Annexure-R

DEPARTMENT OF CIVIL ENGINEERING
Curriculum Fall 2024 & Onward Batches

1st Semester 1st Year (First Semester)		
CE-107	**Civil Engineering Materials (Th + Lab)**	**3(2+1)**
Prerequisite: Nil	**Contact Hours:** 32+48	**Marks: 5 0 + 5 0**

Objectives:

- To familiarize students about the characteristics of construction materials used in Civil Engineering
- To develop the skills for identification of suitable construction materials for Civil Engineering projects.

CLOs:
After Completing the "Civil Engineering Materials" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN various properties of construction materials	**C2**	**1**
2	CHOOSE/APPLY appropriate constructional materials for various uses.	**C3**	**4**
3	ANALYZE physical and mechanical properties of various materials	**P3**	**2**

Course Contents:

1. **Materials and their Properties**

- Introduction to construction materials
- Physical, mechanical, and chemical properties
- Electrical and thermal properties

2. Binding Materials (Cement and Lime)

- Introduction and manufacture of Ordinary Portland Cement
- Constituents of cement
- Types of cement and their use
- Properties and field tests of cement
- Special cements
- Introduction and preparation of lime
- Setting and hardening of lime
- Comparison (cost and characteristics) of lime and cement
- Introduction to concrete

3. Fine & Coarse Aggregates and Stones

- Definition and introduction of aggregates
- Mechanical and physical properties of aggregates
- Importance and methods of grading of aggregates
- Introduction, types, applications, characteristics of good building stones
- Artificial stones
- Recycled materials

4. Metals (Steel and Aluminum)

- Introduction to steel
- Mechanical and physical properties of steel
- Application of steel in civil engineering projects

5. Ceramics, Bricks and Blocks

- Manufacture of ceramics
- Properties and applications of ceramics in buildings
- Dimensions, manufacture and classification of bricks
- History and evolution of blocks
- Properties and applications of blocks
- Dimensions, manufacture and classification of blocks

6. Glass and Wood

- Constituents of glass and methods of manufacture.
- Types, use and significance of glass in civil engineering

7. Timber

- Timber, sap in timber, seasoning of timber, application of timber in civil engineering
- Lamination of wood

8. Pavement materials

- Bitumen
- Asphalt
- Road Metals

9. Miscellaneous Construction Materials

- Asbestos, Plaster of Paris, Abrasives
- Paint
- Bamboo
- Natural, artificial, steel fibers, Resin materials, Geotextile materials
- Modern Materials (Fiber reinforced polymer etc

Lab Outlines:

The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	Introduction to the Laboratory and HSE (Health, Safety and Environment) measures.
2	To carry out sieve analysis of various samples of coarse aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
3	To carry out sieve analysis of various samples of fine aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
4	To determine different densities (Specific gravities) and water absorption of coarse aggregate.
5	To determine different densities (Specific gravities) and water absorption of fine aggregate.
6	To determine water absorption of bricks and to discuss the results.
7	To determine dimension tolerance of a burnt clay bricks.
8	To determine efflorescence of a burnt clay bricks.

9	To determine compressive strength of bricks and to discuss the results.
10	To determine the compressive strength of mortar with various mix ratios.
11	To determine Fineness of OPC by sieving
12	To determine Normal consistency of OPC by Vicat's Apparatus
13	To determine Initial setting time, and final setting time of OPC by Vicat's Apparatus
14	To determine strength of provided samples of timber.
15.	To perform Open Ended Lab.

Recommended Books:

1. Edward Allen, Joseph Iano, (2019), Fundamental of Building Construction Materials and Methods, 7th Edition (or latest), John Wiley & Sons. NY.
2. Eva Kultermann and William P. Spence, Construction, Materials, Methods, and Techniques, Building for a sustainable future (2022), 5th Edition (or latest), Cengage Learning, Inc.
3. William F., Smith, (2009), Foundation of Materials Science & Engineering, 5th Edition (or latest), McGraw Hill.
4. Duggal, S. K, (2010), Building Materials, New Age International.
5. David R. H. Jones and Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design (2019), 5th Edition (or latest), Butterworth-Heinemann publishing.
6. Duggal, S. K., Building Materials, New Age International. *(Latest Edition)*
7. Basik, Civil Engineering Materials, *(Latest Edition)*
8. Engineering Materials by Surrendra Singh

1st Semester 1st Year (First Semester)		
CE-103	**Engineering Drawing (Th + Lab)**	**2(1+1)**
Prerequisite: Nil	**Contact Hours:** 16+48	**Marks: 5 0 + 5 0**

Objectives:

- To familiarize students about the detailed understanding of basic drawing concepts as well as simple architectural and civil engineering drawings.
- To familiarize students about the detailed guidance on the manual drawing concepts keeping in mind the load bearing masonry structures.

CLOs:

After Completing the " Engineering Drawing " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN fundamental concepts of engineering drawing for simple objects/structures.	**C2**	**1**
2	DRAW orthographic projections of points, lines and architectural views of building	**C3**	**1**
3	Manually MAKE drawings of simple objects / load bearing structures.	**P3**	**1**

Course Contents:

1. **Introduction**

- Drawing instruments and their use.
- Types of lines, Dimensioning and planning of a drawing sheet, Standard drafting conventions,
- Principal requirements of Geometric Drawing.
- Drawing types with respect to technicality (Survey plan, contour plan,
- geotechnical plan, infrastructures drawing, architectural drawing,
- structural drawing, plumbing drawing, electrical drawing, HVAC drawing)
- Drawing types with respect to project execution (Proposals/PC-1 drawing, Submission /Tender drawing, Working /Construction drawing, Completion /As-built drawing.

2. **Projections**

- Orthographic projection of points in quadrants,
- First and third angle projections,
- Orthographic projection of lines in simple and inclined positions.
- Isometric Projection of Solids

3. **Architectural Plan, Elevation and Section of a Simple Building (House)**

- Architectural views (Plan, elevation and section) of a simple building
- General terminologies and symbols including schedule of opening

Lab Outlines:

The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	To know about different tools used in civil engineering drawing. To learn fixing sheet, drawing Border line, Seal box, and use of different tools.
2	To draw the projection of points, when point is 1st and 2nd quadrant
3	To draw the projection of points, when point is 3rd and 4th quadrant
4	To draw the projection of straight lines in simple positions
5	To draw the projection of straight lines in inclined positions
6	To draw plan, elevation and section of one room
7	To draw plan, elevation of two room with verandah.
8	To draw Section of two room with verandah.
9	To draw Plan, elevation and section of a boundary wall.
10	To draw architectural details of straight flight stair.
11	To draw architectural details of Quarter turn stair and Dog legged stair.
12	To draw architectural details of Open well stair (with and without landing)
13	To draw architectural details of Bifurcated stair.
14	To draw structural details of simple stair.
15.	To perform Open Ended Lab

Recommended Books:

1. Horchsel R. P; Engineering Drawing and Geometry, John Willy & Sons, 2nd Edition, 2002.
2. Jensen C.H and Mason F. H. S "Drafting Fundamentals", McGraw Hill,
3. 5th Edition.
4. N. D. Bhatt; Engineering Drawing, 50th Edition (2010), Charotar Book Stall
5. Parkinson, A. C. A First Year Engineering Drawing. English language Book Society. Reprint 1964.
6. Basics of Engineering Drawing by Dr. Zahid Ahmed Siddiqi, 2016

1st Semester 1st Year (First Semester)		
NS-101	**Quantitative Reasoning-I (Th)**	**3(3+0)**

Prerequisite: Nil **Contact Hours:** 48+0 **Marks:** 100+0

Objectives: To learn fundamentals of mathematics related to the quantitative concepts

CLOs:
After Completing the "Quantitative Reasoning-I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND fundamentals of mathematics and basic statistical concepts;	**C2**	**1**
2	INTERPRET data presented in various formats including but not limited to tables, graphs, charts, and equations etc.	**C2**	**2**

Course Contents:

1. **Numerical Literacy:**
   - Number system and basic arithmetic operations.
   - Units and their conversions, dimensions, area, perimeter and volume.
   - Rates, ratios, proportions and percentages.
   - Types and sources of data.
   - Measurement scales.
   - Tabular and graphical presentation of data.
   - Quantitative reasoning exercises using number knowledge.
2. **Fundamental Mathematical Concepts:**
   - Basics of geometry (lines, angles, circles, polygons etc.).
   - Sets and their operations.
   - Relations, functions, and their graphs.
   - Exponents, factoring and simplifying algebraic expressions.
   - Algebraic and graphical solutions of linear and quadratic equations and inequalities.
   - Quantitative reasoning exercises using fundamental mathematical concepts.
3. **Fundamental Statistical Concepts:**
   - Population and sample.
   - Measures of central tendency, dispersion and data interpretation.
   - Rules of counting (multiplicative, permutation and combination).
   - Basic probability theory.
   - Introduction to random variables and their probability distributions.
   - Quantitative reasoning exercises using fundamental statistical concepts.

Recommended Books:

1. Quantitative Reasoning: Tools for Today's Informed Citizen" by Bernard L. Madison, Lynn and Arthur Steen.
2. "Quantitative Reasoning for the Information Age" by Bernard L. Madison and David M. Bressoud.
3. "Fundamentals of Mathematics" by Wade Ellis.
4. "Quantitative Reasoning: Thinking in Numbers" by Eric Zaslow.
5. "Thinking Clearly with Data: A Guide to Quantitative Reasoning and Analysis" by Ethan Bueno de Mesquita and Anthony Fowler.

6. “Using and Understanding Mathematics: A Quantitative Reasoning Approach” by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
7. “Discrete Mathematics and its Applications” by Kenneth H. Rosen.
8. “Statistics for Technology: A Course in Applied Statistics” by Chatfield, C.
9. “Statistics: Unlocking the Power of Data” by Robin H. Lock, Patti Frazer Lock, Kari Lock Morgan, and Eric F. Lock.

1st Semester 1st Year (First Semester)		
HS-102	**Functional English (Th)**	**3(3+0)**
Prerequisite: Nil	**Contact Hours:** 48+0	**Marks:** 100+0
Objectives: To enhance language skills and develop critical thinking.		
CLOs: After Completing the "Functional English" Course, each student will be able to:		

CLO	Description	Taxonomy Level	PLO
1	APPLY enhanced English communication skills through effective use of word choices, grammar and sentence structure.	**C3**	**9**
2	UNDERSTAND a variety of literary / non-literary written and spoken texts in English.	**C2**	**9**
3	STUDY inter-cultural variations in the use of English language and to effectively adapt their communication style and content based on diverse cultural and social contexts.	**A3**	**9**

Course Outline:

1 Foundations of Functional English:

- Vocabulary building (contextual usage, synonyms, antonyms and idiomatic expressions)
- Communicative grammar (subject-verb-agreement, verb tenses, fragments, run-ons, modifiers, articles, word classes, etc.)
- Word formation (affixation, compounding, clipping, back formation, etc.)
- Sentence structure (simple, compound, complex and compound- complex)
- Sound production and pronunciation.

2 Comprehension and Analysis:

- Understanding purpose, audience and context.
- Contextual interpretation (tones, biases, stereotypes, assumptions, inferences, etc.).
- Reading strategies (skimming, scanning, SQ4R, critical reading, etc.).
- Active listening (overcoming listening barriers, focused listening,

3 Effective Communication:

- Principles of communication (clarity, coherence, conciseness, courteousness, correctness, etc.).
- Structuring documents (introduction, body, conclusion and formatting).
- Inclusivity in communication (gender-neutral language, stereotypes, cross-cultural communication, etc.).
- Public speaking (overcoming stage fright, voice modulation and body language).
- Presentation skills (organization content, visual aids and engaging the audience).
- Informal communication (small talk, networking and conversational skills).
- Professional writing (business e-mails, memos, reports, formal letters, etc.).

Recommended Books:

1 "Understanding and Using English Grammar" by Betty Schrampfer Azar.
2 "English Grammar in Use" by Raymond Murphy.
3 "The Blue Book of Grammar and Punctuation" by Jane Straus.
4 "English for Specific Purposes: A Learning-Centered Approach" by Tom Hutchinson and Alan Waters.
5 "Cambridge English for Job-hunting" by Colm Downes.
6 "Practical English Usage" by Michael Swan.
7 "Reading Literature and Writing Argument" by Missy James and Alan P. Merickel.

8	"Improving Reading: Strategies, Resources, and Common Core Connections" by Jerry Johns and Susan Lenski.
9	"Comprehension: A Paradigm for Cognition" by Walter Kintsch.
10	"Communication Skills for Business Professionals" by J.P Verma and Meenakshi Raman.

1st Semester 1st Year (First Semester)		
CS-131	**Applications of Information and Communication Technologies (ICT) (Th + Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours:** 32+48 **Marks:**50+50

Objectives:

- To develop skills of ICT and its applications in elementary civil engineering problems.

CLOs:

After Completing the "Applications of Information & Communication Technology (ICT)" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN the fundamental concepts, components, and scope of Information and Communication Technologies (ICT).	**C2**	**1**
2	IDENTIFY uses of various ICT platforms and tools for different purposes	**C1**	**2**
3	APPLY ICT platforms and tools for different purposes to address basic needs in different domains of daily, academic, and professional life.	**C3**	**2**
4	FOLLOW the ethical and legal considerations in use of ICT platforms and tools.	**P3**	**5**

Course Contents:

1. **Introduction to Information and Communication Technologies:**
   - Components of Information and Communication Technologies
   - (Basics of hardware, software, ICT platforms, networks, local and
   - cloud data storage etc.).
   - Scope of Information and Communication Technologies (use of ICT
   - in education, business, governance, healthcare, digital media and
   - entertainment, etc.).
   - Emerging technologies and future trends.
2. **Basic ICT Productivity Tools:**
   - Effective use of popular search engines (e.g., Google, Bing, etc.) to explore World Wide Web.
   - Formal communication tools and etiquettes (Gmail, Microsoft Outlook, etc.).
   - Microsoft Office Suites (Word, Excel, PowerPoint).
   - Google Workspace (Google Docs, Sheets, Slides).
   - Dropbox (Cloud storage and file sharing), Google Drive (Cloud storage with Google Docs integration) and Microsoft OneDrive (Cloud storage with Microsoft Office integration).
   - Evernote (Note-taking and organization applications) and OneNote (Microsoft's digital notebook for capturing and organizing ideas).
   - Video conferencing (Google Meet, Microsoft Teams, Zoom, etc.).
   - Social media applications (LinkedIn, Facebook, Instagram, etc.).
3. **ICT in Education:**

- Working with learning management systems (Moodle, Canvas, Google Classrooms, etc.).
- Sources of online education courses (Coursera, edX, Udemy, Khan Academy, etc.).
- Interactive multimedia and virtual classrooms.

4. **ICT in Health and Well-being:**
   - Health and fitness tracking devices and applications (Google Fit,
   - Samsung Health, Apple Health, Xiaomi Mi Band, Runkeeper, etc.).
   - Telemedicine and online health consultations (OLADOC, Sehat Kahani, Marham, etc.).
5. **ICT in Personal Finance and Shopping:**
   - Online banking and financial management tools (Jazz Cash, Easypaisa, Zong PayMax, 1LINK and MNET, Keenu Wallet, etc.).
   - E-commerce platforms (Daraz.pk, Telemart, Shophive, etc.)
6. **Digital Citizenship and Online Etiquette:**
   - Digital identity and online reputation.
   - Netiquette and respectful online communication.
   - Cyberbullying and online harassment.
7. **Ethical Considerations in Use of ICT Platforms and Tools:**
   - Intellectual property and copyright issues.
   - Ensuring originality in content creation by avoiding plagiarism and unauthorized use of information sources.
   - Content accuracy and integrity (ensuring that the content shared through ICT platforms is free from misinformation, fake news, and manipulation).
   -

Lab Outline:
The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	Introduction to various Parts of computer including CPU, basic input output devices, Window accessories, system tools.
2	**Basic Features:** Creating and editing documents with Microsoft Word
3	**Advance features:** Creating documents with advance formatting operations of Microsoft Word
4	**Basic Features:** Creating and editing multimedia presentations with Microsoft PowerPoint
5	**Advance features:** Creating presentations with advance operations of Microsoft PowerPoint
6	**Basic Features:** Creating and editing spreadsheets with Microsoft Excel
7	**Advance features:** Creating spreadsheets with advance operations of Microsoft Excel
8	Getting familiar with Code-blocks / Dev-C++ and writing simple programs
9	Working with variables, constants, different data types, escape sequences and different Operators.

10	Decision making with conditional control structures using C++ using if, if-else, if-else-if
11	Decision making with conditional control structures using C++ using switch statement
12	Working with iterative control structures using C++
13	Working with nested control structures using C++
14	Processing set of homogeneous data items with arrays using C++.
15	Working with functions using C++
16	To Perform an Open-ended Lab.

Recommended Books:

1. "Discovering Computers" by Vernmaat, Shaffer, and Freund.
2. "GO! With Microsoft Office" Series by Gaskin, Vargas, and McLellan.
3. "Exploring Microsoft Office" Series by Grauer and Poatsy
4. "Computing Essentials" by Morley and Parker
5. "Technology in Action" by Evans, Martin and Poatsy

1st Semester 1st Year (First Semester)		
NS-109	**Applied Physics & Electro Mechanical Fundamentals (Th + Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours:** 32+48 **Marks:** 50+50

Objectives:

- This course equips the students with the applied concepts of Applied Physics and Electro-Mechanical Fundamentals.
- Students would have developed a good understanding of the fundamentals covering vectors, applied mechanics, electro-statics, waves and oscillations, electrical elements and circuits, relevant electronics in Civil Engineering testing, thermodynamics, HVAC, and renewable energy systems.

CLOs:

After Completing the "Applied Physics & Electro Mechanical Fundamentals" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND concepts related to basic physics and electro-mechanical engineering.	**C2**	**1**
2	APPLY fundamental concepts of physics and electro- mechanical engineering.	**C3**	**2**
3	PRACTICE the concepts of physics and electro-mechanical engineering.	**P4**	**4**

Course Outlines:

1. **Vectors:**
   - Review of vectors
   - Ordinary Differentiation of Vector, Gradient of Scaler field
   - Divergence and Curl of Vector Field
   - Line and Surface Integrals with applications
2. **Mechanics:**
   - Newton's Laws and their Applications (Simple Accelerometer, Banked Curve, and Rotor)
   - Frictional Forces and determination of Co-efficient of Friction, Work Energy Theorem, applications of the law of Conservation of Energy
   - Angular Momentum
   - Centre of Mass of two particles, many particles, and Solid Object
   - Rotational Inertia of Solid Bodies
3. **Waves and Oscillations:**
   - Simple Harmonic Oscillator, Damped Harmonic Oscillation
   - Forced Oscillation, and Resonance, Types of Waves, and Superposition Principle
   - Wave Speed on a stretched string
   - Wave equation, Energy & Power of a Wave
4. **Modern Physics**
   - Planck's explanations of Black Body Radiation Photoelectric Effect
   - Compton Effect
   - De-Broglie Hypothesis
   - Electron Microscope, Atomic structure, X-rays, and Moseley's Law
   - Atomic Nucleus and Properties of Nucleus

- Radioactive Decay and Radioactive Dating, Radiation Detection Instruments, Nuclear Reactions

5. **Electrical Elements and Circuits (Demonstrative / Labs)**
   - Review of electric current, voltage, power, and energy
   - Ohm's law, inductance, capacitance
   - AC single and poly-phase system
   - DC machines, AC synchronous machines, AC induction machines, transformers converting machines.
   - Brief introduction to motors and generators
6. **Electronics (Demonstrative / Labs)**
   - Electronic strain gauges and transducers
   - LDTs and LVDTs
   - Diode transistor and simple rectifier circuit.
   - Electrical know-how related to experimental design instruments like corrosion rate measurements.
7. **Thermodynamics (Demonstrative / Labs)**
   - Review of Laws of Thermodynamics covering fundamentals of heat transfer, conduction, convection, and radiation.
   - Thermal conductivity, specific heat, and overall heat transfer coefficients
8. **Heating, Ventilation and Air Conditioning (HVAC)**
   - Introduction to HVAC components.
   - Heating and cooling load and its calculations
   - Comfort charts and outline of air-conditioning systems

Lab Outline: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	To recognize the equipment of Mechanics available in Laboratory, and Introduction HSE measures for Mechanics Laboratory.
2	To prove parallelogram law of forces using force board.
3	To determine center of gravity (centroid) of various objects.
4	To verify the Principle of Moments.
5	To determine the rotational inertia of a point mass with rod, ring and disc experimentally and verify with the calculated theoretical values.
6	To determine the moment of inertia of different disc assemblies and compare the results with theoretical values using Rolling disc on inclined Plane apparatus.
7	To observe the relationship between Linear and Angular Speed.
8	To verify the validity of Hooke's Law.
9	To determine the effort required to lift a load and efficiency of lifting by a Wheel and Differential axle.
10	To determine the Mechanical advantage, Velocity ratio and Efficiency of Winch.
11	To determine the Mechanical advantage, Velocity ratio, Efficiency and friction loss of a laboratory Screw Jack at different loads.
12	To determine the time period of Simple Pendulum and compare it with theoretical values.
13	To determine the time period of Compound Pendulum and compare it with theoretical values.
14.	To measure current, voltage, and power of an electric source.

