

MODEL CURRICULUM

for

UNDERGRADUATE DEGREE COURSES IN

CIVIL ENGINEERING

(Engineering & Technology)

[January 2018]



ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
Nelson Mandela Marg, Vasant Kunj, New Delhi 110 070
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All India Council for Technical Education
Model curriculum for
Undergraduate Degree Courses in Engineering & Technology

CIVIL ENGINEERING
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CIVIL ENGINEERING

Chapter-1
General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab) per week	1 credit

B. Range of credits -A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:

S. No.	Category	Breakup of Credits (Total 160)
1	Humanities and Social Sciences including Management courses	12
2	Basic Science Courses	26
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	29
4	Professional core courses	47
5	Professional Elective courses relevant to chosen specialization/branch	23
6	Open subjects–Electives from other technical and/or emerging subjects	11
7	Project work, seminar and internship in industry or appropriate work place/ academic and research institutions in India/abroad	12
8	Mandatory Courses [Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
	Total	160*

**Minor variation is allowed as per need of the respective disciplines.*



D. Credit distribution in the First year of Undergraduate Engineering program:

Subject	Lecture (L)	Tutorial (T)	Laboratory/Practical (P)	Total Credits (C)
Chemistry-I	3	1	3	5.5
Physics	3	1	3	5.5
Mathematics-I	3	1	0	4
Mathematics-II	3	1	0	4
Programming for Problem Solving	3	0	4	5
English	2	0	2	3
Engineering Graphics & Design	1	0	4	3
Workshop/ Practicals	1	0	4	3
Basic Electrical Engineering	3	1	2	5
*Biology	2	1	0	3
*Engineering Mechanics	3	1	0	4
* Mathematics-III	2	0	0	2

**These courses may be offered preferably in the 3rd semester & onwards.*

E. Course Code and Definition:

Course code	Definitions
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC-CE	Professional core courses
PEC-CE	Professional Elective courses
OEC-CE	Open Elective courses
LC-CE	Laboratory course
MC	Mandatory courses
PROJ-CE	Project

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Code No.	Subject	Semester	Credits
1	HSMC101	English	II	3
2	HSMC251	Introduction to Civil Engineering	III	2
3	HSMC201	Humanities-I (Effective Technical Communication)	III	3
4	HSMC252	Civil Engineering - Societal & Global Impact	IV	2
5	HSMC255	Professional Practice, Law & Ethics	V	2
Total Credits:				12



BASIC SCIENCE COURSES

Sl. No.	Code No.	Subject	Semester	Credits
1	BSC101	Physics (Mechanics & Mechanics of Solids)	I	5.5
2	BSC103	Mathematics –I (Calculus, Multivariable Calculus and Linear Algebra)	I	4
3	BSC 102	Chemistry-I	II	5.5
4	BSC 104	Mathematics –II (Differential Equations)	II	4
5	BSC 109	Biology for Engineers	III	3
6	BSC225	Life Science	III	2
7	BSC201	Mathematics-III (Transform & Discrete Mathematics)	III	2
Total Credits:				26

ENGINEERING SCIENCE COURSES

Sl. No.	Code No.	Subject	Semester	Credits
1	ESC101	Basic Electrical Engineering	I	5
2	ESC102	Programming for Problem Solving	II	5
3	ESC104	Workshop Manufacturing Practices	II	3
4	ESC105	Engineering Graphics & Design	I	3
5	ESC202	Basic Electronics	III	2
6	ESC203	Computer-aided Civil Engineering Drawing	III	2
7	ESC205	Engineering Mechanics	III	4
8	ESC212	Energy Science & Engineering	III	2
9	ESC209	Mechanical Engineering	IV	3
Total Credits:				29

PROFESSIONAL CORE COURSES/FUNDAMENTAL ENGINEERING PRINCIPLES & TOOLS

Sl. No.	Code No.	Subject	Semester	Credits
1	PCC-CE201	Instrumentation & Sensor Technologies for Civil Engineering Applications	IV	3
2	PCC-CE202	Engineering Geology	IV	2
3	PCC-CE203	Disaster Preparedness & Planning	IV	2
4	PCC-CE204	Introduction to Fluid Mechanics	IV	3
5	PCC-CE205	Introduction to Solid Mechanics	IV	2
6	PCC-CE206	Surveying & Geomatics	IV	3
7	PCC-CE207	Materials, Testing & Evaluation	IV	3
8	PCC-CE301	Mechanics of Materials	V	3
9	PCC-CE302	Hydraulic Engineering	V	3



