statement (EIS).Environmental Risk Assessment (ERA), Legal and Regulatory aspects in India, Types and limitations of EIA, Terms of Reference in EIA. Issues of EIA – National – cross sectoral –social and cultural.

Unit II : Components and methods

Components, screening, setting, analysis, prediction of impacts, mitigation. Matrices , Networks –, Checklists. Importance assessment techniques , cost benefit analysis , analysis of alternatives , methods.

Unit III: Impact assessment (Water quality)

Water Quality Impact Assessment – attributes, water quality impact assessment of water resources projects, data requirements of water quality impact assessment, Case studies

Unit IV: EIA for various industries

Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring.

Unit V: Provisions of EIA

Latest EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for public hearing, post environmental monitoring, Procedure for obtaining Environmental clearance for construction projects.

Unit VI : Case study

Case study of EIA construction project or any other project.

Text Books:

1.S R Khandeshawr N S Raman, A R Gajbiye (2019) ," Environmental Impact Assessment ", Willey Publication.
2. David P. Lawarance , " Environmental Impact Assessment ", Willey Publication.
3. Dr R.R. Bharatwal, " Environmental Impact Assessment ", by New Age Publication, New Delhi.

Reference Books

1. Y. Anjaneyulu, Valli Manickam, " Environmental Impact Assessment ", CRC Publication.
2. Anjali Reddy , " Environmental Impact Assessment ",BS Publicaiton.

Term Work

Construction project based on EIA of construction project or any other project.

Professional Elective IV
Advanced Design of R.C. Structures (CVUA42201C)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	25	-	125

Prerequisite: Structural Analysis, Design of RC Structures

Course Objectives: The course will help students to understand design of RC structures constructed for specific purpose.

Course Outcomes:

Upon completion of the course, students will be able to

1. **Explain** the concept of yield line theory and analyse the RC slabs using yield line theory.
2. **Design** the flat RC slabs as per guidelines given in Indian Standard Code.
3. **Design** the circular RC ground water tanks as per guidelines given in Indian Standard Code.
4. **Design** the rectangular RC ground water tanks as per guidelines given in Indian Standard Code.
5. **Design** the RC cantilever retaining walls as per guidelines given in Indian Standard Code.
6. **Design** RC combined footing as per guidelines given in Indian Standard Code.

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Unit I : Yield Line Theory

Introduction, assumptions, methods of analysis and basic principles, illustrative example of slab design

Unit II: Flat Slabs

Advantages and Disadvantages, design requirements, direct design method, equivalent frame method

Unit III: Design of circular ground water tanks

Introduction, types, function, codal provisions, methods of analysis, Design of circular water tanks resting on ground by Limit State method.

Unit IV: Design of rectangular ground water tanks

Design of square and rectangular water tanks resting on ground by Limit State method.

Unit V: Design of cantilever retaining wall

Introduction, Functions and types of retaining walls, Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions, Introduction and concept of counter fort retaining walls.

Unit VI:Design of Combined Footing

Introduction, design of slab type combined footing, design of beam & slab type of combined footing

Term Work:

Students are required to solve at least two assignments on each unit.

Textbooks:

1) PillaiS. and MenonDevdas, 3rd Edition (2017), "Reinforced Concrete Design", Tata McGraw Hill, New Delhi.
2) Punmia, Jain and Jain, (2001),"Comprehensive Design of R.C. Structures", Standard Book House, New Delhi.
3) Shah V. L. and KarveS. R., 6th Edition (2013),"Limit state theory and Design of Reinforced Concrete", Structures publications, Pune, India.
4) SinhaN.C.and Roy S.K., 4th Edition (2013),"Fundamentals of Reinforced Concrete", S. Chand Publishing, New Delhi.

Reference Books:

1) VargheseP.C., 2ndEdition, (2005), "Advanced reinforced concrete design", Prentice Hall of India, New Delhi,
2) M. L. Gambhir, "Design of design of reinforced Concrete structures", PHI.
3) Shah V. L. and Karve S. R., 6th Edition (2013),"llustrated Design of Reinforced Concrete Buildings (G+3)", Structures Publications', Pune 411009.
4) Shah H. J., 11th Edition (2016), "Reinforced Concrete, Vol I",Charotar Publishing House, India.