15.	To perform and open ended lab

Recommended Books:

1. Hibbeler, R. C. Engineering Mechanics- Statics and Dynamics, Prentice Hall *(Latest Edition)*
2. Engineering Mechanics, Vol-1 (statics) By J.L. Meriam and L.G. Kraige, *(Latest Edition)*.
3. Vector Mechanics for Engineers – Statics by Ferdinand P. Beer and E. Russell Johnston Jr. (Latest Edition)
4. Engineering Mechanics by R.S Khurmi.

2nd Semester First Year (Second Semester)		
CE-123	**Civil Engineering Drawing & AutoCAD (Th + Lab)**	**3(1+2)**

Prerequisite: Nil **Contact Hours:** 16+96 **Marks:** 50+100

Objectives:

- To enable students to understand of architectural and civil engineering drawings.
- To have skills on using the frequently used software in industry as well as emerging software to ensure the industry needs.

CLOs: After Completing the " Civil Engineering Drawing " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE different perspective (functions) of latest version of CAD.	C1	1
2	INTERPRET drawing related to different civil engineering projects.	C2	8
3	MAKE civil engineering drawings using CAD software.	P4	5

1. Introduction to Auto Cad, Contour Plan, Infrastructure layout, and Site Plan

- General introduction to Auto Cad and its tools for civil engineering drawings
- Auto Cad different commands of latest version
- Learn 2D and 3D drawings preparation on the AutoCAD
- Draw Plan, elevation, & Section of elements using AutoCAD
- Draw Contour plan using AutoCAD
- Draw Infrastructure layout using AutoCAD
- Draw Site plan using AutoCAD

2. Structural Details of a Simple RCC Building (House)

- Drawings of different types of RCC footings with columns
- Drawings of different types of RCC Beams (roof beam, plinth beam, lintel beam)
- Drawings of RCC Slab
- Drawings of water tank (OH, UG)
- Slab reinforcement layout
- Structural details of staircase and boundary wall
-

Lab Outline

The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

S. NO.	List of Experiments
1.	(a) Introduction to AUTOCAD software and to know about units and dimension in AUTOCAD. (b) To know the procedure and usage of different commands of draw, properties, inquiry and dimension toll bar.
2.	(a) To know the procedure and usage of different commands of modify and layer toll bar. (b) To draw irregular closed figure and calculate its area and perimeter in AutoCAD.

3	To draw structural drawings of RCC beams and slabs manually & using CAD
4	To draw Cross section of an urban highway. To draw Plan and section of an urban highway
5	To draw structural drawings of different types of RCC Footings with column manually & using CAD
6	To draw the architect plan, elevation and cross section of single room building manually & using CAD
7	To draw Site Plan, ground floor and First floor plan of a two storied RCC building manually & using CAD
8	To draw Mummty floor and section of a two storied RCC building manually & using CAD
9	To draw Plinth beam framing plan, elevation and sections for a two storied RCC building manually & using CAD
10	To draw ground floor beam framing plan, and sections for a two storied RCC building. To draw ground floor Slab framing plan and produce schedule of slab reinforcement
11	To draw Roof beam framing plan, and sections for a two storied RCC building manually & using CAD To draw Roof Slab framing plan and produce schedule of slab reinforcement manually & using CAD
12	To draw foundation layout plan and produce schedule of footing for a two storied RCC building manually & using CAD
13	To draw Column layout plan and section of a column fora two storied RCC building manually & using CAD
14.	To draw drawings of underground water tank and Over head water tank manually & using CAD
15	To draw the plumbing plan and Electric Plan of any simple building in Auto CAD.
16	Introduction to Revit software

Recommended Books:

1. M. Chakarborti, Civil Engineering Drawing, UBS Publications, (Latest Edition). Gurcharan Singh, Civil Engineering Drawing, (Latest Edition). Malik Book Dept., Lahore
3. Mastering AutoCAD 2017 and AutoCAD LT 2017 by George Omura with Brian Benton, (latest edition), 2016.
4. Boughton, B. Reinforced Concrete Detailer's Manual (Reference Book), HarperCollins, Publishers Ltd. London

2nd Semester 1st Year (Second Semester)		
HS-111	**Islamic Studies/Ethics (Th)**	**2(2+0)**
Prerequisite: Nil	**Contact Hours:** 32+0	**Marks: 5 0 + 0**

Objectives:

- To provide Basic information about Islamic Studies
- To enhance understanding of the students regarding Islamic Civilization
- To improve Students skill to perform prayers and other worships.
- To enhance the skill of the students for understanding of issues related to faith and religious life**.**

CLOs: After Completing the "Islamic Studies" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRATE enhanced knowledge of Islamic foundational beliefs,	**A3**	**6**
2	PRACTICES historical development, spiritual values and ethical principles.	**A2**	**7**
3	DESCRIBE basic sources of Islamic law and their application in daily life.	**A1**	**11**

Course Outline:

1. **Introduction to Islam:**

- Definition of Islam and its core beliefs.
- The Holy Quran (introduction, revelation and compilation).
- Hadith and Sunnah (compilation, classification, and significance).
- Key theological concepts and themes (Tawhid, Prophethood,
- Akhirah etc.).

2. **Sirah of the Holy Prophet (Peace Be Upon Him) as Uswa-i-Hasana:**

- Life and legacy of the Holy Prophet PBUH
- Diverse roles of the Holy Prophet PBUH (as an individual,
- educator, peace maker, leader etc.)

3. **Islamic History and Civilization:**

- World before Islam.
- The Rashidun Caliphate and expansion of Islamic rule.
- Muslims contributions to philosophy, science, medicine
- mathematics, and culture.

4. **Islamic Jurisprudence (Fiqh):**

- Fundamental sources of Islamic jurisprudence.
- Pillars of Islam and their significance.
- Major schools of Islamic jurisprudence.
- Significance and principles of ijtihad.

5. **Family and Society in Islam:**

- Status and rights of women in Islamic teachings.
- Marriage, family, and gender roles in Muslim society.
- Family structure and values in Muslim society.

7 **Islam in the Modern World:**

- Relevance of Islam in the modern world (globalization
- challenges and prospects).
- Islamophobia, interfaith dialogue, and multiculturalism
- Islamic responses to social, ethical, and technological changes
- Role of Islam in religious harmony

8 **Introduction to Islamic Trade and Finance:**

- Islamic Financing Structures
- The Stability of Islamic Financial System
- Financial Engineering
- Regulation of Islamic Financial Institutions

Recommended Books:

1. "The Five Pillars of Islam: A Journey Through the Divine Acts of Worship" by Muhammad Mustafa Al-Azami.
2. "The Five Pillars of Islam: A Framework for Islamic Values and Character Building" by Musharraf Hussain.
3. "Towards Understanding Islam" by Abul A' la Mawdudi.
4. "Islami Nazria e Hayat" by Khurshid Ahmad.
5. "An Introduction to Islamic Theology" by John Renard.
6. . "Islamic Civilization Foundations Belief & Principles" by Abul A la Mawdudi.
7. "Women and Social Justice: An Islamic Paradigm" by Dr. Anis Ahmad.
8. . "Islam: Its Meaning and Message" by Khurshid Ahmad.

2nd Semester 1st Year (Second Semester)		
CE-121	**Engineering Surveying (Th + Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours:** 32+48 **Marks:** 50+50

Objectives:

- To enable students in reading and preparing surveying maps.
- To develop skills to use modern survey instruments.

CLOs:

After Completing the "Engineering Surveying" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN basic surveying techniques used for surveying and leveling.	C2	1
2	PREPARE maps and plans, contour maps, profiles, cross-sections, etc. using surveying techniques.	C3	2
3	OPERATE various survey equipment for measurements with required accuracy.	P4	5

Course Outline:

1. Introduction

- Introduction to land surveying, Definitions of basic surveying terms branches and their application, Instruments used

2. Survey Techniques

- Distance measurement techniques, Compass Traverse survey, and Theodolite Traverse survey.

3. Leveling and Contouring

- Methods and types of levels, precise leveling, Tacheometry and trigonometrical levelling, Methods and applications of contouring

4. Computations and Plotting

- Maps and plans, plotting, contour maps, profiles, cross-sections, prismoidal formula, Computation of areas and volumes by various methods, Computations of area and volumes by graphical analysis and use of surveying software

Lab Outline: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class

S. No.	List of Experiment
1.	Introduction to Health and Safety measures in Surveying Lab. To recognize and introduce various Surveying Instruments and Accessories.
2.	To perform direct and indirect ranging.
3.	To measure the horizontal distance between two terminal stations by different methods.
4.	To determine the horizontal distance between the two terminal stations on a Sloping ground by different Methods.
5.	To produce the plan of a given area by compass traversing
6.	To produce the position in plan of the given points by radiation method.
7.	To produce the position in plan of the given points by intersection method.
8.	To produce the position in plan of the given points by Traversing method.

9.	Introduction to Automatic Level and Temporary Adjustment of an Automatic Level.
10.	To produce the longitudinal section along a proposed alignment of a road
11.	To produce the Cross section along a proposed alignment of a road
12.	Introduction to digital Theodolite, and to perform temporary adjustment.
13.	To determine the latitudes and departures of lines and to calculate coordinates of points.
14.	To determine the area of a closed traverse by coordinate method.
15.	To Perform an Open-Ended Lab

Recommended Books:

1. Plane Surveying, Dr A M Chandra, Latest Edition
2. Surveying Vol: (I + II), B.C Punmia, Latest Edition
3. Surveying Practice, Jerry. A. Nothanson and Philip Kissam, Latest Edition
4. Surveying and Levelling by N.N Basak
5. Surveying Theory and Practice, R.E. Davis, 7th Edition
6. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying – An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
7. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
8. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.
9. Surveying and leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II
10. Surveying and Levelling Part-I by T. P. Kanetker and S.V. Kulkarni (Latest Edition)

2nd Semester 1st Year (Second Semester)		
HS-104	**Pakistan Studies (Th)**	**2(2+0)**

Prerequisite: Nil **Contact Hours:** 32+0 **Marks:** 50+00

Objectives:

After Completing the "Pakistan Study" Course, each student will be able to:

- To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan.
- To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

CLOs:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRATE enhanced know-ledge of the basis of the ideology of Pakistan with special reference to the contributions of the founding fathers of Pakistan	**C3**	**11**
2	DEMONSTRATE fundamental knowledge about the Constitution of Pakistan 1973 and its evolution with special reference to state structure.	**A3**	**6**
3	EXPLAIN about the guiding principles on rights and responsibilities of Pakistani citizens as enshrined in the Constitution of Pakistan 1973.	**A3**	**11**

Course Outline:

1. Introduction to the Ideology of Pakistan:

- Definition and significance of ideology.
- Historical context of the creation of Pakistan (with emphasis on sociopolitical, religious, and cultural dynamics of British India between 1857 till 1947).
- Contributions of founding fathers of Pakistan in the freedom movement including but not limited to Allama Muhammad Iqbal, Muhammad Ali Jinnah., etc.
- Contributions of women and students in the freedom movement for separate homeland for Muslims of British India

2. Two-Nation Theory:

- Partition of Bengal, Simla Deputation 1906, Allama Iqbal's Presidential Address 1930, Congress Ministries 1937, Lahore Resolution 1940).
- Role of communalism and religious differences.

3. Introduction to the Constitution of Pakistan:

- Definition and importance of a constitution.
- Ideological factors that shaped the Constitution(s) of Pakistan (Objectives Resolution 1949).
- Overview of constitutional developments in Pakistan.

4. Constitution and State Structure:

- Structure of Government {executive, legislature, and judiciary).
- Distribution of powers between federal and provincial governments.
- 1st Amendment and its impact on federalism.

5. Fundamental Rights, Principles of Policy and Responsibilities:

- Overview of fundamental rights guaranteed to citizens by the Constitution of Pakistan 197.3 (Articles 8-28).
- Overview' of Principles of Policy (Articles 29-40).
- Responsibilities of the Pakistani citizens (Article 5).

6. Constitutional Amendments:

- Procedures for amending the Constitution.
- Notable constitutional amendments and their implications.

Recommended Books:

1. "The Idea of Pakistan" by Stephen P. Cohen.
2. "Ideology of Pakistan" by Javed Iqbal.
3. "The Struggle for Pakistan" by I.H. Qureshi.
4. "Pakistan the Formative Phase" by Khalid Bin Sayeed.
5. "Pakistan: Political Roots and Development" by Safdar Mahmood.
6. "Ideology of Pakistan" by Sharif-ul-Mujahid.
7. "The Struggle for Pakistan: A Muslim Homeland and global Politics" by Ayesha Jalal.
8. "Jinnah, Pakistan and Islamic Identity: The Search for Saladin" by Akbar S. Ahmed.
9. "Pakistan: A New- History" by Ian Talbot.
10. . "Pakistan in the Twentieth Century; A Political History" by Law-Rence Ziring.
11. "The Constitution of Pakistan 1973". original.
12. 'Constitutional and Political Development of Pakistan" by Hamid Khan.
13. The Making of Pakistan: A Study in Nationalism" by K.K. Aziz.
14. Constitutional Development in Pakistan " by G.W. Choudhury.
15. "Constitution-Making in Pakistan: The Dynamics of Political Order' by G.W. Choudhury.

2nd Semester 1st Year (Second Semester)		
MD-127	**Geology for Engineers (Th)**	**1(1+0)**

Prerequisite: Civil Engineering Materials **Contact Hours:** 16+0 **Marks:** 50+00

Objectives:

- To understand composition of various minerals, rocks and their properties
- To develop a solid base for application of geology to engineering problems

CLOs:

After Completing the " Geology for Engineers " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	IDENTIFY the minerals, rocks, and their physical properties.	C1	1
2	DISCUSS structural geology, geo-hazards, applied geology, and earthquakes for civil engineering projects.	C2	1

Course Outline:

1. **Elements of structural geology**
   - Folds and faults, joints, fractures, and cleavages
   - Unconformities, primary and secondary structural features of rock
   - Expression of geological features on geological field maps
   - Construction of cross sections and geological mapping.
2. **Minerals and rocks**
   - Important minerals and rocks, and their identification
   - Igneous, sedimentary and metamorphic rocks
   - Fossils
   - Basic principles of stratigraphy and Geologic time scale
   - Brief introduction of local geology from boring logs.
3. **Applied geology**
   - Application of geology to planning and design of various civil engineering infrastructure like dams, reservoirs, bridges, application of geology to building materials and soils.
4. **Earthquakes**
   - Theory of plate-tectonics, seismic waves, seismology
   - Prediction of earthquakes and preventive measures against earthquakes
   - Ground subsidence
   - Earthquake zoning of Pakistan

Recommended Books:

1. Banger, K. M. (1988), A Textbook of General AND Engineering Geology, Latest Edition.
2. N.T Price, N. T. & Cosgrove, I. W. (1990), Analysis of Geological Structures, Latest Edition.
3. Steven L. Kramer, (2010), Analysis of Geological Structures, Latest Edition
4. Blyth, F. G. H. (2003), A Geology for Engineers, Latest Edition, Arnold International.
5. Legget, R. F. (2010), Geology and Engineering, Latest Edition, McGraw Hill International
6. Richard and Busch (2019), Laboratory Manual in Physical Geology 9th Edition (or latest), American Geological Institute.
7. Frederick K. Lurgens (2016), Earth: An Introduction to Physical Geology, 12th Edition (or latest), Pearson Publishers.

2nd Semester 2nd Year (Second Semester)		
CE-126	**Engineering Mechanics (Th+Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours:** 32+48 **Marks:** 50+50

Objectives:

- Students learn how to use two dimensional force system and equilibrium on the basis of the principles of statics
- Enable students to develop an understanding of basics concept of kinetics and Kinematics and analysis the bodies and dynamic forces

CLOs: After Completing the "Engineering Mechanics" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	CARRYOUT analysis for the two dimensional force system and equilibrium on the basis of the principles of statics	**C4**	**2**
2	To ILLUSTRATE the basics concept of kinetics and Kinematics and analysis the bodies and dynamic forces.	**C3**	**1**
3	To EXECUTE the application of various force system and equilibrium.	**P4**	**1**

1. **Statistics:**
   Introduction: Concept of mass and units of measurement i.e. force, time and space.
2. **Force systems:**
   Force type, nature and direction of force, characteristics and system of forces, resolution and composition of forces by analytical and graphical method.
3. **Moment:** Concept of moment of force, principle of moments, law of transmissibility. Equilibrium forces:
4. **Moment of Inertia & Centroid**
   Moment of Inertia basic concepts, Moment of inertia and centroid of symmetrical and unsymmetrical bodies.
5. **Equilibrium of forces and its conditions,**
   Free body diagram and its applications, equilibrium of rigid body, types of beams, types of supports, determination of support reactions.
6. **Friction:**
   Concepts, laws of friction, angle of coefficient of friction, friction on horizontal and inclined planes.
7. **Dynamics**:
   Introduction: Introduction to dynamic forces.
8. **Kinematics:** Rectilinear and curvilinear motion, Newton's equations of motion, Dynamic equilibrium.
9. **Kinetics:** Work, energy and power, Virtual work formulation of equilibrium of coplanar force, Potential energy.

MINIMUM PRACTICALS TO BE CONDUCTED

1. To verify Parallelogram law of forces by using Force Board.
2. To verify Triangle law of forces by using Force Board.
3. To verify Polygon law of forces by using Force Board.
4. To verify the polygon law of forces using Funicular polygon apparatus.
5. To verify the first condition of equilibrium using Force Board
6. To verify the second condition of equilibrium using meter scale-beam method Board.
7. To find out the co-efficient of friction of horizontal steel plane for various materials.
8. To find out the angle of static, dynamic friction and the coefficient of friction between various materials on inclined steel plane for various materials.
9. To find out the angle of static, dynamic friction and the coefficient of fiction between various materials on precision fiction force apparatus at different speeds.
10. To verify that the centrifugal force varies in direct proportion to mass of rotating body, square of speed of rotation and the radius of gyrations.

11. To determine the experimental values of the force in the principal parts of the jib Crane and to see the effect of altering the tie length.
12. To compare the results of wall jib crane with the forces obtained from graphical solutions using polygon or triangle law of forces.
13. To comprehend the action of shear and moment resistance in a beam.
14. To measure the bending moment and shear force at a normal section of a loaded beam and to check its agreements with theory.
15. Open ended Lab

Recommended Books:

1. Engineering Statics by R.C. Hibler (Latest Ed.) A text book of Engineering
2. Mechanics by R.S. Khurmi (Latest Ed.) Engineering Mechanics: Statics and Dynamics, (Latest Ed.)
3. Engineering Mechanics by S. Timosheko (Latest Ed.) Hibler, R.C.
4. Engineering Mechanics, Prentice Hall (Latest Ed.) Kurmi, R. S. Engineering Mechanics, S. Chand. (Latest Ed.)

2nd Semester 1st Year (Second Semester)		
NS-102	**Quantitative Reasoning-II (Th)**	**3(3+0)**

Prerequisite: Quantitative Reasoning-I **Contact Hours:** 48+0 **Marks:** 100+0

Objectives:

- The course will familiarize students with the basic concepts of mathematics and statistics and to develop students' abilities to analyze and interpret quantitative information.
- This course will also enable students cultivate their quantitative literacy and problem-solving skills while effectively expanding their academic horizon and breadth of knowledge of their specific major / field of study.

CLOs:

After Completing the "Quantitative Reasoning-II" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND basic quantitative modeling and analyses;	**C2**	**1**
2	APPLY logical reasoning skills to solve quantitative modeling problems;	**C3**	**2**
3	EVALUATE quantitative information to make evidence-based decisions through appropriate computational tools.	**C5**	**5**

Course Outline:

1. **Logic, Logical and Critical Reasoning:**
   - Introduction and importance of logic
   - Inductive, deductive and abductive approaches of reasoning.
   - Propositions, arguments (valid; invalid), logical connectives, truth tables and propositional equivalences.
   - Logical fallacies.
   - Venn Diagrams.
   - Predicates and quantifiers.
   - Quantitative reasoning exercises using logical reasoning concepts and techniques
2. **Mathematical Modeling and Analyses**
   - Introduction to deterministic models.
   - Use of linear function for modeling in real-world situations.
   - Modeling with the system of linear equations and their solutions.
   - Elementary introduction to derivatives in mathematical modeling.
   - Linear and exponential growth and decay models.
   - Quantitative reasoning exercises using mathematical modeling.
3. **Statistical Modeling and Analyses**
   - Introduction to probabilistic models.
   - Bivariate analysis, scatter plots.
   - Simple linear regression model and correlation analysis.
   - Basics of estimation and confidence interval.
   - Testing of hypothesis (z-test; t-test);

- Statistical inference in decision making;
  Quantitative reasoning exercises using statistical modeling.