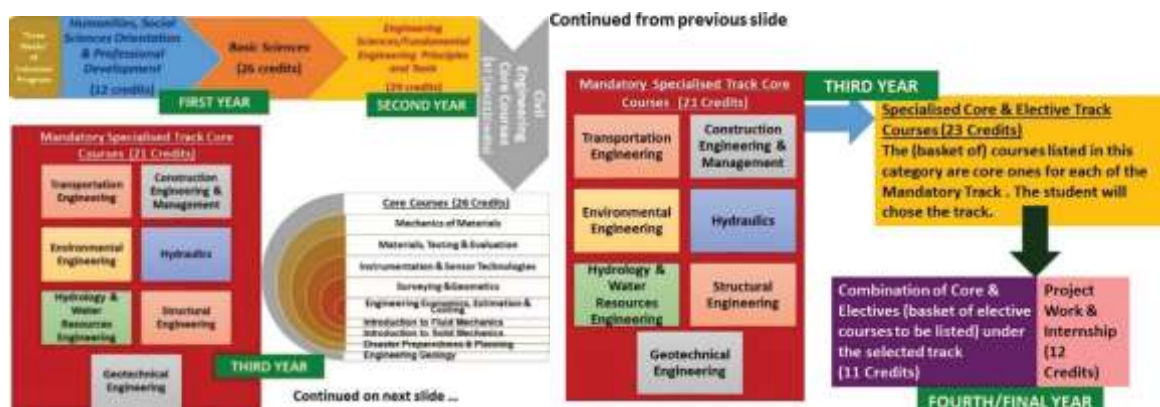
Sl. No.	Code No.	Subject	Semester	Credits
10	PCC-CE303	Structural Engineering	V	3
11	PCC-CE304	Geotechnical Engineering	V	3
12	PCC-CE305	Hydrology & Water Resources Engineering	V	3
13	PCC-CE306	Environmental Engineering	V	3
14	PCC-CE307	Transportation Engineering	V	3
15	PCC-CE308	Construction Engineering & Management	VI	3
16	PCC-CE309	Engineering Economics, Estimation & Costing	VI	5
Total Credits:				47

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Code No.	Subject	Semester	Credits
1	PEC-CEEL302	Elective-I	VI	3
2	PEC-CEEL304	Elective-II	VI	3
3	PEC-CEEL306	Elective-III	VI	3
4	PEC-CEEL308	Elective-IV	VI	3
5	PEC-CEEL401	Elective V	VII	3
6	PEC-CEEL403	Elective-VI	VII	3
7	PEC-CSEL402	Elective VII	VIII	3
8	PEC-CSEL402	Elective VIII	VIII	2
Total Credits:				23

OPEN ELECTIVE COURSES

Sl. No.	Code No.	Subject	Semester	Credits
1	OEEL302	Open Elective-I (Humanities)	VI	3
2	OEEL401	Open Elective-II (Metro Systems & Engineering)-Suggested (See Annexure-I)	VII	3
3	OEEL402	Open Elective-III	VIII	3
4	OEEL403	Open Elective-IV	VIII	2
Total Credits:				11





4 year Curriculum structure Undergraduate Degree in Engineering & Technology

Branch / Course: Civil Engineering
Total credits (4 year course) 160

- I. **Mandatory 3-week Student Induction Program** (Please refer **Appendix-A** for guidelines and details.)