Reference codes and standards:

1. IS: 456-2000 – "Plain and Reinforced Concrete – Code of Practice", New Delhi: Bureau of Indian Standards.
2. SP 34 – "Handbook on Concrete Reinforcement and detailing", New Delhi: Bureau of Indian Standards.
3. SP 16 – "Design Aids for Reinforced concrete to IS 456:1980 Code Book", New Delhi: Bureau of Indian Standards.
4. IS: 3370 – "Indian Standard code of practice for concrete structures for storage of liquids", New Delhi: Bureau of Indian Standards.

OPEN ELECTIVE – IV
Non-Destructive Techniques and Engineering Diagnosis (IOEUA42202E)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	25	-	125

Prerequisite: Applied Physics, Basic Electronics, Engineering Chemistry

Course Objectives: The course will help students

1. To **understand** basic concepts and need of health monitoring.
2. To **recognize** the purpose of specific non-destructive technique and **interpret** its results for damage evaluation.

Course Outcomes:

Upon completion of the course, students will be able to

1. **Understand** and **explain** the need for health monitoring in the field of engineering.
2. **Explain** working principle and applications of transducers under stress.
3. **Demonstrate** use of ultrasonic pulse velocity technique for damage detection.
4. **Demonstrate** use of acoustic emission technique for damage detection.

Unit I: Concept of Health monitoring

Basic concepts of health monitoring with regard to structures, machines and electronic components.

Unit II: Transducers

Introduction, types of transducers, working principle of transducers, applications of transducers to various fields of engineering.

Unit III: NDT - Ultrasonic pulse velocity

Introduction, working principle of ultrasonic pulse velocity technique, application to various fields of engineering.

Unit IV:NDT- Acoustic Emission

Introduction, working principle of acoustic emission technique, application to various fields of engineering.

Term Work:

1) At least two assignments on each unit
2) Demonstration of NDT for damage detection

Reference Books:

1. Ian R. Sinclair, (2001), "Sensors and Transducers", Oxford: Newnes, UK.
2. Christian u. Grosse and Masayasu Ohtsu,(2008) "Acoustic Emission Testing Basics for Research – Applications in Civil Engineering", Le-tex publishing services oHG, Leipzig, Germany.
3. IS13311 (Part1):1992 "Non-destructive testing of concrete - methods of test- Part 1 Ultrasonic Pulse Velocity", New Delhi: Bureau of Indian Standards.

Open Elective – V : Numerical Methods (IOEUA42203E)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	25	-	125

Course Objective:

- To prepare the students to apply numerical methods to solve differential equations, integrations and simultaneous equations and perform regression analysis.

Course Outcomes:

Upon completion of the course, students will be able to

1. Apply curve fitting techniques; carry out regression and interpolation analysis of any engineering problem.
2. Solve simultaneous equations using numerical technique.
3. Perform numerical integration for any engineering problem.
4. Solve differential equation of any engineering problem using numerical technique.

Unit I: Curve Fitting, Regression and Interpolation

Curve fitting with Linear Equation, Criteria for a Best Fit, Linear Least Square Regression, Linear Regression Analysis, Coefficient of Determination, Polynomial Regression, Multiple Linear Regression, Lagrange's Interpolation, Newton's Forward Interpolation, Hermit Interpolation, Inverse Interpolation

Unit II: Simultaneous Equations

Gauss Elimination Method, Partial Pivoting, Gauss Seidel Method, Gauss Jordan Method and Thomas Algorithms for Tridiagonal Matrix.

Unit III: Numerical Integration

Trapezoidal rule, Simpson's Rule ($1/3^{rd}$and $3/8^{th}$), Gauss Quadrature2 point and 3 point method, Double Integration- Trapezoidal Rule, Simpson's $1/3^{rd}$ Rule

Unit IV: Numerical Solution of Differential Equations

Euler Method, Modified Euler Method (Iterative), Runga-Kutta Fourth Order Method, Simultaneous Equations using Runga-Kutta Second Order Method, Introduction to Finite Difference Method.

Term Work:

Students are required to submit at least two assignments on each unit.

Textbooks:

1. Rao V. Dukkipati, (2011), "Numerical methods", New Age International Publishers
2. S. S. Sastry, (2012), "Introductory Methods of Numerical Analysis", PHI Learning Private Limited.

Reference Books:

1. Jaan Kiusalaas, (2013), "Numerical Methods in Engineering with Python 3", Cambridge University Press
2. S. BalachandraRao and C.K.Shantha (2004), "Numerical Methods", University Press