Recommended Books:

1. "Using and Understanding Mathematics: A Quantitative Reasoning Approach" by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
2. "Discrete Mathematics and its Applications" by Kenneth H. Rosen.
3. "Discrete Mathematics with Applications" by Susanna S. Epp.
4. "Applied Mathematics for Business, Economics and Social Sciences" by Frank S Budnick.
5. "Elementary Statistics: A Step-by-Step Approach" by Allan Bluman.
6. "Introductory Statistics" by Prem S. Mann.
7. "Applied Statistical Modeling" by Salvatore Babones.
8. "Barrons SAT" by Sharvon Weiner Green, M.A and Ira K.Wolf.

1st Semester 2nd Year (Third Semester)		
NS-204	**Applied Calculus (Th)**	**3(3+0)**

Prerequisite: Nil **Contact Hours:** 48+0 **Marks:** 100+0

Objectives:

- To learn fundamentals of mathematics and calculus.
- The course emphasizes the geometric interpretation of mathematical concepts and their practical applications, making it suitable for students pursuing studies in civil engineering.

CLOs: After Completing the " Applied Calculus" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	ANALYZE vectors, scalars, and vector products for spatial geometry.	**C4**	**2**
2	APPLY the mathematical concepts for real-life problems solving.	**C3**	**3**

Course Content:

1. **The Geometry of Euclidean Space**
   - Review of vectors, scalars and vector products, equations of straight lineand plane.
2. **Functions, Limit and Continuity**
   - Functions of single and several variables, techniques of finding limits and continuity
   - Parametric Representation of Curves
   - Tangent and Normal to the curve.
3. **Differentiation**
   - Introduction to ordinary and partial derivatives
   - Chain Rule with single and several variables
   - Techniques of finding ordinary derivatives as examples of related rates.
   - Directional Derivatives
4. **Applications of Derivatives**
   - Extrema of functions of single variable
   - First and second derivative tests
   - Optimization problems of functions of single variable
   - Extrema of functions of several variables.
   - Optimization problems of functions of several variables (Lagrange multipliers)
5. **Integration**
   - Introduction to integration
   - Properties and techniques of integration
   - Definite integrals
   - Double integrals
   - Change of order of integration
   - Triple integrals
6. **Applications of Integration**
   - Area under and between the curves
   - Volumes of solids of revolution by disk and Washer method.
   - Work Done
   - Moment of Inertia

7. Infinite Sequence and Series

- Power series
- Maclaurin and Taylor series and their applications.

Recommended Texts & Reference Books:

1. Thomas' Calculus by George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass, Pearson, USA
2. Swokowski, Onlinick & Pence: Calculus
3. Robert T. Smith & Roland B. Minton: Calculus
4. Calculus: Early Transcendentals by James Stewart. Brooks/Cole USA
5. George B. Thomas, Jr. and Ross L. Finney, Calculus and Analytic Geometry.

1st Semester 2nd Year (Third Semester)		
CS-203	**Computer Programming (Th + Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours:** 32+48 **Marks:** 50+50

Objectives:

- To develop skills of computer programming and its applications in elementary civil engineering problems.

CLOs:

After Completing the "Computer Programming" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE basic concepts of computer programming.	**C1**	**1**
2	ANALYZE computing problems related to civil engineering and choose the best possible solution	**C4**	**2**
3	DEVELOP computer programs involving arithmetic operations, input/output statements, decision-making statements, loops and functions.	**P4**	**3**

Course Contents:

- Computational Thinking
- Introduction to programming & PYTHON/MATLAB/Octave
- Numeric, String and List
- PYTHON/Matlab/Octave variables
- Scripts files
- Functions and Files
- Opening Excel/MAT/text files
- Programming with PYTHON/Matlab/Octave
- Syntax
- Algorithms
- Flow charts
- Conditional operations
- Loops structures
- Advance Plotting and Model Building
- 2D plotting, 3D plotting and Advance 3D plotting
- Symbolic Processing
- Numerical Methods for Calculus and Differential Equations in PYTHON/Matlab/Octave
- Engineering Problems
- Introduction to MS/Libre Office with advanced applications of MS Excel/Libre Calc

Lab Outline:

The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	Introduction to various Parts of computer including CPU, basic input output devices, Window accessories, system tools.
2	**Basic Features:** Creating and editing documents with Microsoft Word
3	**Advance features:** Creating documents with advance formatting operations of Microsoft Word
4	**Basic Features:** Creating and editing multimedia presentations with Microsoft PowerPoint
5	**Advance features:** Creating presentations with advance operations of Microsoft PowerPoint
6	**Basic Features:** Creating and editing spreadsheets with Microsoft Excel
7	**Advance features:** Creating spreadsheets with advance operations of Microsoft Excel
8	Getting familiar with Code-blocks / Dev-C++ and writing simple programs
9	Working with variables, constants, different data types, escape sequences and different Operators.
10	Decision making with conditional control structures using C++ using if, if-else, if-else-if
11	Decision making with conditional control structures using C++ using switch statement
12	Working with iterative control structures using C++
13	Working with nested control structures using C++
14	Processing set of homogeneous data items with arrays using C++.
15	Working with functions using C++
16	To Perform an Open-ended Lab.

Recommended Books:

1. Recommended Book (online interactive book + downloadable notebook+ downloadable pdf book slides) https:/7fangohr.github.i()/teaching/python/book.html
2. This book is enough for guidance.
3. https://www.python.org/ -> official reference, tutorial, setup, and jobs for python Or MATLAB/Octave books Reference Books Note: These links are worth knowing, https://runestone, academy/runestone/hooks/published/think spy/index.html — >Reference
   Book and for quizzes (interactive version)
4. https;//www'.ict.ru.ac.za/Resources/cspw7thinkcspy3/thinkcspy3.pdf — > PDF Book
5. https://docs.python.org/3/tulorial/index.html — https: //d iveintopythonS. net/
6. https://autoinatet.heboringstuff.coni/ -> online book
7. httpss://developers.google.com/edu/pyihon -> ,
8. https://archive.org/details/comp332l/mode/2up

https;//prograniniingwithraosh.confi/python,^python-3-cheat-sheet/ —

10. https://perso.linisi.fr/pointaL'_media/python:cours:niementopython3-english.pdf-
11. http://rosettacode.()rg/wiki/Numerical_integration
12. Video Playlist:
13. https://WWW, youtube. c()m/watch?v=h()93auAZiPU&list = PLlKnOrBME6xKNfchz2n HtY and CSBpXRnp --> python for beginners by Kevin Siratvert (Ex MS Developer)
14. https://www.youtuhe.com/watch7v —qel()rE()lT31 --> Computational Thinking, CS50, Prof. David J. Milan. Harvard University. https://www.youluhe.com/watch7v — fL308-
15. Kbi0
16. -> Taste of Python, CS5() by Prof David J. Milan, Harvard University. Or
17. MATLAB/Octave videos

1st Semester 2nd Year (Third Semester) (Elective)		
HS-215	**Communication & Presentation Skills (Th)**	**2(2+0)**

Prerequisite: Functional English **Contact Hours:** 32+0 **Marks:** 50+00

Objectives:

- To enable the students to improve their skills to optimal levels in reading, writing, listening and speaking.
- To enabling the students to enhance their technical writing skills and equipping them with good vocabulary.

CLOs:

After Completing the "Communication & Presentation Skills" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Write clearly, concisely, and grammatically correctly in various forms, avoiding errors.	**A2**	**1**
2	Read critically to understand information better and improve vocabulary.	**A2**	**1**
3	Deliver engaging presentations with effective communication and visuals.	**A3**	**9**
4	Adapt communication style to audience and context, demonstrating active listening.	**A3**	**9**

Course Outline

1. **Writing Skills**
   - Vocabulary Building
   - Writing Skills: Essays, and Letters,
   - Common Writing Errors
   - Purposeful Writing
2. **Reading Skills**
   - Skimming and Scanning
   - Critical Reading
   - Reading for Understanding
   - Techniques and strategies to develop sound vocabulary.
3. **Listening Skills**
   - Introduction to Communication Process
   - Seven Cs of Communication
   - Types of Listening
   - Listening for Comprehension
4. **Speaking Skills**
   - Verbal and Non-Verbal Communication
   - Basics of Presentation Skills
   - Presentation Strategies and public speaking skills. Use of Audio-Visual Aids
   - Basics of Group Communication
   - Listening Skills
   - Communicate effectively in job interviews.

Recommended Books:

1. Anchor in English-II (Lessons 1-5), A SPELT Publication
2. Christopher Fry, “Summary Writing iBook 1)”, Oxford University Press
3. College Essays by John Langan
4. Barron’s TOFFL iBT Edition
5. Communication Skills for Engineers by Sunita Marshal and MuraliKrishna
6. Writing for Computer science by Justin Zobel Research Methodologies - A step by step guide for beginners. Ranjit Kumar,

1st Semester 2nd Year (Third Semester)		
CE-214	**Mechanics of Solids – I (Th + Lab)**	**3(2+1)**

Prerequisite: Engineering Mechanics **Contact Hours:** 32+48 **Marks:** 50+50

Objectives:

- To enable students to learn fundamentals regarding strength of mechanics of solids.
- To enhance skills of utilizing material of appropriate strength for civil engineering application.

CLOs:

After Completing the "Mechanics of Solids– I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRTE the behavior of members (bars, beams) Subjected to different sets of loading and states of stresses.	C3	2
2	SOLVE problems related to biaxial state of stresses, shear force & Bending Moment, and stability of columns	C3	2
3	FOLLOW experiments to study the response of members & materials under different sets of loadings	P4	2

Course Content

1. **Stress, Strain and Mechanical Properties of Materials**
   - Uniaxial state of stress and strain
   - Relationships between elastic Constants
   - Response of materials under different sets of monotonic loading (including impact)
   - Normal and shearing stress and strains
   - Distribution of direct stresses on uniform and non-uniform members
   - Thermal stresses and strains
2. **Shear Force & Bending Moment**
   - Shear Force and Bending Moment Diagrams of beams
   - Relationship between load, shear force and bending moment
3. **Bending Theory**
   - Theory of bending
   - Moment of resistance and section modulus
   - Bending and shearing stress distribution in beams
   - Stresses in composite sections
4. **Theory of Torsion**
   - Theory of torsion of solids and hollow circular shafts
   - Shearing stress distribution, angle of twist, strength and stiffness of shaft
5. **Stability**
   - Struts and columns and their types
   - Euler, Rankine and other formulas for buckling load of columns.
   - Stability analysis of columns under eccentric loading
6. **Analysis of thin Cylinders**

Lab Outline:

The Design work and/or experiments related to above mentioned outline shall be covered in

S. No.	List of Experiment
1.	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Mechanics of Solids Laboratory. (b) To recognize the equipment used in Mechanics of Solids laboratory.
2.	To perform compression test on a specimen by using universal testing machine (UTM).
3.	To determine, diameter and unit weight of steel bar. To determine yield strength and ultimate strength of a steel bar by using Universal testing machine (UTM) and develop stress-strain curve for a steel bar. To determine percentage elongation and percentage reduction in area of steel bar
4.	To determine bending stress in a simply supported beam.
5.	To determine modulus of elasticity of a simply supported beam.
6.	To determine the deflection at point of loading of simply supported beam carrying point load.
7.	To determine the elastic line of simply supported beam.
8.	To determine the deflection at the point of load of cantilever beam carrying point load at end.
9.	To determine the elastic line of cantilever beam
10	To determine support reaction of single span and dual span Simply supported beam carrying point loads
11	To determine torsion strength and shear modulus of a short specimen.
12	To develop an understanding about fatigue and to draw S-N cure for given specimen.
13	To investigate buckling behavior of column.
14	To determine forces in each member of truss under different loads at joint.
15.	To perform an Open-Ended Lab

Recommended Books:

1. Strength of Materials, F.L Singer, Harper and Row Publisher New York, Latest Edition
2. Elements of Strength of Materials, S. Timoshenko, D. Van Nostrand Company New Jersy, Latest Edition
3. Strength of Materials, R. L Ryder, McMillan education limited, Latest Edition
4. Strength of Material by R.S Khurmi

1st Semester 2nd Year (Third Semester)		
CE-212	**Advanced Engineering Surveying (Th + Lab)**	**3(2+1)**
Prerequisite: Engineering Surveying	**Contact Hours:** 32+48	**Marks:** 50+50

Objectives:

- To acquire knowledge of control surveys and their use in advanced branches of surveying.
- To apply principles of surveying and modern tools in related field problems

CLOs:

After Completing the "Advanced Engineering Surveying" Course, each student will be able to

CLO	Description	Taxonomy Level	PLO
1	USE data for setting out of curves and tunnels on highways	**C3**	**3**
2	EXPLIAN construction, control hydrographic surveys, field astronomy, photogrammetry and GPS surveys	**C2**	**1**
3	COMMIT to individual or group survey task as a leader or member expressing team spirit and inspiring Conduct	**P4**	**5**

Course Content:

1. **Highway and Railway Curves**

Circular curves, deflections and chord calculations, Setting out circular curves by various methods, Compound curves, reverse, vertical, parabolic curves, Computation of high or low point on a vertical curve, Design considerations, spiral curves, spiral curve computations, Approximate solution for spiral problems, super elevations

2. **Tunnel Surveying**

Introduction, Surface Alignment, setting out from Ends, Transferring Alignment Underground, Use of gyroscope

3. **Construction Surveys**

Introduction, horizontal and vertical control, Buildings, rail roads, Route surveys, Pipeline and other construction surveys

4. **Control Surveys**

Geodesy universal transverse Mercator grid system, Modified transverse Mercator grid system, Lambert projection, Computations for lambert projection

5. **Hydrographic Surveys**

Objectives of hydrographic survey and electronic charting, Vertical control, depth and tidal measurements, Position fixing techniques, Sounding plan, horizontal control

6. **Field Astronomy**

Solar and stellar observations for position and azimuth determination

7. **Photogrammetry**

Introduction, Application of aerial and terrestrial photogrammetry, Stereoscopy

Lab Outline:
The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class

S. No.	List of Experiment
1.	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Surveying Laboratory. (b) To recognize the equipment available in Surveying Laboratory.
2.	To determine the horizontal distances by tacheometric surveying when line of sight is horizontal.
3.	To determine the horizontal distances and vertical distances by tacheometric surveying when line of sight is inclined.
4.	To measure the height and Reduced level of building using trigonometric leveling, when base is accessible
5.	To determine the R.L at top of elevated object by trigonometric leveling. When base is inaccessible.
6.	To determine the independent coordinates of an existing building by theodolite traversing and produce its plan.
7.	To set out the simple circular curve by deflection angle method.
8.	To set out the simple circular curve by offset from long chord method.
9.	To set out the Compound curve by deflection angle method.
10	To set out the combined curve (Transition curve)
11	To set out the Reverse curve.
12	Introduction to Total Station, and to study its different parts, and perform its adjustment.
13	To perform traversing using Total station.
14	To record the Angular Coordinates and draw plan of an existing building using GPS.
15.	To perform open ended lab

Recommended Books:

1. Plane Surveying, Dr A M Chandra, Latest Edition
2. Surveying Vol: (I + II), B.C Punmia, Latest Edition
3. Surveying Theory and Practice, R.E. Davis, 7th Edition
4. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying - An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
5. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
6. 4. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.
7. Surveying and Leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II
8. Surveying Practice, Jerry. A. Nothanson and Philip Kissam, Latest Edition
9. Surveying and Levelling by R. Agor

1st Semester 2nd Year (Third Semester)		
CE-216	**Theory of Structures (Th)**	**2(2+0)**

Prerequisite: Engineering Mechanics **Contact Hours:** 32+0 **Marks:** 100+00

Objectives:

- To enable students to learn basic of analysis of determinate structures.
- To enhance the skills of analyzing determinate structures under various loading

CLOs:

After Completing the "Theory of Structures" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE various methods of analysis for determinate structures.	C1	1
2	APPLY methods of analysis on determinate structures.	C3	2

Course Content:

1. Introduction to Theory of structures

- Types of structures
- Structure idealization and loads
- Redundancy and stability of structures

2. Analysis of Determinate Pin-Jointed Structures

- Methods of joint
- Methods of sections
- Methods of moment and
- Shear graphical method

3. Analysis of Statically Determinate Rigid Jointed Plane Frames

- Axial force diagram
- Shear force diagram
- Bending moment diagram

4. Three Hinged Arches, Cables and Suspension Bridges

5. Deflection of Beams

- Curvature, slope and deflection of beams using integration methods
- Rotation and deflection of beams by moment area
- Method Conjugate beam method
- Castigliano's second theorem
- Rotation and deflection of plane trusses and frames
- Principle of virtual work, unit load method, graphical method

Recommended Books:

1. R. C. Hibbler, Structural Analysis, Prentice Hall, 9th Edition (2016).
2. Wang, C. K., (1984), Intermediate Structural Analysis, McGraw-Hill Education - Europe.

3. K. M. LEET & Chia-Ming Uang, Fundamentals Structural Analysis rentice Hall, 7th Edition, 2009.
4. H. H. West, Fundamentals of Structural Analysis, John Willey-New York, 2nd Edition, 2002.
5. N.J. Alexender Chajes, Structural Analysis, Prentice Hall, 3rd Edition, 1995.W. J. Spencer, Fundamental Structural Analysis, Palgrave MacMillon, 1988 New York, Inc.

1st Semester 2nd Year (Third Semester) Elective		
SS 210	**Professional Ethics For Engineers (Th)**	2(2+0)

Prerequisite: Nil **Contact Hours: 32+00** **Marks: 50+00**

Objectives:

- To familiarize the students with the moral and ethical values.

CLOs: After Completing the " Professional Ethics " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	IDENTIFY the content of religious, national, or international law dealing with engineering ethics.	C1	6
2	APPLY the knowledge of ethics in their personal and professional life.	C3	7
3	ADOPT the ability to enhance key factors of interpersonal relations.	A3	11

Course Outline:

1. **Moral Values**
   Moral development, moral dilemma, dealing with moral dilemma, moral autonomy, Fulfilment of Promise, Pride and Arrogance, Malpractice, Engineer's moral rights, right of professional conscience, professional rights and Ethical theories, intellectual property rights, patents, design, trademark etc.
2. **Professional ethics, role of professional bodies**,
   Engineering code of ethics, engineering ethics, training in preventive ethics, questionable engineering practices, Micro and Macro ethics, examples of moral problems in engineering. Time management, Cooperation
3. **Inter-Personal Relations (Employer-Employee relationship),**
   employee rights, professionalism and loyalty, right to protest, obligation of confidentiality, effect of change of job on confidentiality, conflict of interest. Grievances, Welfare, health & safety of personnel, whistleblowing and its features, types, procedures to be followed and conditions to be satisfied before whistle blowing
4. **Problem-Solving,**
   Decision-Making, Engineers responsibilities towards society welfare, environment degradation, bio-centric ethics, Ecocentric ethics, Human centered environmental ethics, Global examples of catastrophic engineering incidents. Safety, responsibilities and rights; safety and risks, responsible engineering, cost of unsafe designed product, Moral thinking, tests in moral problems solving, problem solving in engineering ethics, case studies

Recommended Books

1. Engineering Ethics: Concepts and Cases by Charles E. Harris Jr, 2018, 6th Ed., Cengage Learning, ISBN:978-1337554503
2. Ethics in Engineering by Mike Martin, 2022, 5th Ed., McGraw Hill, ISBN: 9781260721744
3. Attributes of Muslim Professionals in the Light of Quran & Sunnah by Akram Muhammad Zeki, 2021, Ilum Press, ISBN: 9789674911201
4. .William G. Sullivan and Elin M. Wicks, Estimation of future events

2nd Semester 2nd Year (hFourt Semester)		
CE-227	**Fluid Mechanics & Hydraulics (Th + Lab)**	**4(3+1)**
Prerequisite: Nil	**Contact Hours:** 48+48	**Marks:** 100+50

Objectives:

- To enable students to learn basics of Fluid mechanics for Civil engineering applications.
- The course will provide detailed guidance on enable students to perform various experiments in Fluid Mechanics laboratory.