II. Semester-wise structure of curriculum

[L= Lecture, T = Tutorials, P = Practicals & C = Credits]

Semester I (First year) Branch/Course Civil Engineering

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science course	BSC101	Physics (Mechanics & Mechanics of Solids)	3	1	3	5.5
2	Basic Science course	BSC103	Mathematics –I (Calculus, Multivariable Calculus and Linear Algebra)	3	1	0	4
3	Engineering Science Courses	ESC101	Basic Electrical Engineering	3	1	2	5
4	Engineering Science Courses	ESC105	Engineering Graphics & Design	1	0	4	3
			Total credits				17.5



Semester II (First year]
Branch/Course Civil Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science courses	BSC 102	Chemistry-I	3	1	3	5.5
2	Basic Science courses	BSC 104	Mathematics –II (Differential Equations)	3	1	0	4
3	Engineering Science Courses	ESC102	Programming for Problem Solving	3	0	4	5
4	Engineering Science Courses	ESC104	Workshop Manufacturing Practices	1	0	4	3
5	Humanities and Social Sciences including Management courses	HSMC101	English	2	0	2	3
			Total credits				20.5

Semester III (Second year]
Branch/Course Civil Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Courses	ESC202	Basic Electronics	1	0	2	2
2	Basic Science courses	BSC 109	Biology for Engineers	2	0	2	3
3	Engineering Science Courses	ESC203	Computer-aided Civil Engineering Drawing	1	0	2	2
4	Engineering Science Courses	ESC205	Engineering Mechanics	3	1	0	4
5	Engineering Science Courses	ESC212	Energy Science & Engineering	1	1	0	2
6	Engineering Science Courses	BSC225	Life Science	1	0	2	2
7	Basic Science courses	BSC201	Mathematics-III (Transform & Discrete Mathematics)	2	0	0	2



Sl. No.	Category	Code	Course Title	Hours per week			Credits
8	Humanities and Social Sciences including Management courses	HSMC201	Humanities-I (Effective Technical Communication)	3	0	0	3
9	Humanities and Social Sciences including Management courses	HSMC251	Introduction to Civil Engineering	2	0	0	2
Total credits							22

**Semester IV (Second year]
Branch/Course Civil Engineering**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Courses	ESC209	Mechanical Engineering	2	1	0	3
2	Professional Core courses	PCC-CE201	Instrumentation & Sensor Technologies for Civil Engineering Applications	1	1	2	3
3	Professional Core courses	PCC-CE202	Engineering Geology	1	0	2	2
4	Professional Core courses	PCC-CE203	Disaster Preparedness & Planning	1	1	0	2
5	Professional Core courses	PCC-CE204	Introduction to Fluid Mechanics	2	0	2	3
6	Professional Core courses	PCC-CE205	Introduction to Solid Mechanics	2	0	0	2
7	Professional Core courses	PCC-CE206	Surveying & Geomatics	1	1	2	3
8	Professional Core courses	PCC-CE207	Materials, Testing & Evaluation	1	1	2	3
9	Humanities and Social Sciences including Management courses	HSMC252	Civil Engineering - Societal & Global Impact	2	0	0	2
10	Mandatory Courses (non-credit)	MC-CE207 (same as HSMC202)	Management I (Organizational Behavior)	3	0	0	0
Total credits							23



Semester V (Third year]
Branch/Course Civil Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				L	T	P		
1	Professional Core courses	PCC-CE301	Mechanics of Materials	3	0	0		3
2	Professional Core courses	PCC-CE302	Hydraulic Engineering	2	0	2		3
3	Professional Core courses	PCC-CE303	Structural Engineering	2	1	0		3
4	Professional Core courses	PCC-CE304	Geotechnical Engineering	2	0	2		3
5	Professional Core courses	PCC-CE305	Hydrology & Water Resources Engineering	2	2	0		3
6	Professional Core courses	PCC-CE306	Environmental Engineering	2	2	0		3
7	Professional Core courses	PCC-CE307	Transportation Engineering	2	0	2		3
8	Humanities and Social Sciences including Management courses	HSMC255	Professional Practice, Law & Ethics	2	0	0		2
9	Mandatory courses (non-credit)	MC-1	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-		0
Total credits								23

Semester VI (Third year]
Branch/Course Civil Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core courses	PCC-CE308	Construction Engineering & Management	2	1	0	3
2	Professional Core courses	PCC-CE309	Engineering Economics, Estimation & Costing	2	1	4	5
3	Professional Elective courses	PEC-CEEL302	Elective-I	3	0	0	3
4	Professional Elective courses	PEC-CEEL304	Elective-II	3	0	0	3



Sl. No.	Category	Code	Course Title	Hours per week			Credits
5	Open Elective courses	OEEL302	Open Elective-I (Humanities)	3	0	0	3
6	Professional Elective courses	PEC-CEEL306	Elective-III	3	0	0	3
7	Professional Elective courses	PEC-CEEL308	Elective-IV	3	0	0	3
			Total credits				23

**Semester VII (Fourth year]
Branch/Course Civil Engineering**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-CEEL401	Elective V	3	0	0	3
2	Professional Elective courses	PEC-CEEL403	Elective-VI	3	0	0	3
3	Open Elective courses	OEC401	Open Elective-II Suggested (Metro Systems & Engineering) See Annexure-I	3	0	0	3
4	Project	PROJ-CE401	Project-1 (Project work, seminar and internship in industry or at appropriate work place)	0	0	12	6
			Total credits				15

**Semester VIII (Fourth year]
Branch/Course Civil Engineering**

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				L	T	P		
1	Professional Elective Courses	PEC-CEEL402	Elective VII	3	0	0		3
2	Professional Elective	PEC-CEEL402	Elective VIII	2	0	0		2



Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
	Courses							
3	Open Elective courses	OEC- 403	Open Elective-III	3	0	0		3
4	Open Elective courses	OEC- 404	Open Elective-IV	2	0	0		2
5	Project	PROJ-CE402	Project-2 (Continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place)	0	0	12		6
			Total credits					16

TOTAL CREDITS – 160



CHAPTER 2

PROFESSIONAL ELECTIVE COURSE TRACKS- CIVIL ENGINEERING [PEC-CE]

The following Seven Mandatory Professional Specialized Tracks offer electives in the respective Tracks:

Track	Professional Core Courses (PCC-CE)
I	Transportation Engineering
II	Construction Engineering & Management
III	Environmental Engineering
IV	Hydraulics
V	Hydrology & Water Resources Engineering
VI	Structural Engineering
VII	Geotechnical Engineering

Besides the **Open Elective Courses**.

The students will have options of selecting the electives from the different tracks/threads depending on the specialization one wishes to acquire. **There should be at least two electives from the open elective course choices (OEC); the rest two can be taken from the other threads, if intended. This is provided in the following:**

Open Elective Courses [OEC]
Soft Skills and Interpersonal Communication
ICT for Development
Human Resource Development and Organizational Behavior
Cyber Law and Ethics
Introduction to Philosophical Thoughts
Comparative Study of Literature
Indian Music System
History of Science & Engineering
Introduction to Art and Aesthetics
Economic Policies in India
Metro Systems and Engineering

OEC 401	Metro Systems and Engineering	3L:0T:0P	3 credits
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GENERAL: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials

CIVIL ENGINEERING-Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management,



Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

ELECTRONICS AND COMMUNICATION ENGINEERING- Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

MECHANICAL & TV + AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

The Professional Elective Courses (PEC-CE) are shown in different tracks. *The list is suggestive. The actual list of electives will depend on the availability of faculty and their research interests. However, there should be courses available in each track/thread. On-line MOOC courses may contribute up to 20% of the credits, with in-house examination being conducted. Please refer to Annexure-I of this document for key syllabus phrases for the course listed below.*

I Transportation Engineering

1. Pavement Materials
2. Pavement Design
3. Public Transportation Systems
4. Traffic Engineering and Management
5. Urban Transportation Planning.
6. Geometric Design of Highways
7. Airport Planning and Design
8. Railway Engineering
9. Intelligent Transportation Systems
10. Highway Construction and Management
11. Port and Harbour Engineering
12. High Speed Rail Engineering
13. Transportation Economics
14. Infrastructure Planning and Design

II Construction Engineering & Management

1. Construction Productivity
2. Building Construction Practice
3. Construction Project Planning&Systems
4. Construction Cost Analysis
5. Sustainable Construction Methods
6. Construction Engineering Materials.
7. Contracts Management
8. Construction Equipment& Automation
9. Repairs & Rehabilitation of Structures



III Environmental Engineering

1. Ecological Engineering
2. Environmental Systems
3. Transport of Water and Wastewater
4. Environmental Laws and Policy
5. Physico-Chemical Processes for Water and Wastewater Treatment
6. Biological Processes for Contaminant Removal
7. Rural Water Supply and Onsite Sanitation Systems
8. Water and Air Quality Modelling
9. Solid and Hazardous Waste Management
10. Air and Noise Pollution and Control
11. Environmental Impact Assessment and Life Cycle Analyses
12. Sustainable Engineering & Technology