CLOs: After Completing the "Fluid Mechanics-I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE basic terms related to fluid statistics, kinematics, dynamics, and simulation model of a real hydraulic structure.	C2	1
2	SOLVE problems related to Pipe flow and various open channel x-sections and flow based on hydraulic energy & momentum principles.	C6	2
4	PRACTICE experiments to verify the theoretical principles of fluid mechanic	P3	4

Course Content:

1. **Properties of Fluid**
   Density, Specific weight, Specific volume, Specific gravity, Viscosity and Newton's law of viscosity, Bulk modulus of elasticity, Surface tension, Capillarity, Dimensions and Systems of units
2. **Fluid Statics**
   Pressure; Pressure head, Pressure-head relationship, Atmospheric pressure, Absolute pressure, Gauge pressure and Pascal's law. Equipment's for measurement of pressure, Piezometer, Manometers, Bourdon gauge and Mechanical gauges. Hydrostatic pressure, Buoyancy and stability of floatation.
3. **Forces on Immersed Bodies**
   - Forces on submerged planes & curved surfaces and their applications, Buoyancy and floatation, Equilibrium of floating and submerged bodies
4. **Fluid Kinematics**
   - Fluid Kinematics Basic concepts of uniform and non-uniform, Flow rate and mean velocity, Acceleration in fluid flow.
5. **Fluid Dynamics**
   Continuity equation in differential form for steady and unsteady flows, Continuity equation's integral form, Total head or energy (Bernoulli's) equation and its applications.
6. **Flow in Pipes Flow through simple pipes**,
   Compound pipes, Pipes in series and parallel, Looping and branching pipes, Analysis of network of pipes and water hammer. Major and minor losses, Reynold's number and its significance, Viscous flow through circular pipes, Turbulent flow through pipes, Universal velocity distribution and Prandtil's mixing length theory.
7. **Dimensional Analysis and Similitude**
   Similitude in hydraulic models , Similitude requirements, geometric, kinematics and dynamics similarities, dimensionless numbers and their significance , Releigh's method ,Buckingham's PI-theorem and its application, physical models, techniques and analysis , Introduction to numerical models

8. Open Channel Flow and its Classifications

Types of open channel and flow. States of flow and Regimes of flow, uniform flow (Chezy's and Manning's velocity equations) through various channel sections.

9. Design of Open Channels and Their Properties

Open channels Channel geometry, Design of most efficient, effective and economical open channel sections.

10. Energy and Momentum Principles

Non-uniform flow, Energy in open channels, Specific energy, Critical flow, Momentum principle and its applications, Hydraulic jump and its applications.

11. Flow Rate Measurement in Open Channels

Measurement of discharge through weirs, modular and non-modular venturi-flumes. Orifices and mouthpieces, sharp-crested weirs and notches, Pitot tube and pitot static tube, Venturi meter, flume, orifice meter

Lab Outline: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

S. No.	List of Experiment
1.	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Fluid Mechanics Laboratory. (b) To recognize the equipment available in Fluid Mechanics Laboratory.
2.	To determine the metacentric height of floating body.
3.	To determine the hydrostatic Pressure, Total pressure, and center of pressure of a vertical rectangular surface and verify its values using principle of moment.
4.	To determine the dynamic viscosity of a fluid using fall sphere viscometer.
5.	To prove validity of Bernoulli's Theorem.
6.	To determine the characteristics of a pipe network consisting of five pipes of various sizes in series.
7.	To determine the characteristics of a pipe network consisting of three pipes of various sizes in parallel.
8.	To determine coefficient of discharge of venturi meter
9.	To determine coefficient of discharge of Orifice meter
10.	To determine coefficient of velocity, coefficient of contraction and coefficient of discharge of orifice of shape 1.
11.	To determine coefficient of velocity, coefficient of contraction and coefficient of discharge of orifice of shape 2.
12.	To determine coefficient of velocity, coefficient of contraction and coefficient of discharge of orifice of shape 3.
13.	To determine coefficient of discharge for rectangular notch
14.	To determine coefficient of discharge for triangular or V notch
15.	To perform an open-ended lab

Recommended Texts & Reference Books

1. Fluid Mechanics & Hydraulic Machines by R.K Rajput
2. Fluid Mechanics & Hydraulic Machines by R.K Bansal
3. Daugherty, R. L., J. B. Franzini and Fenimore, Fluid Mechanics with Engineering Application, McGraw-Hill New York (Latest Edition)
4. Monson Young, Fundamentals of Fluid Mechanics, (Latest Edition)
5. Douglus, Fluid Mechanics, McGraw-Hill Inc.

2nd Semester 2nd Year (Fourth Semester)		
NS-205	**Applied Mathematics (Th)**	**3(3+0)**

Prerequisite: Applied Calculus

Objectives:

- To cover essential mathematical techniques for engineering applications, beginning with the System of Linear Equations and Applications with real-world civil engineering case studies.
- To give Basic Concepts to Students of Modeling covers linear/non-linear differential equations, initial/boundary value problems. Analytical methods for first-order ODEs, variable separable, homogeneous, exact, and linear equations are addressed, alongside applications such as mixing problems and temperature prediction.

CLOs:

After Completing the "Applied Mathematics" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	COMPREHEND the basic mathematical concepts.	**C2**	**2**
2	APPLY the mathematical concepts for problem solving.	**C3**	**4**

Course Content:

1. **System of Linear Equations and Applications**
   - Overview of the linear system of equations, Cases of unique solution, no solution, and infinite solutions.
   - Echelon form, Gauss elimination method.
   - Relevant engineering case studies such as network analysis, traffic flows, finding max stress in compound cylinders, and applications of linear systems in force balancing of structures.
2. **Eigenvalues and Eigenvectors**
   - Eigenvalues and eigenvectors
   - Applications of linear Algebra: Constructing curves and surfaces. Optimization problems of functions of several variables (Lagrange multipliers)
3. **Linear Programming**
   - Introduction to linear programming, Optimization, Graphical Method, Simplex Method, and Optimization problems in Engineering
   - Transportation Model, Assignment model, Transshipment Model
4. **Basic Concepts and Modeling**
   - Degree and order of ODEs, Linear/Non-linear differential equations, Solutions of differential equations, Initial and Boundary value problems.
5. **Analytical methods of solution for first order ODEs**
   - Variable separable, Homogenous equations, Solution of the related ODE models by these methods.
   - Exact equations, Integrating factor, Linear equations, and related examples, Bernoulli Equations.
6. **Mathematical Methods of Solution for First Order ODEs**
   - Formulation of first-order ODEs: Mixing problems and free fall motion, finding the temperature of a building and logistic equations, etc.
7. **Analytical methods of solution for second order ODEs**
   - Homogenous linear ODEs, Method of reduction of order, Wronskian determinant

to check independence of the solution and related examples.

- Cauchy-Euler equations and related examples, non-homogenous linear ODEs, Method of variation of Parameters, and related examples.

8. Mathematical Methods of Solution for Second-Order ODEs

- Earthquake model of single-story building and bridge collapse problems etc.

9. Laplace Transform

- Laplace transforms, Inverse Laplace transform, shifting theorem.
- Laplace transform of derivatives, Solution of second order ODE by Laplace transform

Recommended Texts & Reference Books:

1. Introductory Linear Algebra: By Bernard Kolman and David R. Hill, Latest Edition.
2. Elementary Linear Algebra: By Howard Anton and Chris Rorrers, Latest Edition.
3. Advanced Engineering Mathematics by Erwin Kreyzig, John Wiley & Sons Inc. Latest Edition.
4. Differential Equation with Boundary Value problems by D. G. Zill, M. R Cullen Latest Edition, Brooks/Cole Publishers.
5. A First Course on Differential Equations with Modelling Applications by D. G. Zill, Latest Edition, Brooks/Cole Publishers.
6. An Introduction to Mathematical Modelling by Bender, E.A., Latest Edition, Wiley, New York

2nd Semester 2nd Year (Fourth Semester)		
CE-223	**Construction Engineering (Th)**	**2(2+0)**

Prerequisite: Civil Engineering Materials **Contact Hours:** 32+0 **Marks:** 50+00

Objectives:

- To familiarize students about different construction methodologies and equipment to be used and carried out to construction projects according to drawing and specifications.

CLOs:

After Completing the "Construction Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN different construction methodologies being used in construction industry.	C2	1
2	APPLY acquired knowledge to supervise different components of building works.	C3	2

1. **Construction Aspects of Engineering Projects:**

- An over view of construction aspects for different types of engineering projects, e.g., buildings,
- retaining structures, bridges, pavements and special structures;
- General consideration common to all projects with special reference to building structures.

2. **Construction Methodology**

- Site selection and orientation of building
- Excavation and Related aspects: Methodologies for Excavation in different types of soils, stability of excavations (use of bentonite), and solution of particular problems arising out of condition of sub-soil at site e.g. de-watering, shoring and bracing, sheet piling etc., Protection of adjacent Structures and water proofing.
- Sub structure construction methodologies pertaining to in situ and pre-cast construction for moderate to high rise buildings; Mechanized construction techniques e.g., lift slabs etc;
- Use of admixtures to prevent efflorescence of brick and brick works, Dampness, Wall-dampness etc,
- Masonry Construction (Walls and their construction and types, Stone masonry, brick masonry), Brick Bonds, Plinth wall, etc.
- Foundations: Method of construction for different types of footings, piling works.
- Plain Concrete: Slab on grade, plain cement concrete floors
- Design and use of formwork for various building units/ members, and overview of temporary structures Form work for general in situ construction and a comparison with pre-cast construction
- Scaffolding
- Structural Construction (reinforced concrete frame construction such as; columns, beams, slab, roof), pre-stressed concreting
- Floor its types and construction

- Roofs and their construction types, Roof waterproofing
- Wood Works (doors, windows, floors etc.)
- Finishing works (paint, tiling, marble, metal finishing works etc.)
- Construction joints, Plinth beams and plinth protection.
- Types of doors, and windows and their usage
- Acoustics and maintenance of buildings

4. **Concreting:**
   - Methods of preparation, pouring, placement and curing of concrete in foundations. Construction joints, Plinth joints in raft foundations, mass concreting; Plinth beams and plinth protection, damp proof course. underwater concreting.
5. **Developments in Construction Technology**
   - Introduction to advanced construction and maintenance technologies (trenchless construction, short-creting and retrofitting)
   - Mechanized construction (pre-cast construction, tilt-up construction etc.)
   - Introduction to use of Virtual Environment for Construction

Recommended Books:

1. Building Construction, N.L.Arora, B.R. Gupta, Latest Edition
2. Building Construction, A. Kumar, Mir-Publisher Karachi, Latest Edition
3. Building Construction, S.K Sharma, S. Chand & Company New Delhi, Latest Edition.
4. Building Construction, Thomson J.F, Butter worth London, Latest Edition
5. Building Construction, Whitney C. Huntington, National Book Foundation Pakistan, Latest Edition

2nd Semester 2nd Year (Fourth Semester)		
CE-225	**Mechanics of Solids – II (Th)**	**2(2+0)**

Prerequisite: Mechanics of Solids – I **Contact Hours:** 32+0 **Marks:** 50+00

Objectives:

- To develop ability of students to carry out analysis of complex state of stress.
- To familiarize about the stability, analysis and failure modes of structure elements.

CLOs:

After Completing the "Mechanics of Solids-II" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	ANALYZE beams subjected to unsymmetrical bending, curved beams and beams on elastic foundations.	C4	2
2	APPLY theory of elasticity under generalized loading.	C3	2
3	DISCUSS theory of plasticity and plastic analysis of beams and frames.	C2	2

Course Content:

- **Enhanced Topics Related to Beam Bending and Shear**
  - Unsymmetrical bending
  - Shear flow, shear center
  - Analysis of curved beams
  - Beams on elastic foundations
- **Theory of Elasticity**
  - Analysis of stresses and strains due to combined effect of axial, bending and twisting forces/moments
  - Elementary theory of elasticity
  - Equilibrium and compatibility equations
  - Stress and deformation relationships
  - Theories of failure
- **Stress and Strain Transformations**
  - Biaxial state of stresses
  - Resolution of stresses
  - Principal plane, principal stresses and strains,
  - Graphical representation of stress and strains, Mohr's circle of stresses and strains
- **Analysis of thick Cylinders**
  - Analysis of thick cylinders
- **Theory of Plasticity**
  - Elementary theory of plasticity
  - Plastic hinges
  - Shape factor
  - Collapse mechanism

6. **Fatigue**

- Fatigue due to cyclic loading
- Discontinuities and Stress Concentration
- Corrosion Fatigue
- Low Cyclic Fatigue

Recommended Texts & Reference Books:

- Arthur P. Boresi. & Richard J. Schmidt, Advanced Mechanics of Materials, John Wiley;6th Edition (2002)
- Pytel, A. & Ferdinand L. Singer, Strength of Material, Harper and Row Harper

CollinsCollege Div; 4th Sub Edition (1987)

- R.C. Hibbeler, Mechanics of Materials, Prentice Hall; 10th edition
- James M. Gere & Barry. J. Goodno, Mechanics of Materials, 8th Edition, CL Engineering
- James M. Gere & Stephen P. Timoshenko, Mechanics of Materials, 4th Edition, 1997,PWS Pub Co.
- Mechanics of Materials by Zahid Ahmed Siddiqi, 2015

2nd Semester 2nd Year (Fourth Semester)		
CE-228	**Structural Analysis (Th)**	3(3+0)

Prerequisite: Theory of Structures **Contact Hours:** 32+**0** **Marks:** 100+00

Objectives:

- To familiarize students with various methods of analysis of indeterminate structures.
- To develop the skills for using the state-of-the-art methods of structural analysis.

CLOs:

After Completing the "Structural Analysis-I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	ANALYZE Indeterminate structures using force and displacement methods	**C4**	**2**
2	ANALYZE Indeterminate structures using matrix methods	**C4**	**2**
3	ANALYZE the beam and girders under the application of moving loads.	**C4**	**2**

1. **Analysis of Indeterminate Structures Using Force Approach**
   - Compatibility methods for beams and frames with and without support settlement
2. **Analysis of Indeterminate Structures Using Displacement Approach**
   - Moment distribution for beams and frames for prismatic and non-prismatic members with and without side-sway and support settlement
   - Slope deflection method for beams and frames with and without support settlement
3. **Matrix Methods**
   - Introduction to flexibility method
   - Introduction to stiffness method
   - Development of member and structure stiffness matrices
   - Bending moment and shear force diagrams
   - Use of appropriate software for matrix operations
4. **Finite Element Method**
   - Introduction to finite elements
   - Shape functions for bar element
5. **Moving Loads**
   - Influence lines for reactions
   - Shear force and bending moment in statically determinate beams and paneled girders
   - Influence lines for member forces in pin jointed frames
   - Calculation of maximum stress function (reaction, shear, bending moment, axial force) in these structures

Recommended Books:

1. R. C. Hibbler, Structural Analysis, Prentice Hall, 10th Edition (2021).
2. Aslam Kassimali, (2014), Structural Analysis, 5th Edition
3. Wang, C. K., (1984), Intermediate Structural Analysis, McGraw-Hill Education - Europe.
4. West, H. H., (1989), Analysis of Structures: An Integration of Classical and Modern Methods , John Wiley and Sons Ltd; 2nd Edition.
5. Alexander, Chajes, (1990), Structural Analysis 6. Rizwan, S.A., (2003), Theory of Indeterminate Structures, 2nd Ed.

2nd Semester 2nd year (Fourth Semester)		
CE-226	**Concrete Technology (Th + Lab)**	3(2+1)

Prerequisite: Civil Engineering Materials

Contact Hours: 32+48 **Marks: 50+50**

Objectives:

- To familiarize the students with the fundamental properties of concrete.
- To enable students to design various structural elements of a structure.

CLOs: After Completing the "Concrete Technology" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS various properties and types of concrete and its constituent materials.	**C2**	**1**
2	DESIGN the concrete mixes.	**C6**	**3**
3	PERFORM experiments on concrete in fresh and hardened state	**P3**	**4**

1. **Concrete ingredients**
   Concrete constituent materials and their physical and mechanical properties
2. **Types of Concretes**
   Types of concrete based on binding material, strength, grade, applications, etc.
3. **Properties of concrete**
   Properties of Fresh concrete
   Properties of hardened concrete.
4. **Admixtures,**
   various types of admixtures and their practical applications, Advancement in concrete mixes
5. **Design of concrete mixes**
   Design various types of concrete mixes for getting different strength
6. **Production of concrete**
   Various stages of production of concrete
7. **Curing, Batching & Transportation of Concrete.**
8. **Durability**
   Durability, aspects and factors controlling durability of concrete structures
9. **Structural Health Monitoring of Concrete**
   Non-destructive testing of concrete, Structural Health monitoring techniques of Concrete structures

Practical Work to be carried out:

1. Introduction to Concrete Laboratory and HSE Measures.
2. To determine the quantity of silt and clay in a given sample of fine aggregate.
3. To determine the compressive strength of mortar cubes.
4. To prepare the concrete mix and determine the workability of fresh concrete by; a) slump test method.
   (a) compaction factor test method.
   (b) V-Bee Consistometer test method
5. To determine the unit weight of fresh concrete.
6. To determine the unit weight of hardened concrete.
7. To determine the water absorption of hardened concrete.
8. To determine the compressive strength of concrete cubes and cylinders.

9. To determine the splitting tensile strength of concrete cylinders.

10. To determine the flexural strength of plain concrete beams using centre-point loading method.
11. To determine the flexural strength of plain concrete beams using third-point loading method.
12. To determine the modulus of elasticity of concrete
13. To determine the compressive strength of concrete sample by Schmidt Hammer.
14. To take out the concrete core by core cutting machine and determine its compressive strength.
15. To perform the open-ended lab.

Recommended Books:

1. Structural Concrete by M. Nadim Hassoun Latest Edition

2. Concrete Technology, A. M. Neville and J.J. Brooks, Publisher: Longman, Latest Edition
3. Advanced Concrete Technology: Constituent Material, J. Newman and B.S. Choo, Publisher: Butterworth Heinemann, Latest Edition
4. Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher: John Wiley & Sons. Inc., Latest Edition

2nd Semester 2nd Year (Fourth Semester)		
HS-306	**Civics and Community Engagement (Th)**	**1(1+0)**

Prerequisite: Nil **Contact Hours:** 16+0 **Marks:** 50+0

Objectives:
After successful completion of this course, students will be equipped with knowledge related to civics, citizenship, and community engagement which can be applicable to the real-world situations to make a positive impact on their communities

CLOs: After Completing the "Civics and Community Engagement" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRATE fundamental understanding of civics, government, citizenship and civil society.	A3	6
2	UNDERSTAND the concept of community and recognize the significance of community engagement for individuals and group	A4	9
3	IDENTIFY the importance of diversity and inclusivity for societal harmony and peaceful co-existence	A4	7

1. **Introduction to Civics and Citizenship**
   - Definition of civics, citizenship, and civic engagement
   - Historical evolution of civic participation
   - Types of citizenship: active, participatory, digital etc.
   - The relationships between democracy and citizenship
2. **Civics and Citizenship**
   - Concepts of civics, citizenship, and civic engagement.
   - Foundations of modem society and citizenship.
   - Types of citizenship: active, participatory, digital, etc.
3. **State, Government and Civil Society**
   - Structure and functions of government in Pakistan.
   - The relationship between democracy and civil society.
   - Right to vote and importance of political participation and representation.
4. **Rights and Responsibilities**
   - Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973.
   - Civic responsibilities and duties.
   - Ethical considerations in civic engagement (accountability, non- violence, peaceful dialogue, civility, etc.)
5. **Community Engagement**
   - Concept, nature and characteristics of community.
   - Community development and social cohesion.
   - Approaches to effective community engagement.
   - Case studies of successful community driven initiatives.
6. **Advocacy and Activism**
   - Public discourse and public opinion.
   - Role of advocacy in addressing social issues.
   - Social action movements.
7. **Digital Citizenship and Technology**
   - The use of digital platforms for civic engagement.

- Cyber ethics and responsible use of social media.
- Digital divides and disparities (access, usage, socioeconomic,
- geographic, etc.) and their impacts on citizenship.

8. Diversity, Inclusion and Social Justice:

- Understanding diversity in society (ethnic, cultural, economic,
- political etc.).
- Youth, women and minorities' engagement in social development.
- Addressing social inequalities and injustices in Pakistan.
- Promoting inclusive citizenship and equal rights for societal harmony
- and peaceful co-existence.

Recommended Books:

1. "Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education.
2. "Citizenship in Diverse Societies" by Will Kymlicka and Wayne Norman.
3. "Engaging Youth in Civic Life" by James Youniss and Peter Levine.
4. "Digital Citizenship in Action: Empowering Students to Engage in Online Communities" by Kristen Mattson.
5. "Globalization and Citizenship: In the Pursuit of a Cosmopolitan Education" by Graham Pike and David Selby.
6. "Community Engagement: Principles, Strategies, and Practices" by Becky J. Feldpausch and Susan M. Omilian.
7. "Creating Social Change: A Blueprint for a Better World" by Matthew Clarke and Marie-Moni ue Steckel

1 st Semester 3rd Year (Fifth Semester)		
NS-306	**Numerical Analysis (Th)**	**3(3+0)**

Prerequisite: Nil **Contact Hours: 48+0** **Marks: 100+0**

Objectives:

- To teach the students about numerical methods and their theoretical bases.
- Aims at inculcating in the students the skill to apply various techniques in numerical analysis, understand and do calculations about errors that can occur in numerical methods and understand and be able to use the basics of matrix analysis.