IV Hydraulics

1. Design of hydraulic structures/Irrigation Engineering
2. Pipeline Engineering
3. Open Channel flow
4. River Engineering
5. Hydraulic modelling
6. Basics of computational hydraulics
7. Transients in closed conduits
8. Urban Hydrology and Hydraulics
9. Groundwater

V Hydrology & Water Resources Engineering

1. Water Quality Engineering
2. Surface Hydrology
3. Environmental Fluid Mechanics
4. Water Resources Field Methods

VI Structural Engineering

1. Reliability Analysis of Structures
2. Engineering Risk & Uncertainty
3. Decision and Risk Analysis
4. Engineering Materials for Sustainability
5. Concrete Materials
6. Wood Structures
7. Masonry Structures
8. Structural Analysis-I
9. Structural Analysis-II
10. Advanced Structural Analysis
11. Structural Analysis by Matrix Methods



12. Structural Mechanics
13. Reinforced Concrete
14. Concrete Technology
15. Design of Concrete Structures-I
16. Design of Concrete Structures-II
17. Prestressed Concrete
18. Design of Steel Structures
19. Metal Structure Behaviour- I
20. Metal Structure Behaviour- II
21. Bridge Engineering
22. Industrial Structures
23. Design of Structural Systems
24. Structural Dynamics
25. Earthquake Engineering
26. Civil Engineering Design-I
27. Civil Engineering Design-II
28. Geographic Information Systems and Science
29. Modelling and Analysis of Uncertainty
30. Systems Engineering & Economics

VII Geotechnical Engineering

1. Soil Mechanics-I
2. Soil Mechanics-II
3. Foundation Engineering
4. Geotechnical Design
5. Structural Geology
6. Offshore Engineering
7. Rock Mechanics
8. Environmental Geo-technology

CHAPTER 3

DETAILED 4-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering & Technology

Branch/Course: CIVIL ENGINEERING

[Please note: The lab component of the course should have one hour of tutorial followed or preceded by laboratory assignments wherever required.]

3.1 HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT



HSMC101	English	2L:0T:2P	3 credits
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Detailed contents

1. Vocabulary Building

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures

Use of phrases and clauses in sentences

Importance of proper punctuation

Creating coherence

Organizing principles of paragraphs in documents

Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement

Noun-pronoun agreement

Misplaced modifiers

Articles

Prepositions

Redundancies

Clichés

4. Nature and Style of sensible Writing

Describing

Defining

Classifying

Providing examples or evidence

Writing introduction and conclusion

5. Writing Practices

Comprehension

Précis Writing

Essay Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations



Suggested Readings:

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
- (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- (vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

HSMC201	Effective Technical Communication	3L:0T:0P	3 credits
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Module 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Module 2: Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Module 3: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Module 4: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Module 5: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.



4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

HSMC251	Introduction to Civil Engineering	2L:1T:0P	2 credits
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When the students enter the college to pursue a degree in Civil Engineering and as well pursue a career in Civil Engineering after graduation, they need to understand the breadth and depth available in this field for possible engagement. When many alternative disciplines of engineering appear to offer apparently more glamorous avenues for advancement, the Civil Engineering student should realize the solid foundations available in this mother of all engineering disciplines. The students should understand the enormous possibilities available for creative and innovative works in this all pervasive field of engineering.

This course is designed to address the following:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Proposed Syllabus

What is Civil Engineering/ Infrastructure, History of Civil Engineering, Overview of ancient & modern civil engineering marvels, current national planning for civil engineering/ infrastructure projects, scope of work involved in various branches of Civil Engineering – Architecture & Town planning, Surveying & Geomatics, Structural Engineering, Construction Management, Construction materials, Hydrology and Water Resources Engineering, Hydraulic Engineering, Environmental Engineering & Sustainability, Pavement Engineering and construction, Traffic & Transportation Engineering and Management, Geotechnical Engineering, Ocean Engineering, Building Energy Efficiency, Basics of Contract Management, Professional Ethics, Avenues for entrepreneurial working, Creativity & Innovativeness in Civil Engineering,

Modules

1. **Basic Understanding:** What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career
2. **History of Civil engineering:** Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers



3. **Overview of National Planning for Construction and Infrastructure Development;** Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;
4. **Fundamentals of Architecture & Town Planning:** Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities
5. **Fundamentals of Building Materials:** Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes
6. **Basics of Construction Management & Contracts Management:** Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management
7. **Environmental Engineering & Sustainability:**Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;
8. **Geotechnical Engineering:** Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling
9. **Hydraulics, Hydrology & Water Resources Engineering:** Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects
10. **Ocean Engineering:** Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures
11. **Power Plant Structures:** Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects
12. **Structural Engineering:** Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;
13. **Surveying & Geomatics:** Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;
14. **Traffic & Transportation Engineering:** Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.