CLOs: After Completing the "Numerical Analysis" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	APPLY numerical methods for the solutions of linear/nonlinear equations	**C2**	**2**
2	IDENTIFY the function from the numerical data to find the best fit curve	**C3**	**3**
3	COMPUTING eigenvalues and delve into numerical optimization techniques, with practical applications illustrated through case studies	**C4**	**3**

1. Error Analysis and Interpolation

- Error analysis, Types of error, Sources of error, Norms of vectors and matrices
- Interpolation: Newton forward and backward difference formula for
- interpolation, Central difference interpolation formulae, Lagrange's
- interpolation, Error in interpolation, Relevant engineering case studies

2. Numerical Differentiation and Integration

- Derivation of numerical differentiation of first order and second order derivatives using two points and three points along with its application in engineering
- Numerical integration: Trapezoidal rule, Simpson's rules, Composite Trapezoidal Simpson Rules and Romberg integration, Applications of numerical in engineering, Relevant case studies

3. Methods of solution a system of Linear Equations

- Solution of system of linear algebraic equations, Gauss elimination method, LU factorization
- Applications of these methods in engineering disciplines, Relevant case studies

4. Iterative Methods for Linear and Nonlinear Equations

- Numerical Solution of nonlinear equations: Bisection method, Newton's method, Secant method
- Solution of system of linear equations by Jacobi and Gauss Seidel
- Applications of these methods in engineering disciplines, Relevant case studies

5. Numerical Methods for IVPs

- Euler's method and its variations.
- Runge-Kutta methods of order 2 and 4.
- Linear multistep methods, Numerical solution of system of ODEs
- Applications in engineering: Some relevant case studies

6. Numerical Methods for Computing Eigenvalues

- Eigenvalues and Eigenvectors of matrix: power method,
- Inverse power method.
- Applications of eigenvalues in civil engineering.

7. Numerical Optimization

- Unconstrained Optimization,
- Lagrange Multipliers,
- Method of steepest descent
- Applications of optimization in civil engineering

Recommended Books:

1. Numerical Analysis: By Richard L. Burden, J. Douglas Faires, (Latest Edition).
2. Numerical Methods for Scientists and Engineers by R.W. Hamming (Latest Edition).
3. Numerical Methods for Engineers by Steven C. Chapra and R. P. Canale (Latest Edition).

1 s t Semester 3rd Year (Fifth Semester)		
CE-315	**Applied Hydraulics (Th + Lab)**	**2(2+1)**

Prerequisite: Fluid Mechanics and Hydraulics

Contact Hours: 32+48 **Marks: 50+50**

Objectives:

In this course student will learn the application of the principles of fluid mechanics to problems dealing with the collection, storage, control, transport, regulation, measurement, and use of water.

CLOs: After Completing the "Hydraulics Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	**ANALYZE** states of flow with respect to water surface and channel bed profiles due to sediment transport in open channels.	C4	2
2	Analyze the working of hydraulic machines for an effective design of water supply and hydropower schemes.	C4	2
3	**MANAGE** experimentally the open channel, pipe network flows and investigate technically the usage of hydraulic machines in daily life and their effect on environment.	P4	5

.

1. **Gradually Varied Flow in Open Channels**

Dynamic equation of gradually varied flow, Surface profiles, Computation of backwater curve length and surface profiles.

2. **Steady Flow in Open Channel**

Specific energy and critical depth

Dynamic equation of gradually varied flow, Dynamic equation of gradually varied flow, Surface profiles, Computation of backwater curve length and surface profiles. Humps and constrictions Hydraulic jump Broad crested weirs, venturi flume and critical depth meters

3. **Sediment Transport in Open Channels**

Importance of sediment transport, Bed load and suspended load, Threshold motion of the sediment, Use of different empirical methods/formulae to estimate sediment load in ppm, Open channel bottom deformation (theory and practical aspects).

4. **Waterpower Development Hydroelectric power**

Important terms and definitions and principal components of a hydroelectric scheme, Classification of hydel plants, Runoff plants, Storage plants, Pumped storage plants, Tidal plants, Low head, medium head and high head schemes.

5. **Dams and Hydro Power Engineering**

Selection of hydropower sites, Components and layout of hydropower scheme, Types of dams, forces on dams, design of gravity dams and environmental impacts, Reservoir engineering, operation and regulation of storage reservoirs

6. **Reaction and Centrifugal Turbine Types**

Construction features, Operations, Specific speed.

7. **Pumps:**

Centrifugal pumps their classification, Cavitation, Draft tube, Construction features and operation and specific speed, Reciprocating pumps their classifications (single acting and double acting pumps), Acceleration head, Maximum suction lift, Use of air vessels, Specific speed.

Lab Outline: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class	
S. No	**List of Experiment**
1	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Fluid Mechanics Laboratory. (b) To recognize the equipment available in Fluid Mechanics - II Laboratory.
2	To observe the flow lines pattern across the obstacle in the flow channel.
3	To observe different regime of flow and compute their Reynold's number using Horizontal Osborne Reynolds apparatus
4	To observe different regime of flow and compute their Reynold's number using Vertical Osborne Reynolds apparatus
5	To determine friction factor of long pipe carrying Laminar flow and compare it with theoretical values.
6	To determine friction factor of long pipe carrying turbulent flow and compare it with theoretical values.
7	To determine the head loss related to different flow rates through 45o elbow, 90o elbow, sudden enlargement, sudden contraction, and short bend and calculate the loss coefficients.
8	To determine the losses through gate valve related to flow rate and calculate loss coefficients related to velocity head
9	To find the force produce by the jet through nozzle on Plate deflector and compare it with theoretical values.
10	To find the force produce by the jet through nozzle on Hemisphere deflector and compare it with theoretical values.
11	To find the force produce by the jet through nozzle on Cone deflector and compare it with theoretical values.
12	To find the force produce by the jet through nozzle on Slope deflector and compare it with theoretical values.
13	To determine the mechanical power produced by the Pelton Wheel turbine, and its efficiency.
14	To determine the mechanical power produced by the Francis turbine, and its efficiency.
15	To Perform open-ended lab.

Recommended Books:

1. Roberson J. A., Cassidy J. J., and Chaudhry M. H., (1998) Hydraulic Engineering, John Wiley & Sons
2. Wynn P., (2014) Hydraulics for Civil Engineers, ICE Publishing. Lindell J. E., Moore W. P., and King H. W., (2018), Handbook of Hydraulics, 8th Edition, McGraw Hill
3. David, A. Chin, (2010) Water Resources Engineering, 2nd Edition, John Wiley & Sons

1st Semester 3rd Year (Fifth Semester)		
HS-307	**Expository Writing (Th)**	**3(3+0)**

Prerequisite: Functional English, **Contact Hours:** 48+0 **Marks:** 100+0

Objectives:

- After successful completion of this course, students will be able with writing skills in various contexts
- The course will also enable students to dissect intricate ideas, to amalgamate information and to express their views and opinions through well-organized essays.
- The students will further be able to refine their analytical skills to substantiate their viewpoints using credible sources while adhering to established ethical writing norms.
- Additionally, the course will highlight the significance of critical thinking enabling students to produce original and engaging written texts.

CLOs: After Completing the "Expository Writing" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND the essentials of the writing process integrating pre-writing drafting, editing and proofreading to produce well -structured essays.	**C2**	**9**
2	DEMONSTRATE mastery of diverse expository types to address different purposes and audiences.	**A3**	**7**
3	UPHOLD ethical practices to maintain originality in expository writing.	**A4**	**7**

1. **Introduction to Expository Writing:**
   - Understanding expository writing (definition, types, purpose and applications)
   - Characteristics of effective expository writing (clarity, coherence and organization)
   - Introduction to paragraph writing
2. **The Writing Process:**
   - Pre-writing techniques (brainstorming, free-writing, mind mapping, listing, questioning and outlining etc.)
   - Drafting (three stage process of drafting techniques)
   - Revising and editing (ensuring correct grammar, clarity, coherence, conciseness etc.)
   - Proofreading (fine-tuning of the draft)
   - Peer review and feedback (providing and receiving critique)
3. **Essay Organization and Structure:**
   - Introduction and hook (engaging readers and introducing the topic)
   - Thesis statement (crafting a clear and focused central idea)
   - Body Paragraphs (topic sentences, supporting evidence and transitional devices)
   - Conclusion (types of concluding paragraphs and leaving an impact)
   - Ensuring cohesion and coherence (creating seamless connections between paragraphs)
4. **Different Types of Expository Writing:**
   - Description
   - Illustration
   - Classification
   - Cause and effect (exploring causal relationships and outcomes)

- Process analysis (explaining step-by-step procedures)
- Comparative analysis (analyzing similarities and differences)

5. Writing for Specific Purposes and Audiences:

- Different types of purposes (to inform, to analyze, to persuade, to entertain etc.)
- Writing for academic audiences (formality, objectivity, and academic conventions)
- Writing for public audiences (engaging, informative and persuasive language)
- Different tones and styles for specific purposes and audiences

6. Ethical Considerations:

- Ensuring original writing (finding credible sources, evaluating information etc.)
- Proper citation and referencing (APA, MLA, or other citation styles)
- Integrating quotes and evidence (quoting, paraphrasing, and summarizing)
- • Avoiding plagiarism (ethical considerations and best practices)

Recommended Books:

1. "The St. Martin's Guide to Writing" by Rise B. Axelrod and Charles R. Cooper.
2. "They Say/ I Say: The Moves That Matter in Academic Writing" by Gerald Graff and Cathy Birkenstein.
3. "Writing Analytically" by David Rosen Wasser and Jill Stephen.
4. "Style: Lessons in Clarity and Grace" by Joseph M. Williams and Joseph Bizup.
5. "The Elements of Style" by William Strunk Jr. and E.B. White.
6. "Good Reasons with Contemporary Arguments" by Lester Faigley and Jack Selzer.
7. "Writing to Learn: How to Write - and Think - Clearly About Any Subject at All" by William Zinsser.
8. "The Norton Field Guide to Writing" by Richard Bullock, Maureen Daly Goggin, and Francine Weinberg.
9. "The Art of Styling Sentences" by Ann Long knife and K.D. Sullivan.
10. "Writing Toda "b Richard Johnson-Sheehan and Charles Paine

1st Semester 3rd Year (Fifth Semester)		
CE-310	**Geoinformatics (Lab)**	**0(0+2)**

Prerequisite: Nil **Contact Hours:** 0+96 **Marks: 0+100**

Objectives:

- To familiarize the students of Civil Engineering with the field of Geoinformatics which has at its core the technologies supporting the processes of acquiring, analyzing and visualizing spatial data.

CLOs: After Completing the "**Geoinformatics**" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	CONDUCT various geo informatics tasks using modern tools and software and to review engineering information using GIS / Remote sensing	P4	5

1. **Coordinates system**
   Introduction to Geo-Informatics, Coordinate Systems, Global Horizontal Control Systems, Understanding Vertical Controls, World Geodimetric System of Vertical Control, Earth's Gravitational Model.
2. **Instrumentations**
   Navigational Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and working of GPS, System Operation & Characteristics, Differential GPS (DGPS).
3. **GIS**
   Fundamentals of GIS Data Handling, Earth model, Map projections, Introduction to spatial analysis. GIS modeling tools and Analysis. Hands-on with software
4. **Data Files**
   Standard Database Formats, Understanding GIS data. Vector and Raster Formats, Spatial Statistics.
5. **Remote Sensing**
   Physicals basis of Remote Sensing, Satellite System, Sensors, Types of Resolutions, Geo-referencing, Image classifications and Processing Techniques, Classification. Acquisition of Global Datasets, Understanding Digital Elevation Model, Digital Surface Model, and Limitations of Satellite acquired data. Aerial & Satellite Photogrammetry and Hydrographic surveys Aerial and Satellite photogrammetry. Satellite System, Application, and limitations. Applications of GIS and remote sensing in hydrographic surveying.

Practical work to be carried out:

1. Introduction to GIS software.
2. Installing ArcMap Software
3. Working in ArcMap and Map Making
4. Working with Projections
5. Digitizing in ArcMap
6. Geo Referencing
7. Spatial Analysis and Geo-Processing
8. Digital Data and Tables
9. Tables Operations in ArcMap
10. Table Operations import join Spatial Selection
11. Searching and Downloading Satellite and DEM Data
12. Introduction to Google Earth Digitization and Map Making.
13. Working with Rasters
14. Working with Satellite Data for Land Use Land Cover Mapping and Change Detection
15. Applied exercises of GIS and RS in Civil Engineering.

-

Lab Outlines: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

S. No	List of Experiments
1.	Introduction to GIS software.
2.	Installing ArcMap Software
3.	Working In ArcMap and Map Making
4.	Working With Projections
5.	Digitizing in ArcMap
6.	Geo Referencing
7.	Spatial Analysis and Geo-Processing
8.	Digital Data and Tables
9.	Tables Operations in ArcMap
10.	Table Operations import join Spatial Selection
11.	Searching and Downloading Satellite and DEM Data
12.	Introduction to Google Earth Digitization and Map Making.
13.	Working with Rasters
14.	Working with Satellite Data for Land Use Land Cover Mapping and Change Detection
15	To perform open ended lab

Recommended Books:

1. Remote Sensing and Image Interpretation, Thomas M. L., Ralph W. K., 5th Edition
2. Introduction To Geographic Information Systems, Chang K. T., 3rd Edition

1st Semester 3rd Year (Fifth Semester)		
CE-317	**Reinforced Concrete Design-I (Th)**	3(3+0)

Prerequisite: Civil Engineering Materials , Concrete Technology

Contact Hours: 48+0 **Marks: 100+0**

Objectives:

- To enable students to design various structural concrete members.
- To design torsion reinforcement to corner balance torsion effect

CLOs: After Completing the "Reinforced Concrete Design-I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Discuss the design fundamentals related to various reinforced concrete structures	C2	1
2	DESIGN various structural reinforced concrete elements.	C6	3

1. **Reinforced Concrete (Basic Principles, Working Stress and Ultimate Strength Method)**
   - Basic principles of reinforced concrete design and associated assumptions behavior of reinforced concrete members in flexure, design philosophy, design codes, factor of safety and load factors, prevailing methods of design of reinforced concrete members.
   - Working stress method, serviceability criteria and checks for deflection, crack width, and crack spacing, Importance of working stress method related to pre-stress.
   - Ultimate strength method, analysis of prismatic and non-prismatic sections in flexure, compatibility-based analysis of sections and code requirements for flexure
2. **Structural Framing and Load Calculations of a Simple Structure for Gravity Design**
   - Structural framing
   - Load calculations, types of basic loads, service and factored load combinations
   - Load distribution and calculations for slabs, beams, columns and footings
3. **Design of RCC structures**
   - Analysis and design of prismatic and non-prismatic sections in flexure
   - Design for diagonal tension, design and detailing for bond, anchorage and development length
   - Analysis and design of doubly reinforced concrete beams
   - Shear stress in reinforced concrete beams
   - Slabs, types of slabs, Analysis and design of one way solid slabs
   - Columns, types of columns, Analysis and design of short columns subjected to combined flexural and axial loading.
   - Footing, types of footing, Analysis and design of isolated, combined, strap and raft/mat footing

Recommended Books

- Design of Concrete Structures, A.H. Nilson, D. Darwin and C.W. Dolan, Publisher: McGraw Hill Company, Latest Edition
- Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher: John Wiley & Sons. Inc., Latest Edition
- Reinforced Concrete Design, C.K Wang and C.G Salamon, Harlperand Row, Publisher New York, Latest Edition

1st semester 3rd year (Fifth Semester)		
CE-319	**Geometric Design of Highways & Airports (Th)**	2(2+0)

Prerequisite: Nil **Contact Hours: 32+00** **Marks: 50+00**

Objectives:

- To familiarize the students with the geometric Design of Airports.
- To enable students to design various highway and Airport elements.

CLOs: After Completing the " Geometric Design of Highways & Airports " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS basic concepts of geometric design of Highways and Airports.	C2	1
2	CALCULATE slopes, curves, sight distance and width for safe design of highways and runways	C2	3

1. **Highway Geometric Design (Alignments)**
   - Introduction to Geometric Design,Horizontal Curves, Super Elevation,
   - Introduction, Grades, Vertical curves, Grade Line, Transition Curve, Curve Widening,
   - Highway Drainage ,Sight Distance, PIEV Theory, Highway elements
   - Requirements, Introduction to Civil 3D
2. **Geometric Design of Airports**
   - Classification of airports, Characteristics of aircrafts related to airport design;
   - Factors affecting airport site selection ,Runway design, runway orientation Components, length transverse grades, longitudinal grades and sight distances,
   - Taxiways. Width, longitudinal and transverse slopes, sight distance and exit to taxiway.
   - Grading & runway Drainage, Various Runway configurations.
   - Airfield lighting system *Aerodrome reference codes
   - Runway ACR/PCR values through latest equipment HWD *
   - Cost-benefit analysis for construction of airport
   - Overview of ICAO, FAA & IATA
   - Terminal building functional areas, visual aids, Apron/Aircraft parking.

Recommended Books:

1. A Policy on Geometric Design of Highways and Streets by AASHTO, 7th Edition, 2018
2. Geometric Design Projects for Highways: An Introduction by John G. Schoon latest edition
3. Planning and Design of Airports, Latest Edition by Robert M. Horonjeff , Francis X. McKelvey, William J. Sproule , Seth Young
4. Airport Engineering: Planning, Design, and Development of 21st Century Airports, letest Edition Norman J. Ashford, Saleh Mumayiz, Paul H. Wright
5. Runway Geometric and Structural Design: According to FAA Regulations: JFK

International Airport Case Study Paperback – April 19 2021 by ENG Mohamed Abdelsalam

1st Semester 3rd Year (Fifth Semester)		
CE-313	**Railways & Waterways Engineering (Th)**	**2(2+0)**

Prerequisite: Nil **Contact Hours: 32+0** **Marks: 50+0**

Objectives:

- To provide background knowledge of transportation engineering with detailed and thorough understanding of framework of various transportation systems.

CLOs: After Completing the "Railways and Waterways Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS concepts of transportation systems and its planning in solving urban transportation problems.	C2	3
2	APPLY the principles of transportation engineering to solve the problems that are most likely to be encountered in the planning and design of railways and coastal structures based on best practices and guidelines.	C3	3

1. Introduction to Transportation Systems and Planning

- Comparison of different modes of transportation
- Phases of planning, Planning process and mode choice decisions, Urban transportation problems: Transportation and urban growth, Mass transit system, Comparison of different transit modes, Transit and environment, Transit and urban sustainability.

2. Railway Engineering

- Introduction, planning, routes of railways,, crossings and transfer, passengers' traffic and stations, planning of stations / platforms for passengers, Railway Track, gauge, Track components, Rail, rail fittings, fixtures, Sleeper types, comparison, Sleepers and ballast requirements and specification per kilometer of track, Formation and cross- section details, drainage, track defects, signals, branching, classification and Marshall signals, other signals, maintenance and adjustment of railway. Points and Crossing, Station and Yards, Level crossing, Signaling and control, Suburban Railways, Metro railways system, Modernization of railways, Underground Railways.

3. Ports and Harbor Engineering

- Water Transportation: Sea Port, Harbors, Ports and harbors of Pakistan
- Types and selection of site, Breakwaters, Jetties, Wharves, Navigation aids: Buoys and light houses, Inland water transportation. Components and classification, site investigation, waterway design. Design principles and requirements of harbors, and their construction, Transit sheds and warehouses.

Recommended Books:

1. Jason C. Yu, Transportation Engineering Introduction to Planning, Design and Operations, Elsevier Science Ltd. (Latest Edition)
2. Horon Jeff, R. Planning and Design of Airports, McGraw Hill Professional; (Latest Edition).
3. Gregory P. Tsinker, Port Engineering Planning Construction Maintenance and Security, John Wiley, (Latest Edition) William Walter Hey, Railway Engineering, Wiley; (Latest Edition).
4. Railway Engineering by Chandra and Agarwal, Oxford University Pres

Dock and Harbor Engineering, Oza and Oza, Charotar Publisher.

2nd Semester 3rd Year (Sixth Semester)		
CE-328	**Soil Mechanics (Th + Lab)**	**4(3+1)**

Prerequisite: Nil **Contact Hours:** 48+48 **Marks:** 100+50

Objectives:

- To enable students to learn soil properties and its behavior under loading.
- To apply the laws of mechanics to soil so that engineers can design safe structures.

CLOs:

After Completing the "Soil Mechanics" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN fundamental engineering concepts of soil's behavior based on its physical and index properties, and classification of soil.	**C2**	**2**
2	INVESTIGATE interaction between water and soil and the effects of static versus flowing water on soil's behavior, and in-situ stresses.	**C4**	**4**
3	ANALYZE compaction and its mechanism, and process of consolidation in soils.	**C4**	**2**
4	PRACTICE laboratory testing to determine index properties of soil, flow of water through soil, and compaction and consolidation parameters of soil	**P3**	**4**

Course Content:

1. Introduction

- Introduction to soil mechanics and geotechnical engineering
- Significance of geotechnical engineering
- Soil formation, transportation, sorting, and deposition
- Types of soil deposits and their properties
- Soil types, soil structure and clay minerals.