15. **Repairs & Rehabilitation of Structures:** Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.
16. **Computational Methods, IT, IoT in Civil Engineering:** Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,...GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, ...)
17. **Industrial lectures:** Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning;
18. **Basics of Professionalism:** Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction

ORGANISATION OF COURSE (2-1-0)

S. No.	Module [No. of Lectures within brackets]	Tutorials
1	Basic Understanding (1)	Develop a matrix of various disciplines and possible roles for engineers in each
2	History of Civil engineering (1)	Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each
3	Overview of National planning for Construction and Infrastructure Development (1)	Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area
4	Architecture & Town Planning (1)	Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City
5	Building Materials (2)	Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report
6	Construction Management, Contracts management (2)	Identify 5 typical construction methods and list their advantages/ positive features
7	Environmental Engineering & Sustainability (2)	Environmental Engineering & Sustainability: Sustainability principles, Sustainable built environment, water treatment systems, good practices of wastewater management. examples of Solid and hazardous waste management, Air pollution and control



S. No.	Module [No. of Lectures within brackets]	Tutorials
8	Geotechnical Engineering (2)	List top five tunnel projects in India and their features; collect and study geotechnical investigation report of any one Metro Rail (underground) project; Visit a construction site and make a site visit report
9	Hydraulics, Hydrology & Water Resources Engineering (1)	Identify three river interlinking projects and their features; visit a Hydraulics Lab and make a report
10	Ocean Engineering, Ports & Harbours (1)	Identify 5 typical ports in India and list the structures available in them; Visit a related/similar facility, if possible in nearby place and make a report
11	Power Plant Structures (1)	Collect the typical layout for a large thermal power plant and a large hydro power plant and identify all the structures and systems falling in them.
12	Structural Engineering (3)	Identify 5 unique features for typical buildings, bridges, tall structures and large span structures; Visit Structures Testing Lab/facility and make a report
13	Surveying & Geomatics (1)	Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other
14	Traffic & transportation (1)	Investments in transport infrastructure; Developments and challenges; Intelligent Transport Systems; Smart Cities, Urban Transport; Road Safety; Sustainable and resilient highway design principles; Plan a sustainable transport system for a city; Identify key features/components in the planning and design of a green field highway/airport/port/railway and the cost – economics.
15	Repairs & rehabilitation of Structures (1)	Collect the history of a major rehabilitation project and list the interesting features
16	Computational Methods, IT, IoT in Civil Engineering (2)	Visit an AutoCad lab and prepare a report; Identify ten interesting software systems used in Civil Engg and their key features
17	Industrial lectures (2)	For each case study list the interesting features
18	Basics of Professionalism (3)	List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting projects and their positive features; Write 400 word reports on one ancient monument and a modern marvel of civil engineering
	TOTAL NO. LECTURES =30	15



Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R.(1979), Law of Contract, Oxford University Press
9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.
11. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
14. Bare text (2005), Right to Information Act
15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
17. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
18. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd
19. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
20. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
21. Engineering Ethics, National Institute for Engineering Ethics, USA
22. www.ieindia.org
23. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
24. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS
25. CONSTRUCTION CONTRACTS, <http://www.jnormanstark.com/contract.htm>
26. Internet and Business Handbook, Chap 4, CONTRACTS LAW, <http://www.laderapress.com/laderapress/contractslaw1.html>
27. Contract &Agreements , <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
28. Contracts, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
29. Business & Personal Law. Chapter 7. “How Contracts Arise”, <http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt>
30. Types of Contracts, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, <http://www.worldbank.org/html/opr/consult/guidetxt/types.html>
32. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), <http://www.sandia.gov/policy/14g.pdf>



Goals & Outcomes:

- Introduction to what constitutes Civil Engineering
- Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering
- Highlighting the depth of engagement possible within each of these areas
- Exploration of the various possibilities of a career in this field
- Understanding the vast interfaces this field has with the society at large
- Providing inspiration for doing creative and innovative work
- Showcasing the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration
- Highlighting possibilities for taking up entrepreneurial activities in this field
- Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering

HSMC252	Civil Engineering – Societal & Global Impact	2L:0T:0P	2 credits
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The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realise the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.

The course covers:

- Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
- Awareness of the impact of Civil Engineering for the various specific fields of human endeavour
- Need to think innovatively to ensure Sustainability

Module 1: Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;

Module 2: Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering



Module 3: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;

Module 4: Environment-Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Module 5: Built environment-Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

Module 6: Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

ORGANISATION OF COURSE (2-0-0)

S. No.	Module	No of Lectures	Details
1	Introduction	3	
2	Understanding the Importance of Civil Engineering	3	
3	Infrastructure	8	
4	Environment	7	
5	Built Environment	5	
6	Civil Engineering Projects	4	
	TOTAL	30	

Text/Reference Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht



2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. <http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx>
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

What the student will learn? To develop an understanding of:

- The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
- The extent of Infrastructure, its requirements for energy and how they are met: past, present and future
- The Sustainability of the Environment, including its Aesthetics,
- The potentials of Civil Engineering for Employment creation and its Contribution to the GDP
- The Built Environment and factors impacting the Quality of Life
- The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.
- Applying professional and responsible judgement and take a leadership role;



HSMC255	Professional Practice, Law & Ethics	2L:0T:0P	2 credits
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Basic elements of civil engineering professional practice are introduced in this course. Roles of all participants in the process-owners, developers, designers, consultants, architects, contractors, and suppliers - are described. Basic concepts in professional practice, business management, public policy, leadership, and professional licensure are introduced. The course covers professional relations, civic responsibilities, and ethical obligations for engineering practice. The course also describes contracts management, and various legal aspects related to engineering. Further, the course familiarizes students with elementary knowledge of laws that would be of utility in their profession, including several new areas of law such as IPR, ADR.

The course is designed to address the following:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

Proposed Syllabus

Professional practice covering the respective roles of the various stakeholders in the profession of civil engineering and the factors governing the same; Professional ethics relating to civil engineering; Various aspects of contracts relating to construction and management of contracts; types of contractual and other disputes in the profession and methods of dispute resolution; legal aspects relating to employment and service conditions of labour; intellectual property rights and their legal framework

Modules:

Module 1 A- Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

Module 1 B- Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

Module 2:*General Principles of Contracts Management: Indian Contract Act, 1972 and amendments* covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For



Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms;

Module 3 : *Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:* Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Module 4: *Engagement of Labour and Labour & other construction-related Laws:* Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

Module 5: *Law relating to Intellectual property:* Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

ORGANISATION OF COURSE (2-0-0)

S. No	Module	No of Lectures	Details
1A	Professional Practice	2	
1B	Professional Ethics	2	
2	Contracts Management	18	
3	Dispute Resolution Mechanisms	5	
4	Labour; Labour & other Laws	2	
5	Intellectual Property Management	1	
	TOTAL	30	



Text/Reference Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
12. Bare text (2005), Right to Information Act
13. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
14. K.M. Desai (1946), The Industrial Employment (Standing Orders) Act
15. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
16. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2, pp 117-127, MCB UP Ltd
17. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
18. Ethics in Engineering- M.W.Martin & R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, <http://www.jnormanstark.com/contract.htm>
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW, <http://www.laderapress.com/laderapress/contractslaw1.html>
24. Contract & Agreements <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
25. Contracts, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
26. Business & Personal Law. Chapter 7. “How Contracts Arise”, <http://yucaipahigh.com/schriestensen/lawweb/lawch7.ppt>
27. Types of Contracts, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
28. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, <http://www.worldbank.org/html/opr/consult/guidetxt/types.html>
29. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), <http://www.sandia.gov/policy/14g.pdf>

Goals & Outcomes:

- To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
- To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour
- To give an understanding of Intellectual Property Rights, Patents.
- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop good ideas of the legal and practical aspects of their profession