2. Index and Physical Properties

- Basic physical and index properties of soil
- Water content, void ratio, porosity, degree of saturation, air voids, unit weights, specific gravity etc.
- Phase relationships, and numerical examples
- Particle size and shapes, sieve Analysis, hydrometer Analysis.
- Consistency and various states of fine-grained soils
- Atterberg's limits
- Related numerical examples

3. Soil Classification Systems

- Importance of soil classification
- Grain size distribution, gradation curves and interpretation
- Soil classification systems: Textural classification system, AASHTO soil classification system, Unified soil classification system, and description of their subgroups.

- Related numerical examples.

4. Permeability and Seepage

- Permeability and Seepage
- Darcy's law
- Factors affecting permeability.
- Laboratory and filed determination of permeability.
- Capillary action and its effects in soils
- Seepage force
- Introduction to flow net
- Quicksand condition and sand boiling
- Related numerical examples.

5. In-Situ Stresses

- Stress condition in soil: effective and neutral stresses, stresses in saturated soils with upward and downward seepages

6. Compaction of Soils

- Compaction of soils
- Fundamentals of compaction
- Standard and modified Proctor compaction tests
- Moisture density relationship
- Compaction standards
- Factor effecting compaction.
- Field control and measurement of in situ density and field compaction.
- Numerical examples and assignments.

7. Consolidation of Soils

- Consolidation of soils
- Mechanics of consolidation
- Theory of one-dimensional consolidation, related assumptions, and validity
- Oedometer test and graphical representation of data
- Compression index and co-efficient of compressibility
- Time factor, coefficient of volume change and degree of consolidation
- Primary and secondary consolidation
- Normal and pre-consolidated soils
- Related numerical examples.

Lab Outline: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class

S. No.	List of Experiment
1.	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Geotechnical Engineering Laboratory. (b) To recognize the equipment available in Geotechnical Engineering Laboratory.
2.	To prepare a representative soil sample by using Quartering method and Riffle box method
3.	To determine the water content of soil sample by: a). Oven Drying Method b). Hot Plate Method c). Sand Bath Method

4.	To determine the water content of soil sample by: a). Speedy Moisture Tester b). Infrared Moisture Tester
5.	To determine the particle size distribution of coarse-grained soil by Sieve Analysis.
6.	To determine the particle size distribution of fine-grained soil by Hydrometer Analysis.
7.	To determine the specific gravity of fine-grained soil by Density Bottle Method.
8.	To determine the liquid limit of fine-grained soil by Casagrande Apparatus
9.	To determine the liquid limit of fine-grained soil by Fall Cone (Penetrometer) Method.
10	To determine the plastic limit of the fine-grained soil by Glass Plate Method.
11	To determine the plastic limit of the fine-grained soil by Fall Cone Method.
12	To determine the shrinkage limit of fine-grained soil.
13	To determine the coefficient of permeability of coarse-grained soil by Constant Head Method.
14	To determine the coefficient of permeability of fine-grained soil by Falling Head Method.
15.	To Perform open-ended lab.

Recommended Texts & Reference Books:

1. Braja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.
2. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press, 734 pp.
3. Craig, R. F. (2019). Craig's Soil Mechanics, 9th Ed., CRC Press, 654 pp.
4. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.
5. Doland P. Coduto (1999/Latest Edition), Geotechnical Engineering-Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.
6. Bowles J. E. (1984). Physical and Geotechnical properties of Soils, 2nd Ed., McGraw-Hill, New York, 578 pp.

2nd Semester 3rd year (Sixth Semester)		
CE-324	**Quantity Surveying & Cost Estimation (Th + Lab)**	**3(3+0)**

Prerequisite: Civil Engineering Drawing & AutoCAD

Contact Hours: 48+0 **Marks:** 100+0

Objectives:

- Ability of student to learn principles of computations related to quantity surveying.
- To enhance the skills of student for preparation of detailed estimation & bill of quantities for various Civil Engineering projects.
- To familiarize students with tender and contract documents.

CLOs: After Completing the "Quantity Surveying & Cost Estimation" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	COMPREHEND the quantity take-offs, estimates, their types and procedural requirements.	**C2**	**2**
2	COMPREHEND terms related to tender and contract documents	**C2**	**8**
3	PREPARE cost estimates by studying and scrutinizing quantities of various construction activities.	**C4**	**4**

Course Content:

1. **Quantity Takeoff**
   - Review of basic take-off mathematics and measurement Units.
   - Takeoff Rules and Measurement Accuracy
   - Organization of take-off
   - Quantity take-off and Pricing of Labor, Material and Equipment for; Sitework, Concrete, Masonry, Carpentry, and Finishes Works.
   - Estimating Procedures and Considerations for Masonry walls, Concrete (Beams, Columns, Retaining Wall, Piles Dams, etc) Steel Truss, Road, Sewer and Water Mains Pipe Works.
   - Maintaining of Measurement Books
2. **Development of Estimates, Pricing and Related Aspects**
   - Types and methods of estimates (conceptual estimates, preliminary, detailed estimates)
   - Rate analysis
   - Labor productivity
   - Cost analysis of construction materials
   - Estimate Setup, Overhead, Profit, Sources of Estimating Errors, Escalation, Contingency, Life-Cycle Costing and Analysis.
   - Concept of Cost Code
   - Use of different types of indices for conceptual estimates
3. **Contractual Aspects Related to Bidding**
   - Specifications and their types for various items of construction projects
   - Overview of payment schemes in construction projects
   - Preparation of Civil Engineering tender/bid proposal documents evaluation methods of proposals and bids.

- Preparation of documents for bid submissions
- Overview of Standard form of contract/bidding documents with special reference to clauses related to cost related issues of the projects (such as PEC, FIDIC, AIA etc.) General practice in government departments for schedule of rates and specifications.

Recommended Books:

1. Marks Kalin, Robert S. Weygant, Harold J. Rosen & John R. Regenar, Construction Specifications Writing: Principles and Procedures (2010), Wiley.
2. Steven J. Peterson and Frank R. Dagostino, Estimating in Building Construction (2015) 8th Edition, Pearson Publishing.
3. Steven J. Peterson, Construction Estimating Using Excel (2017) 3rd edition Pearson publishing.
4. Standard Form of Bidding Documents by Pakistan Engineering Council.
5. David Chappell, Construction Contracts Questions and Answers (2021), 4th Edition, Taylor & Francis. Jimmie Hinze, Construction Contracts (2010), 3rd Edition, McGraw-Hil

2nd Semester 3rd Year (Sixth Semester)		
CE-326	**Environmental Engineering – I (Th + Lab)**	**3(2+1)**

Prerequisite: Nil **Contact Hours: 32+48** **Marks:** 50+50

Objectives:

- To learn principles of environmental engineering applied to the design implementation and treatment of water supply schemes

CLOs: After Completing the "Environmental Engineering – I" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE the characteristics of potable water used in daily life, environmental legislations and management.	**C2**	**1**
2	DESIGN the water treatment plants and water distribution networks.	**C6**	**3**
3	PRACTICE various laboratory tests to obtain physical, chemical and biological properties of water.	**P3**	**4**

1. **Introduction:**

- Understanding the environment (basic concepts) and environmental engineering, Importance for civil engineers, Basic facts.

2. **Environmental Legislation and Management:**

- Environmental issues of urban and rural areas, Environment and sustainable development, Role of various environmental agencies and NGOs to prevent environmental degradation, National Environmental Quality Standards (NEQS). Environmental Impact Assessment (EIA)

3. **Water Supply Projects:**

- Importance and necessity of planned water supplies, Planning and preparing a water supply project: data to be collected, analysis of data and project formulation, project drawings, project estimates, project supervision and reporting.

4. **Water Demand:**

- Various types of water demand, Estimation of water use: per capita demand, factors affecting water use, variations in demand and their effects on the design of a water supply project components, Design periods and factors governing design periods, Population forecast, and methods of population forecast, Water sources.

5. **Water Quality:**

- Introduction, sources of water pollution, common impurities in water, testing of water, collection of water samples, Physical, chemical and bacteriological tests, standards of Drinking water, Water borne diseases.

6. **Water Collection:**

- Water collection methods, Intakes, factors governing location of intake, types of intakes, design of intake.

7. **Water Conveyance:**

- Conduit and its types, Pumps, types of pumps and design of a pumping Station.

8. **Water treatment unit Processes:**

- Standard water treatment methods: screening, sedimentation, coagulation, filtration and disinfection, water softening, special/Miscellaneous water treatment methods.

9. **Design of Water Treatment Plant:**

- Design of various water treatment unit operations: screens, plain sedimentation tanks, coagulant dose, coagulation-cum-sedimentation tanks/clarifiers/dissolved air floatation tanks, filters, chlorination dose, dewatering and sludge disposal.

10. Water Distribution:

- Water supply system, Water distribution methods: requirements of a good distribution system, design of distribution systems forces (stresses) acting on pipes, materials for pressure conduits, pipe appurtenances, pipe fittings, laying and testing of water supply lines, Design of service reservoirs, Detection of water wastage in distribution pipes, House water connections.

Lab Outline:

The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class

S. No.	List of Experiment
1.	Introduction of Environmental Engineering lab and HSE measures.
2.	Sample preparation techniques including Dilution, Filtration/Centrifugation, Solid phase extraction, Digestion and Distillation.
3.	To determine the Turbidity contents of given sample of water.
4.	To determine the Suspended Solids / Non-filterable residue in sample of water.
5.	To prepare different water samples of varying pH and Total Dissolved Solids (TDS)
6.	determine pH, TDS and Electrical Conductivity (EC) of prepared water samples.
7.	To determine the Taste and odour value of given water sample.
8.	To determine the Acidity of given sample of water.
9.	To determine the Alkalinity of given sample of water.
10	To determine the Hardness of given sample of water.
11	To determine the Chloride Concentration in given sample of water.
12	To determine the Sulphates in given sample of water.
13	To determine the Total Chlorine Concentration in given sample of water.
14	Determination of Jar Test (Alum dose selection) for turbid waters.
15.	To perform an open-ended lab.

Recommended Books:

1. Water Supply & Sanitary Engineering by RANGWALA Latest Edition
2. Water Supply Engineering, S. K. Garg, Khana Publication Delhi. Latest Edition
3. Water Supply Engineering and Sewerage, E. W. Steel and TJ. Mcghee, Me Graw Hill Company, Latest Edition
4. Environmental Pollution and control, PAarne. Ves. Lined and J.Jaffery Peirce, Me Graw Hillinc USA, Latest Edition
5. Environmental Management, Dr. Biswaryo Mukherjee, Viskas Publishing House Pvt Ltd, Latest Edition
6. Environmental engineering by NN basak
7. Sajjad Haider Sheikh, Javed A. Azeez “Water Supply and Sewerage (Theory & Applications)” (1st Edition, 2022)

2nd Semester 3rd Year (Sixth Semester)		
CE-329	**Reinforced Concrete Design-II (Th + Lab)**	**3(2+1)**

Prerequisite: Reinforced Concrete Design-I

Objectives:

- To enable students to design various reinforced and pre-stressed structural elements using advance design approaches.

CLOs:

After Completing the "Reinforced Concrete Design-II" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESIGN various reinforced concrete structural members.	**C6**	**3**
2	DISCUSS design requirements and techniques of Pre-stressed concrete.	**C2**	**3**
3	Get acquainted with structural drawings and PRACTICE software for analysis and design of different structural components.	**P3**	**5**

1. **Reinforced concrete: .**
   - Slender columns, Analysis and design of slender columns subjected to combined flexure and axial loading.
   - Shear walls, Analysis and design of shear walls.
   - Two-way slabs, methods for the design of two-way slabs
   - Design of flat plate, flat slab and waffle slabs for flexure and shear under gravity loading
   - Retaining walls, Analysis and design of retaining walls Water tanks, design of water tanks.
   - Bridges, types of bridges, preliminary design of reinforced concrete bridges Introduction to seismic design of reinforced concrete structures
2. **Pre-stressed concrete: .**
   - Basic concept of pre-stressing, classification and methods of prestessing .
   - Advantages and applications of prestressed concrete.
   - Properties and importance of high strength materials used in prestressed concrete.
   - Prestress losses, estimation of prestress losses.
   - Analysis and preliminary design of simply supported prestressed concrete beams for flexure.
3. **Introduction to earthquake resistant design of structures.**
4. **Design of gravity and cantilever retaining walls.**
5. **Introduction to computer aided analysis and design**

S. No.	List of Experiment
1.	Introduction to Practical contents, Equipment, and HSE (Health, Safety and Environment) measures to be followed in Laboratory.
2.	Introduction to ETABS software and setting out grid lines and story data in ETABS.
3.	To define material properties, member properties, and assign member properties, support conditions.
4.	To define load patters, assign gravity loads, and defining diaphragms
5.	To assign wind load, earthquake load, mass source and define load combinations.
6.	To analyze a multi-story building using ETABS software and perform post-analysis check.
7.	To design a multi-story building using ETABS software, perform post-design check and exporting results.
8.	To perform design and detailing of footing.

9.	To perform design and detailing of columns.
10	To perform design and detailing of beams
11	To perform design and detailing of slabs.
12	To get acquainted with the structural drawing of RCC staircases.
13	To draw the L-section and cross section of a simply supported rectangular RCC beam.
14	To draw a cross section of end connection of a column with a beam.
15.	To Perform open-ended lab.

Recommended Books:

- Advanced Concrete Technology: Constituent Material, J. Newman and B.S. Choo, Publisher: Butterworth Heinemann, Latest Edition
- Design of Concrete Structures, A.H. Nilson, D. Darwin and C.W. Dolan, Publisher:McGraw Hill Company, Latest Edition
- Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher:John Wiley & Sons. Inc., Latest Edition
- Reinforced &Prestressed Concrete. F.K. Kong, R.H. Evans, Van Nostrand ReimholdU.K., Latest Edition
- Prestressed Concrete Design, T.Y. Lin, Mc Graw Hill Company, Latest Edition

2nd Semester 3rd Year (Sixth Semester)		
MD-322	**Modelling and Simulation (Lab)**	**2(0+2)**
Prerequisite: Nil	**Contact Hours:** 0+96	**Marks:**0+100

Objectives:

- Introduction to fundamental concepts, techniques, and tools for creating mathematical models and conducting simulations to analyze complex systems

CLOs:

After Completing the "Modelling and Simulation" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	PRACTICE the different computer-based simulation and modelling	**P3**	**5**

1. Simulation

- Prepare Model Inputs and Outputs
- Configure Simulation Conditions
- Run Simulations
- View and Analyze Simulation Results
- Test and Debug Simulations
- Optimize Performance
- Simulation Guidelines & Best Practices

2. Modeling

- Design Model Architecture
- Manage Design Data
- Design Model Behavior
- Configure Signals, States, and Parameters
- Configure Inputs and Visualizations
- Analyze and Remodel Design
- Test Model Components
- Modeling Guidelines & Best Practices

Lab Outlines: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

S.No	List of Experiments
1.	Introduction to Programming with MATLAB: Overview of MATLAB environment and basic commands, Basic data types, arrays, and matrix operations, Plotting and visualizing data.
2.	Introduction to transfer functions and system modeling. Finding the response of a system to a unit step function and analyze the system responses.
3.	Introduction to transfer functions and system modeling. Finding the response of a system to a unit impulse function and analyze the system responses.
4.	Introduction to transfer functions and system modeling. Finding the response of a system to a unit ramp function and analyze the system responses.
5.	Introduction to Simulink in MATLAB: Creating and simulating a basic Simulink model, analyzing and interpreting simulation results.
6.	To Simulating the control system using Simulink.
7.	To analyze the Modeling of a neural network for damage detection in structures.
8.	To Designing a fuzzy controller for a simple engineering problem.
9.	Introduction to ANFIS, Creating and training an ANFIS model and its applications in MATLAB.

10.	Implementing a Monte Carlo simulation for reliability analysis and interpreting the probability of failure.
11.	Modeling and simulating the risk assessment of a construction project.
12.	Modeling and simulating the dynamic response of a multi-degree-of-freedom (MDOF) system. Plotting and interpreting the response of the structure.
13.	Formulating an optimization problem for structural design Using MATLAB's optimization toolbox to solve the problem.
14.	Modeling heat conduction in a building wall. Simulating the temperature distribution over time and analyzing the results.
15	To perform open ended lab
16	Introduction to ABAQUS, & ETAB
17	Analyze structural elements using ABAQUS, & ETAB softwares

Recommended Books:

1. Introduction to MATLAB for Engineering Students by David Houcque, Northwestern University latest edition.
2. https://www.mathworks.com/help/simulink/simulation.html
3. https://www.mathworks.com/help/simulink/modeling.htm

2nd Semester 3rd Year (Sixth Semester)		
CE-321	**Engineering Hydrology (Th + Lab)**	**2(2+0)**

Prerequisite: Nil **Contact Hours:** 32+0 **Marks:** 50+0

Objectives:
To enable students to learn broad areas of hydrological engineering and principles of water management particularly in agriculture

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN hydro-meteorologic processes and their measurements / computation .	C2	1
2	ANALYZE the occurrence, movement and distribution of water above, on and below the surface of earth and discuss climate resilient solutions for mitigation of climate change scenarios	C5	7
3	EVALUATE climate resilient solutions for mitigation of climate change scenarios	C6	6

Course outline

1. **Hydrology,**
   The world's freshwater resources, Evaporation from Ocean, Hydrologic cycle, Hydrologic equation, Importance and Scope of hydrology.
2. **Precipitation**
   Cloud formation, Precipitation, Measurement of Rainfall, Computation of Average Rainfall over a Basin.
3. **Runoff**
   Components of stream flow, Catchment characteristics, Mean and Median elevation, Classification of streams, Isochrones, Factors affecting runoff, Estimation of runoff.
4. **Hydrographs**
   Hydrograph components, Hydrograph separation, Estimating the volume of direct runoff, Unit hydrograph, Application of Unit hydrograph.
5. **Flood Estimation**
   Size of floods, Estimation of peak flood, Flood forecasting and warning.
6. **Groundwater Hydrology, Well Hydraulics and Tube Wells**
   Permeability, Storage Coefficient, Transmissivity, Specific yield, Specific retention, Aquifer and its types, Yield of a well, Interference among wells, Well losses, Specific Capacity of well, Types and Construction of tube well, Comparison of Tube Well Irrigation and Canal Irrigation
7. **Water Resource Management**
   Water resources in Pakistan, Indus basin irrigation system (IBIS), Indus water treaty 1960 and water accord 1991, Indus river system authority (IRSA), Planning and development of water resources projects, The future of water resources.
8. **Climate Resilience**
   Climate change, its causes and effects, Mitigation, Adaptation and Resilience strategies to cope with climate related impacts, Case studies.
9. **Computer Application**
   Application of Hydrologic models.

Recommended Books:

- Hydrology: Principles, Analysis and Design, H. M. Raghunath, New Age International Publishers, India, Latest Edition.
- Engineering Hydrology-An Introduction, Abdul Razzaq Ghumman, Abd ur Rehman Printers Islamabad

- Introduction to Hydrology, Warren Viessman, Jr. and Gary L. Lewis, Prentice Hall, Latest Edition
- A Textbook of Hydrology, Dr. P. Jaya Rami Reddy, University Science Press, India, Latest Edition.
- Hydrology for Engineers, R. K. Linsley, Max A. Kohler, and Joseph L. Paulhus McGraw- Hill Education (ISE Editions); Latest Edition

1st Semester 4th Year (Seventh Semester)		
CE-413	**Traffic Engineering & Pavement Design (Th + Lab)**	**3(2+1)**

Prerequisite: Geometric Design of Highways & Airports

Contact Hours: 32+48 **Marks:** 50+50

Objectives:

- After successful completion of this course, students will be equipped with knowledge related to traffic operations.
- Students shall be able to design highway pavements.

CLOs:

After Completing the "Traffic Engineering & Pavement Design" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN the fundamentals of highway and traffic engineering.	C2	1
2	**DESIGN** pavements using appropriate design solution considering indigenous conditions.	C4	3
3	PRACTICE to investigating properties asphalt mix and capacity analysis of road segments.	P3	4

1. Highway Engineering

- Highway Planning; Principles, Location Survey in Rural & Urban Areas,
- Location Controls.
- Elements of a Typical Cross-Section of Road, Types of Cross-sections
- Classification of Highways, Highway Materials, Types & Characteristics,
- Specification & tests.

2. Traffic Engineering

- Traffic studies & Estimates, Speed-flow-density relationship, Traffic Lane, Capacity, Level of Service, Design Speed, Traffic Safety (signs, marking, signals), Channelization
- Design of Intersection at Grade & Grade Separated (Access control)
- Parking and Accident Studies, Conflict analysis
- Intelligent Transportation System (ITS), Advanced Transportation
- Management Systems (ATMS), Advanced Traveler Information Systems
- (ATIS), Delays and
- Que formation, Que theory (DD1 & MD1)
- Public Transport System, Rapid Transit modes (BRT), Basic methods for estimating public transport demand, Corridor and network development.
- Traffic Impact assessment & Mitigation Planning
- Introduction to Vissim/Synchro Plus Sim Traffic

3. Concept of Pavement Design and Material Specification

- The Pavement, Types of Pavements, Principle of Pavement Design
- Approaches to Pavement Design, Pavement Design Standards
- Resilient behavior of Unbound Granular Material
- Asphalt Binder Rheology, Asphalt Mixtures Design (Marshall Method of
- Mix Design)
- Introduction to SHRP Specification and Superpave Method of Mix Design

4. Pavement Design Methods and Analysis

- Axle Load, Equivalent Single Axle Load, Classification of Commercial Vehicles, Axle Loading of Commercial Vehicles, influence of Axle configuration and

Loading on the Damaging Effect

- Contact Area between the Tyre and Road, Repetition, and Impact Factors
- Methods of Pavement Design (Empirical ~Mechanistic), AASHTO Pavement Design Method, Group Index Method, CBR Method, Wester Guard method, Road Note,
- AASHTO 1993 Pavement Design Methodology and practice, Road Note 31 Pavement Design Methodology, Concept of Mechanistic-Empirical Pavement Design, Stresses and Strains in Flexible & Rigid Pavements.

5. Introduction to MEPDG Software

- Pavement Evaluation and Rehabilitation
- Pavement Failures, Construction and Maintenance
- Pavement Evaluation and Rehabilitation, Introduction to Non-Destructive Testing Recycling Methods and Reclaimed Asphalt Pavement (RAP), Pavement Drainage System and Design

Lab Outlines: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	Introduction to Practical contents, Equipment, and HSE (Health, Safety and Environment) measures to be followed in Laboratory.
2	To determine the Los Angeles abrasion value (% wear) of aggregate sample.
3	To perform impact value and crushing value test of aggregates.
4	To determine Particle shapes (Elongation & Flakiness Index) of various Aggregate samples and then to discuss the results.
5	To determine the stripping value of the given aggregate sample by static immersion method.
6	To determine Penetration grade and softening point of Bituminous Sample by Penetrometer & Ring & Ball Apparatus.
7	To determine the Flash and Fire Point of Bituminous Sample by Cleveland Open Cup Apparatus.
8	To determine the Ductility of Bituminous Sample Using a Ductilometer.
9	To determine aggregate gradation for job mix formula.
10	To determine volumetric of asphalt mix.
11	To find out JMF for Specified Paving Job (Marshall Method).
12	To analyze the spot speed on selected road using different methods.
13	To carry out intersection traffic count including turning movement on an intersection using manual and camera technique.
14	To calculate Peak hour factor, ADT, AADT of any selected road section.
15	To carry out parking study in any parking lot.
16	To perform an open ended lab.

Recommended Books:

1. Yang H. Huang, (2003), Pavement Analysis and Design, 2nd Edition (or latest), Pearson Higher Education.
2. Fred. L. Mannering and Scott S. Washburn, (2013), Principles of Highway Engineering and Traffic Analysis, 5th Edition (or Latest), John Wiley & Sons. NY.
3. Asphalt Institute, (2005), Mix Design Methods for asphalt concrete and other Hot-Mix Types, MS-2, 2nd Edition (or latest), Asphalt Institute.
4. Asphalt Institute, (2005), Superpave Mix Design, SP-2, 3rd Edition, Asphalt Institute.

1st Semester 4th Year (Seventh Semester)		
CE-416	**Environmental Engineering-II (Th)**	**2(2+0)**

Prerequisite: Environmental Engineering – I

Contact Hours: 32+0 **Marks: 50+0**

Objectives:

- To introduce knowledge of environmental laws and regulations required in context to pollution control and impact assessment.
- To introduce the definition and characteristics of solid waste concept of waste management and methods of safe disposal.

CLOs: After Completing the "Environmental Engineering-II" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE various characteristics of municipal and industrial wastewater and its composition, solid waste management, air and noise pollution.	**C2**	**6**
2	EXPLAIN wastewater collection and conveyance systems, understanding the management tools for solid waste reduction, reuse and recycling.	**C2**	**7**
3	DESIGN the wastewater treatment plant and manage the hazardous waste for societal and environmental sustainability.	**C6**	**3**

1. WASTEWATER ENGINEERING:

- **Wastewater quality:** Wastewater terminology, Sources of wastewater, Characteristics of municipal, industrial Agricultural, storm wastewater, Wastewater composition and Characteristics, Sampling techniques, Wastewater quality and analysis, Quality parameters/monitoring.
- **Wastewater Infrastructure:** Collection and conveyance system of wastewater, wastewater disposal, Wastewater flow rates, hydraulic design of sewers, sewer materials, shapes, fittings, and joints, laying and testing of sewers, ventilation of sewers, cleaning of sewers, sewer appurtenances, House drainage system.
- **Wastewater Treatment Unit Processes/Operations**
  Estimating wastewater quantity, Conventional wastewater treatment systems, Municipal wastewater treatment unit processes: physical treatment methods, biological treatment methods, special/physico-chemical and chemical treatment methods, Sludge disposal and reuse, Wastewater reclamation and reuse, Natural treatment, Self-purification systems.
- **Design of a Wastewater Treatment Plant**
  Design of bar racks and screens, Grit chambers, Sedimentation tanks (detritus tanks, skimming tanks), Activated sludge processes, Aerated lagoons, Trickling filters, Rotating biological contractors, Stabilization ponds, Control of nutrients, Odour and VOCs control, Sludge thickeners and digesters, Composting units, Dewatering equipment, Wetlands.
- **Small Wastewater Treatment Systems**
  Small wastewater systems and characteristics, Design of on-site systems: septic tanks, Imhoff tanks, pit latrines.

2. SOLID WASTE MANAGEMENT:

Types, Characteristics of solid waste, Sources, Objective and components of solid waste management, Generation-collection-transferring and disposal of waste (incineration and landfill options), Waste minimization: recycling reuse of solid waste, composting.

Recommended Books:

1. Water Supply & Sanitary Engineering by RANGWALA Latest Edition
2. Environmental Engineering and management, Suresh K. Dhamejarg, Vikas Publishing House Pvt Ltd. Latest Edition
3. Wastewater Engineering, Metcalf and Eddy, Tata Mc Graw Hill Publishing Company Ltd.
4. Water Supply, Twort, Ac Twist. F.M. Low and FW Crowley Arnold International

1st Semester 4th Year (Seventh Semester)		
CE-407	**Irrigation & Drainage Engineering (Th + Lab)**	**4(3+1)**

Prerequisite: Fluid Mechanics & Hydrology

Contact Hours: 48+48 **Marks: 100+50**

Objectives:

- To enhance the capabilities of students related to irrigation engineering and canal network.
- To enable students to learn fundamentals of drainage engineering particularly related to canals, water logging & Salinity.

CLOs: After Completing the "Irrigation & Drainage Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	**DESCRIBE** basic terms related to irrigation system and hydraulic structures.	C2	1
2	**EXAMINE** the various irrigation concepts and soil-water-crop relationships.	C2	2
3	**DESIGN** irrigation canals, drains and other hydraulic structures.	C6	4
4	PRACTICE the field and software experimentation to verify crop water requirements for designing of irrigation scheduling	P3	5

1. **Introduction**
   - Definition, Necessity, Scope, Benefits, and ill effects of irrigation engineering.
2. **Methods of Irrigation**
   - Irrigation methods
   - Factors affecting choice of irrigation methods
   - Pressurized and non-pressurized methods
   - Uniformity coefficient
3. **Soil-Water-Crop Relationship**
   - Soil and its physical and chemical properties
   - Root zone soil water
   - Crops of Pakistan and crop rotation
4. **Water Requirement of Crops**
   - Functions of irrigation water
   - Standards for irrigation water
   - Relationship between duty and delta
   - Factors affecting and improving duty
   - Classes of soil water
   - Equilibrium points-soil moisture tension
   - Depth of effective root zone
   - Depth and Frequency of irrigation
5. **Canal Irrigation System**
   - Alluvial and non-alluvial canals
   - Alignment of canals
   - Distribution system for canal irrigation
   - Determination of canal capacity
   - Canal losses and Channel section for minimum seepage loss
6. **Design Interpretation of Earthen/Alluvial Channels**
   - Kennedey's theory, Lacey's theory, Rational approach, Channel design software

7. Lined Channels

Canal Lining and its types

8. Permissible velocities in lined channels

9. Design interpretation of lined irrigation channels

10. Diversion Head Works

11. Weir and barrage

- Types and components of diversion weir
- Head regulator and cross regulator
- Canal regulation and silt control at the head works
- Silt excluders and silt ejectors

12. Canal Outlets

- Types, Essential requirements and characteristics of outlets
- Tail cluster and tail escape

13. Hydraulic Structures

- Canal Falls, flumes, canal outlets
- Cross drainage works: Design, types and functions
- Dams, Types, design, etc

14. Drainage

- Land drainage, objective, benefit, Types of drainage system, Design of surface and subsurface drainage system (Tile drains), Disposal of drainage effluent.

15. Water logging and salinity

- Causes and effects of water logging
- Reclamation of waterlogged soils
- Drains and tube wells
- Causes and effects of salinity and alkalinity of lands in Pakistan.
- Major Drainage projects of Pakistan

Lab Outlines: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	Introduction to Practical contents, Equipment, and HSE (Health, Safety and Environment) measures to be followed in Laboratory.
2	To investigate the determination of seepage flow rate underneath a sheet pile wall.
3	To demonstrate the seepage through an earthen dam.
4	To demonstrate the formation of the “quick sand” condition in porous soil medium.
5	To determine the uplift pressure on foundation of hydraulic structure
6	To demonstrate the draining effect of an open trench on the uplift pressure on foundation hydraulic structure
7	To demonstrate the process of collapse of an improperly designed earth dam with slopes too steep for the material used
8	To demonstrate the flow and pressure condition in a permeable layer behind a retaining wall
9	To determine Uniformity Coefficient for a Drip irrigation system.
10	To determine Coefficient of discharge for sluice gate

11	To determine coefficient of weir for different types of weirs.
12	To investigate the characteristics of a standing wave (the hydraulic jump) produced when water flows beneath an undershot weir and to observe the flow patterns obtained
13	To observe the flow patterns obtained for water flowing around splitters with different profiles
14	To determine the relationship between upstream head and flow rate through different types of spillway and calculate coefficient of discharge.
15	To measure discharge by Float method.
16	To measure discharge using Current meter.
17	Introduction to the CROPWAT Software.
18	Determination of CWR (Crop Water Requirement) of crop using CROPWAT
19	To perform an Open Ended Lab

Recommended Books:

1. Peter, W., and Yitayew, M., (2015) Irrigation and drainage engineering, Springer
2. Hossain, A., Practices of irrigation & on-farm water management, Springer
3. Singh V, P., and Su Q., (2022) Irrigation Engineering (Principles, Processes, Procedures, Design, and Management), Cambridge University Press

1st Semester 4th Year (Seventh Semester)		
CE-427	**Steel Structures (Th)**	2(2+0)

Prerequisite: Nil **Contact Hours:** 32+0 **Marks: 50+0**

Objectives:

- To acquaint students with use of steel as a structural component and develop their ability to design steel structures

CLOs: After Completing the "**Steel Structures**" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE the theories and models suitable for the analysis and design of structural steel members.	**C2**	**2**
2	DESIGN structural steel members under axial loads, flexure and shear.	**C6**	**3**
3	DESIGN connections in structural steel members.	**C6**	**3**

1. Introduction

- Use of steel as a structural material
- Mechanical properties
- Types and shapes of structural steel members
- Specifications and design codes
- Design philosophies, load and safety factors.

2. Fundamentals of Working Stress Method

- Overview of Allowable Stress Design (ASD)
- Service load and allowable stresses

3. LRFD Method of Design

- Factor of safety, loads and load combination.
- Concept of load and resistance factors
- Plastic design and limits on design
- Analysis and design of tension members
- Analysis and design of Compression Members.
- Local and overall stability
- Euler's buckling load in columns

4. Analysis and design of Steel beams

- Compact, non-compact and slender sections
- Bending strength
- Shear Strength
- Lateral torsional buckling.
- Biaxial Bending
- Purlins, sag rods

5. Beam-column and axial-flexure interaction

- Second order effects
- Moment magnification.
- Plate girder proportioning and design.

6. Simple welded and bolted connections

7. Overview of moment and shear connections

Recommended Books:

- Steel Design by William T. Siggui, 6th edition
- Structural Steel Design by Jack C. McCormac, 5th Edition
- American Institute of Steel Construction-AISC Manual 15th Edition

1st Semester 4th Year (Seventh Semester)		
CE-421	**Foundation Engineering (Th)**	**2(2+0)**

Prerequisite: Soil Mechanics and Geotechnical Engineering

Contact Hours: 32+0 **Marks:** 50+0

Objectives:
To enhance the skills related to soil investigation, Design of deep and Shallow Foundation.

CLOs:
After Completing the "Foundation Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	CARRY OUT site characterization for geotechnical investigations.	C5	4
2	DESIGN an appropriate type of shallow foundation for various loadings and ground conditions	C6	3
3	EVALUATE load bearing capacity of deep foundations for different ground conditions.	C5	4

1. **Soil Exploration**
   - Planning of soil exploration program
   - Soil exploration methods: probing, test pits, auger boring, wash
   - percussion, rotary drilling, and geophysical methods,
   - Types of soil samplers, Disturbed and undisturbed sampling
   - In situ tests: standard penetration test, cone penetration test, and field vane
2. **Introduction to Foundations**
   - Purpose and types of foundations, Selection of foundation type and depth
   - Design requirements for the foundations, Foundation design Criteria
   - Allowable settlements and angular distortion, types of deep foundations
   - Reasons to use deep foundation, Classification of piles, Methods of installation of Piles, Load transfer mechanism of piles, Load carrying capacity of piles in different soils, Empirical correlations for pile capacity evaluation, Settlement of Piles.
   - Pile load test and interpretation.
   - Pile group capacity, group efficiency, elastic, and consolidation settlement
   - of group of piles, uplift capacity of pile group.
   - Rock socketed piles
3. **Bearing Capacity and Design of shallow foundations**
   - Types of bearing capacities: gross and net bearing capacity/pressures
   - Modes of bearing capacity failures, Development of bearing capacity theory.
   - Methods to evaluate soil bearing capacity: Terzaghi's, Meyerhof's,
   - Hansen's, Vesic's, Skempton's method.
   - Effects of water table on bearing capacity of soils.
   - Bearing capacity from in-situ tests; SPT, CPT, Plate load test
   - Presumptive values of bearing capacity.
   - Design of strip, isolated, combined and raft foundations, concept of
   - floating/compensated foundations.
   - Foundations on difficult soils: design and preventive measures
   - Related numerical problems.
4. **Introduction to relevant software**
   - GeoStudio, Plaxis etc.

Recommended Books:

1. Baraja M. Das (2017). Principles of Foundation Engineering, 9th Ed, Cengage Learning, Inc., USA.
2. Robert Wade Brown (2004), Practical Foundation Engineering Handbook, McGraw- Hill.
3. Donald P. Coduto (2001), Foundation Design: Principals and Practice, (Latest Ed), Prentice Hall, NJ.
4. Tomlinson, M. J. (2001) Foundation Design and Construction, 7th Ed (or latest), Pearson Education.
5. Bowles, J. E. (1998), Foundation Analysis and Design, 6th Edition (or latest ed), McGrow-Hill International Press.
6. Smith and Ian Smith (1998), Elements of Soil Mechanics, 7th Ed (or latest), Blackwell Science.

First Semester Final Year (Sevent Semester) (Elective)		
SS-207	**Sociology for Engineers (Th)**	**2(2+0)**

Prerequisite: Nil **Contact Hours:** 32+**0** **Marks:** 50+00

Objectives:

- To understand the discipline of sociology from the engineering perspective and will highlight its application to engineering profession.
- This will also enable the engineers to fit their technical ideas into a socially acceptable product /project in a more successful manner.

CLOs:

After Completing the "Sociology for Engineers" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Introduce to the methods and philosophy of the social science to help their understanding of the sociocultural dimension of human existence as a fundamental reality in engineering projects etc.	**A1**	**1**
2	To provide opportunity for students to begin the process of considering social problems/ issues while designing engineering products.	**C2**	**6**
3	To allow engineers to play a pro-active role in critical discussions and analysis of social issues specifically.	**A2**	**6**
4	To demonstrate comprehension of roles and functions of various social institutions, stale organizations, Professional bodies and relationships for analyzing their social impact Assessment.	**A3**	**6**

Course Outline:

1. **Fundamental Concepts and Importance of Sociology for Engineers**

- Nature, Scope, and Importance of Sociology, Sociological Perspectives and Theories, Social Interactions, Social Groups/ Social Institutions & heir interface with Engineering Project/services, Sociology & Impact of Technology & Engineering Products/Project on Society.

2. **Cultural Impacts of Engineering Projects on Society**

- Definition of Culture, Types of Culture & elements of Culture,
- Authority, Dominance Socialization and Personality, Role of Engineering Projects on Culture, social norms and values of Society, Cultural Infusion of Engineers in Society.

3. **Theoretical Perspective of Sociology: Diffusion and Innovation; Adoption and Adaptation; Social development; Community Development**

- Development Processes of Societal Development, Cooperation and Conflict in Community Development in Engineering Context.

4. **Understanding of Societal & Ethical Norms and Values for Engineers**

- Ethics, Engineering product/services for Less privileged. Role of Engg & Technology in addressing social inequality. Core Social Values/Norms affecting Engg Performance

5. **Organizational Social Responsibility (OSR) of Engineers**

- Extent to which development intends to sensitize societal and under privileged needs
- Gender inclusiveness and balance
- Special and Disadvantaged Community of the Area o Planning for community inclusiveness Societal Obligation of Engineers

6. **Engineers, Society and Sustainability**

- Social System and Concept of Sustainable Development Technology and Development, Population Dynamics in Pakistan, Causes and Consequences of Unplanned Urbanization, Community Development, Programs in Pakistan, Community Organization & Engineering Projects, Population, Technological & Industrial expansion and Development with focus on social/human/ethical dimensions.

7. **Social Approaches and Methodologies Administration & Stakeholders Analysis:**

- All Phases of the Project (pre, post and execution) Structured, Focused Group, Stakeholder Consultative Dialogues etc. Dynamics of Social Change, Sociology of Change and Industrial Development, Social Change due to Technology Driven Economic Growth,

8. **Case Studies of Different Development Projects in Social Context SIA (Social Impact Assessment):**

- Base line and need-assessment, evaluation and impact assessment surveys of the development projects. Role of F.ngg & Technology for Creating Social Cohesiveness & Societal Integration. Technology leased change in Collective Behavior, Social Audit of Engineering Projects,

9. **Engineering Intervention for Social Stratification**

- Factors of Social Stratification, Engineering Interventions for addressing Social Stratification, Social Mobilization through Technological Innovation.

Recommended Books:

1. Godhade, J. IT, and S.T.hundcrkari. 2018. Social Responsibility of Engineers. International Journal of Academic Research and Development. Vol. 03; Special Issue. March 2018.
2. Nichols, S.P.andWcldon,W.F.2017. Professional Responsibility: The Role of
1. Engineering in Society Center for Electro-mechanics, The University of Texas at Austin, USA.
2. Aslakscn, F..W.2O16. The Relationship between Engineers and Society: is it currently fulfilling its potential? Journal and Proceedings of the Royal Society of New South Wales, Vol. 148,Nos.455.456. Gum Booya Pty Lie, Allambie Heights, Australia.
3. Bell, S. Engineers, Society and Sustainability. Synthesis Lectures on Engineers, Technology, and Society, Edited by Caroline Baillie, University of Western Australia, Morgan and Claypool Publishers
4. Jamison, A., Christen sen, S.I L, andLars,B.2t)l I .A Science and Technology in cultural perspective
5. Vcrmaas,P.,Krocs,P.,Poct,L,and houkcs,W.20 11 .Philosophy of technology y:FromTcchnical Artefacts to Socio technical systems.
6. Mitcham,C.,andMunoz,D.2010.1 humanitarian Engineering. MorganandCla ypool Publishers. Riley, D.2008.Engineering and Social Justice. Morgan and Claypool Publishers.
7. bulgiarello,G. 1991 .Thc Social Functions of Engineering: A Current Assessment, A Chapter in“ Engineering as A Social Enterprise. Sociology

First Semester Final Year (Sevent Semester) (Elective)		
SS 211	**Human Resource Management (Th)**	2(2+0)
Prerequisite: Nil	**Contact Hours: 32+00**	**Marks: 50+00**

Objectives:

- To familiarize the students with basic rules of Human Resource Management.

CLOs: After Completing the " Human Resource Management " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS key challenges and trends in Human Resource Management (HRM).	**C2**	**8**
2	Apply job analysis techniques, including HR planning, job description, and specification.	**C3**	**10**
3	Explain staffing strategies, covering recruitment techniques, sources, and selection tests.	**C2**	**8**

Course Outline:

- Emerging Human resource management challenges. Trends in HRM
- Global vs local HRM practices
- HRM from Islamic and indigenous perspective
- Basic Islamic philosophy of managing human resource Conducting Job analysis.
- HR Planning, Job Description, Job Specification
- Staffing
- Recruiting and selecting employees
- Recruitment techniques
- Sources of recruitment
- Selection tests and Interviewing techniques
- Employee development
- Performance appraisals
- Performance management Training and development Training the employees Types of training
- Technique of training
- Project Description and discussion Compensations
- Managing compensation Types of compensation Rewarding performance Pay for Performance
- Designing and administering benefits
- Types of benefits
- Employee relations

SUGGESTEDINSTRUCTIONAL/READING MATERIALS

1. By Luis R. Gomez Mejia, David B. Balkin, Robert L. Cardy Managing Human Resources. (Fourth ed.)

First Semester Final Year (Sevent Semester) (Elective)		
SS 203	**Engineering Economics (Th)**	2(2+0)

Prerequisite: Nil **Contact Hours: 32+00** **Marks: 50+00**

Objectives:

- To familiarize the students with the role of Engineering Economics.

CLOs: After Completing the " Engineering Economics " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Apply economic principles to analyze engineering projects.	C3	2
2	Utilize cost analysis methods to evaluate project feasibility and make decisions.	C3	10
3	Understand risks and uncertainties in engineering economic assessments. Consider economic factors such as inflation and taxation in decision making.	C2	8

Course Outline:

1. Introduction

- Engineering Costs, Estimation Models & Cash Flow Diagram, Life cycle cost

2. Time value of Money

- Time value of money, equivalence, use of spread sheet, simple and compound interest, Uniform series & Arithmetic & geometric gradient, Nominal & effective, continuous compounding Economic criteria, Present Worth, future worth and annuity

3. Rate of Return

- Minimum acceptable rate of return(MARR), Internal rate of return, External rate of return Choosing the best alternative Incremental Analysis

4. Benefits and Cost ratio and Payback period

Benefit and cost ratio (B/C Ratio), discounted benefit and cost ratio Simple payback period, discounted payback period, Sensitivity & breakeven analysis, Principle of comparative advantage

5. Depreciation

- Depreciation, Depreciation using Unit of Production
- Depreciation using straight line method Depreciation using Depletion

6. Taxes

- Income Taxes, After tax RoR, Replacement analysis Design life, salvage value Up gradation Vs replacement

7. **Risk and Uncertainty Estimation of future events**

- Monte Carlo Simulation Bayes theorem, Concepts of Imports and Exports Basic concepts of import and export Dumping and anti-dumping and related laws

Recommended Books

1. .William G. Sullivan and Elin M. Wicks, Estimation of future events
2. N. M. Fraser and E. M. Jewkes, Engineering Economics: Financial Decision Making for Engineers
3. D. G. Newnan, J. Whittaker, T. G. Eschenbach and J. P. Lavelle, Engineering Economic Analysis

J. Tarquin, L. T. Blank, Engineering Economy, McGraw Hil

First Semester Final Year (Sevent Semester) (Elective)		
SS 203	**Engineering Law (Th)**	2(2+0)

Prerequisite: Nil **Contact Hours: 32+00** **Marks: 50+00**

Objectives:

- To familiarize the students with fundamentals of Engineering Laws.

CLOs: After Completing the "Engineering Laws " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEFINE key terms: legal studies, law, sources of law..	**C2**	**1**
2	COMPREHEND the fundamental principles of contract law as they relate to engineers.	**C2**	**1**
3	RECOGNIZE the duty of care for engineers and grasp the concept of negligence in engineering. Gain insight into aspects of employment law relevant to engineers.	**C1**	**6**

Course Outline:

- Introduction to legal studies,
- Concepts and sources of law,
- Basic principles of the law contract as it relates to engineers, The duty of care for engineers and the concept of negligence, Aspects of employment law;
- Intellectual property,
- Designs, patents,
- Copyright in engineering,
- Enforcing rights to intellectual property.

Recommended Books:

1. RE laidlaw, C R Young, A R Dick, Engineering Law, University Press, 1958.
2. CF Allen, Business law for engineers, University of Michigan library, 1919.

2nd Semester 4th Year (Eighth Semester)		
CE-401	**Geotechnical Engineering (Th + Lab)**	4(3+1)

Prerequisite: Soil Mechanics

Contact Hours: 48+48 **Marks: 100+50**

Objectives:

- To enhance the skills related to baring capacity and settlement evaluation of soils.

CLOs:

After Completing the "Geotechnical Engineering" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	INTERPRET shear strength characteristics of soil, stress distribution, and lateral earth pressures shear strengths, earth retaining structures.	C2	1
2	ANALYZE settlement of soil, and stability of slopes and excavation.	C4	2
3	DESCRIBE the basics of earth and rockfill dams and various soil improvement techniques.	C2	1
4	PRACTICE laboratory and field testing for strength parameters of soil	P3	4

1. **Shear Strength**
   - Concept and parameters of shear strength of soils
   - Mohr Coulomb's failure envelope
   - shear strength of cohesive and non-cohesive soils
   - Factors affecting shear strength of soil and its applications in engineering.
   - Laboratory and field tests for determination of shear strength.
   - Related numerical problems
2. **Stress Distribution in Soils**
   - Geo-static stresses
   - Total stress, effective stress, and pore water pressure
   - Vertical stresses induced due to structural loads
   - Approximate methods.
   - Westergaard and Boussinesq's theories
   - Pressure bulb and stress isobars
   - Stress distribution diagrams on horizontal and vertical planes
   - Stress at a point outside the loaded area
   - Newmark's influence charts
   - Fadum's charts
   - Related numerical problems
3. **Lateral Earth Pressure**
   - Definition, pressure at rest
   - Active and passive earth pressures
   - Coulomb's and Rankine's theories
   - Trial wedge and Culmann's method
   - Earth pressure diagrams for different configurations loading
   - Related numerical problems
4. **Settlement Analysis**
   - Definition, total settlement, and differential settlement

- Angular distortion
- Consolidation settlement
- Elastic or immediate settlement
- Primary and secondary consolidation settlements
- Computation of elastic and consolidation settlement
- Causes of settlement and methods of controlling it
- Limits of allowable total and differential settlement
- Related numerical problems

5. Slope Stability Analysis

- Types of slopes
- Factors affecting slope instability and remedial measures
- Types of failure modes
- Critical slip circle and its location
- Infinite slope stability analysis
- Swedish circular method
- Ordinary method of slices
- Bishop's simplified method
- Taylor's slope stability number method
- Related numerical problems
- Earth and Rockfill Dams
- Definition and types of dams
- Components of a dam and their functions
- Coffer dams and their types
- General design considerations and typical cross sections

6. Soil Improvement

- Basic principles and objectives of soil improvement
- Mechanical and chemical stabilization of soil
- Different methods and their application to various soil types

Lab Outlines: The Design work and/or experiments related to above mentioned outline shall be covered in the Laboratory/Design class.

Sr. No	List of Experiments
1	(a) Introduction to the HSE (Health, Safety and Environment) measures to be followed in Geotechnical Engineering Laboratory. (b) To recognize the equipment available in Geotechnical Engineering Laboratory.
2	To determine the moisture-density relationship by Standard Proctor Test.
3	To determine the moisture-density relationship by Modified Proctor Test.
4	To determine the CBR value for un-soaked soil sample.
5	To determine the CBR value for soaked soil sample.
6	To determine the field density by Core Cutter Method.
7	To determine the field density by Water Replacement/Oil Replacement Method.
8	To determine the field density by Sand Replacement (Sand Cone) Method.
9	To determine the relative density of soil sample by Vibrating Table.

10	To determine the shear strength parameters of sandy soil by Direct Shear Box Test.
11	To determine the shear strength parameters of clayey soil by Direct Shear Box Test.
12	To determine the shear strength of clayey soil by Un-Confined Compression Test and Pocket Penetrometer Test.
13	To determine the shear strength of a clayey soil by Laboratory Vane Shear Test.
14	To determine shear strength of fine-grained soil by Tri-Axial Test (Demonstration only).
15	To determine consolidation parameters of saturated fine-grained soil by One Dimensional Consolidation test.
16	To Perform open-ended lab.

Recommended Books:

1. Baraja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.
2. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press 734 pp.
3. Craig, R. F. (2019). Craig's Soil Mechanics, 9th ed., CRC Press, 654 pp.
4. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.
5. Doland P. Coduto (1999), Geotechnical Engineering-Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.
6. Bowles J. E. (1984). Physical and Geotechnical properties of soils, 2nd Ed. McGraw Hill, New York, 578 pp.

2nd Semester 4th Year (Eighth Semester)		
MD-455	**Occupational Health and Safety (Th)**	**1(1+0)**

Prerequisite: Nil **Contact Hours:** 16+0 **Marks: 50+0**

Objectives:

- In this course students will acquire knowledge of safe work practices applicable to office, industry, and construction settings

CLOs: After Completing the "**Occupational Health and Safety**" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	IDENTIFY hazards in the home, laboratory and workplace that pose a danger or threat to their safety or health, or that of others.	C1	3
2	PRESENT a coherent analysis of a potential safety or health hazard both verbally and in writing citing the Occupational Health and Safety regulations and other supported legislation	A5	6

1. **Health and Safety Foundations**
   - Nature and scope of health and safety
   - Reasons/benefits and barriers for good practices of health and safety
   - Legal framework and OHS Management System
   - Fostering a Safety Culture
   - Four principles of safety- RAMP (Recognize, Assess, Minimize, Prepare)
   - Re-thinking safety-learning from incidents
   - Safety ethics and rules
2. **Roles and responsibilities towards safety**
   - Building positive attitude towards safety
   - Safety cultures in academic institutions
   - Recognizing and Communicating Hazards
   - Hazards and Risk
   - Types of hazards: Physical (mechanical and non-mechanical), Chemical (Toxic and biological agents), electrical, fire, construction, heat and Temperature, noise and vibration, falling and lifting etc.
   - Learning the language of safety: Signs, symbols and labels
   - Finding Hazard Information
   - Material safety data sheets
   - Safety data sheets and the GHS (Globally Harmonized Systems)
3. **Accidents & Their Effect on Industry**
   - Costs of accidents
   - Time lost.
   - Work injuries, parts of the body injured on the job
   - Chemical burn injuries
   - Construction injuries
   - Fire injuries
4. **Assessing and Minimizing the Risks from Hazards**
   - Risk Concept and Terminology
   - Risk assessment procedure
   - Risk Metric's
   - Risk Estimation and Acceptability Criteria

- Principles of risk prevention
- Selection and implementation of appropriate Risk controls
- Hierarchy of controls
- Preparing for Emergency Response Procedures
- Fire
- Chemical Spill
- First Aid
- Safety Drills / Trainings:
- Firefighting
- Evacuation in case of emergency

1. Stress and Safety at Work Environment

- Workplace stress and sources
- Human reaction to workplace stress
- Measurement of workplace stress
- Shift work, stress and safety
- Improving safety by reducing stress
- Stress in safety managers
- Stress and workers compensation
- Incident Investigation
- Importance of investigation
- Recording and reporting
- Techniques of investigation
- Monitoring
- Review
- Auditing Health and Safety

Recommended Books:

1. The A-Z of Health and Safety by Jeremy Stranks, 2006.
2. The Manager's Guide to Health & Safety at Work by Jeremy Stranks, 8th edition, 2006.
3. Occupational Safety and Health Law Handbook by Ogletree, Deakins, Nash, Smoak and Stewarts, second edition, 2008.

2nd Semester 4th Year (Eighth Semester)		
MD-426	**Architecture and Town Planning (Th)**	**2(2+0)**

Prerequisite: Nil **Contact Hours:** 32+0 **Marks:** 50+0

Objectives:

- To understand ancient and modern form of living.
- To impart knowledge related to planning and development of inhabitant areas.

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN various ancient and modern forms of living.	C2	1
2	DESCRIBE terms related to planning and development of inhabitant areas.	C2	3
3	IDENTIFY issues of urban planning and residence demand of population	C1	6

1. **Architecture**
   - Historical Development
   - General introduction to history of architecture
   - Emergence/Development of Islamic Architecture
   - Geographical, climatic, religious, social and historical influences
   - Architectural beauty
2. **Qualities, Factors and Use of Materials**
   - Strength, vitality, grace, breadth and scale Proportion
   - Colour and balance
   - Stone, wood, metals, concrete, composites, ceramics
3. **Architectural Aspects of Building Planning**
   - Walls and their construction
   - Openings and their position, character and shape Roofs and their development and employment
   - Columns and their position, form and decoration
   - Moulding and their form decoration
   - Ornament as applied to any buildings
4. **Town Planning**
   - Definitions
   - Trends in Urban growth
   - Objectives of town planning
   - Modern planning in Pakistan and abroad
5. **Preliminary Studies**
   - Study of natural resources, economic resources, legal and administrative problems
   - Civic surveys
   - Preparation of relevant maps
6. **Land Use Patterns, Street Patterns**
   - Various theories of land use pattern
   - Location of Parks and recreation facilities
   - Public and semi-public buildings
   - Civic centers, commercial centers, local shopping centers
   - Public schools, industry & residential areas
   - Layout of streets, road crossing & lighting Community planning
7. **City Extensions and Urban Planning**

- Sub Urban development
- Neighborhood Units
- Satellite Towns and Garden City
- Issues related to inner city urban design and emergence/upgradation of squatter settlements.

Recommended Books:

1. Dan Cruickshank, Sir Banister Fletcher's A History of Architecture, Architectural Press; 20th Edition (September 25, 1996)
2. Leonard Benevolo; Origins of Modern Town Planning, MIT Press, 15Aug- 1971
3. Sir Rymond Unwin, Town Planning in Practice, FQ Legacy Books (December 31, 2010)

2nd Semester 4th Year (Eighth Semester)		
SS-422	**Entrepreneurship (Th)**	**2(2+0)**

Prerequisite: Nil

Contact Hours: 32+0 **Marks:** 50+0

Objectives:

- Students learn how to start-up and operate a business.
- Enable students to analyze, create, develop and pilot small businesses.

CLOs: After Completing the "Entrepreneurship" Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	Explain fundamental entrepreneurial concepts, skills and process;	C2	1
2	Understanding on different personal, social and financial aspects associated with entrepreneurial activities;	C2	10
3	Basic understanding of regulatory requirements to set up an enterprise in Pakistan, with special emphasis on export;	C2	10

1. Introduction to Entrepreneurship:

- Definition and concept of entrepreneurship.
- Why to become an entrepreneur?
- Entrepreneurial process.
- Role of entrepreneurship in economic development.

2. Entrepreneurial Skills:

- Characteristics and qualities of successful entrepreneurs (including stories of successes and failures);
- Areas of essential entrepreneurial skills and ability areas such as creative and critical thinking, innovation and risk taking.

3. Opportunity Recognition and Idea Generation:

- Opportunity identification, evaluation and exploitation.
- Idea generation techniques for entrepreneurial ventures.

4. Marketing and Sales:

- Target market identification and segmentation.
- Four P's of Marketing.
- Developing a marketing strategy.
- Branding.

5. Financial Literacy:

- Basic concepts of income, savings and investments.
- Basic concepts of assets, liabilities and equity.
- Basic concepts of revenue and expenses.
- Overview of cash-flows.
- Overview of banking products including Islamic modes of financing.
- Sources of funding for startups (angel financing, debt financing, equity financing etc.)

6. Team Building for Startups:

- Characteristics and features of effective teams.
- Team building and effective leadership for startups

7. Regulatory Requirements to Establish Enterprises in Pakistan:

- Types of enterprises (e.g., sole proprietorship; partnership; private limited companies etc.).

- Intellectual property rights and protection.
- Regulatory requirements to register an enterprise in Pakistan, with special emphasis on export firms.
- Taxation and financial reporting obligation.

Recommended Books:

- "Entrepreneurship: Successfully Launching New Ventures" by Bruce R. Barringer and R. Duane Ireland.
- "Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko.
- "New Venture Creation; Entrepreneurship for the 21st Century" by Jeffry A. Timmons, Stephen Spinelli Jr., and Rob Adams.
- "Entrepreneurship: A Real-World Approach" by Rhonda Abrams.
- "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries.
- "Effectual Entrepreneurship" by Stuart Read, Saras Sarasvathy, Nick Dew, Robert Wiltbank, and Anne-Valerie Ohlsson.

2nd Semester 4th Year (Eighth Semester)		
CE-425	**Construction Planning & Project Management (Th)**	**3(3+0)**

Prerequisite: Nil **Contact Hours:** 48+0 **Marks:** 100+0

Objectives:

- The primary objective of this course is to get the fair understanding of core issues pertaining to Construction Planning & Management .
- Engineering students will learn key Project Management skills and strategies and will be able to face emerging challenges.

CLOs:

After Completing the " Construction Planning & Management " Course, each student will be able to:

CLO	Description	Taxonomy Level	PLO
1	To UNDERSTAND the concept of project costing, budgeting, and financial appraisal;	**C2**	**10**
2	To MAKE exposure to project Planning Control and Risk Management et al., using standard tools and schedule variance analysis	**C3**	**10**
3	To CLASSIFY Projects Management by "practice", through the medium of "End of Semester Group Project"	**C4**	**10**
4	To UNDERSTAND the use of computers in Project Management, especially a tool like MS Project & Primavera etc.	**C2**	**5**

1. **Project Management Concepts**
   - History of Project Management, Introduction to Project Management, Project,
   - Program & Portfolio Management, Project characteristics, Objectives&
   - Requirements, Project Phases/Stages, Project Life Cycle, Project Environment,
   - Project Scope & Project Charter, Project Manager, Project Stakeholder Analysis
2. **Project Proposal Development**
   - Project Proposal, Characteristics of good proposal, Types of Proposals, Request for Proposal, Request for Quotation etc). Proposal Templates etc
3. **Project Feasibility**
   - Brief review of various aspects of Project Feasibility like Technical, Social, Managerial, Economic, Financial & Marketing, Administrative etc.
4. **Project Selection Criteria (Economic Analysis of Engineering Projects)**
   - Using Break Even Analysis, Cost Benefit Ratio, Internal Rate of Return, Net Present Value etc.
5. **Project Contract & Procurement Management**
   - Engineering contracts, Type of contracts, understanding of procurement Process & Cycle, PPRA Rules, PIDING SEPRA And PEC Rules
6. **Project Planning and Scheduling**
   - Project Planning (Resource & HR Planning), Work Breakdown Structure, Project Network & Scheduling, Manning Schedule and Activity Charts, Critical Path Method (CPM)/Project Evaluation & Review Techniques
7. **Project Costing & Estimation**
   - Cash Flow Diagram , Cost Estimation in Projects, Cost components in projects and methods for cost estimation in projects, Cost Control in Projects, Estimation of Outstanding
   - Work, Earned Value Management, Schedule & cost variance analysis
8. **Project HRM & Communication Management**

Effective organization and communication for Successful Projects, Project Organizational Structures (Project matrix and project based organizations),

Project HR Plan preparation, HR Need Assessment and HR Matrix, Building and Managing

- effective project team, Selection & control mechanism of HRM in Projects, Effective Communication Plan.

9. Project Risk Management

- Definitions Project Risk, Project Risk Management Tools, Types of Project Risk, Project Risk Assessment, Risk Identification and Mitigation, Monitoring & Controlling Risk, Generic Risk Management Strategies & Technique.

10. Computer Application in Project Management

- Basic/Elementary Introduction and hands on basic exposure of use of MS Project & Primavera P6 Software in Project Management

11. Project Quality Management

- Defining Quality, Quality Assurance, Quality Management, 7 Quality Improvement Tools as applied to Project Management, Project Quality Management Plan, Quality Management Processes and Strategies

12. Project Closure & Termination

- Project Evaluation, defining project success, Project Completion Criteria, Project Audit, Project Termination &When to close a project, the termination process, Project Close Up & lesson learnt, & Project Archive

Recommended Books:

2. Project Management- A managerial approach, Meredith, J.R and mantel S.J, John Wiley. Latest Edition
3. Human Resource Management in Construction, Langford, D, Longman Group Ltd, UK, Latest Edition
4. Construction Methods and Management, Nunnally S.W Prentice Hall, USA. Latest Edition
5. Principles of Construction Management Roy Pilcher, Mc Graw Hill Company, Latest Edition