

BSc Environmental Engineering

**Revised Scheme of Studies and Course Outline for Session
2025 & onwards**

Institute of Environmental Engineering and Research, UET Lahore, September, 2025

Course Outline of Subjects of BSc Environmental Engineering, Session 2025 & Onwards

Sr. No.	Subject Title	Course Outline
Semester-1		
1.	HU-111 Communication Skills	Introduction to Communication Skills, Study Skills (Skimming and scanning, intensive and extensive, and speed reading, summary and precise writing and comprehension), Translation skills (Urdu to English), Components of Communication, Non-Verbal Communication, Functional English, Paragraph writing (Practice in writing a good, unified and coherent paragraph), Assessment week, Public Speaking, Presentation skills (Personality development (emphasis on content, style and pronunciation), Resume/CV Writing and job application, Resume/CV Writing, Interview Skills, Formal Presentations
2.	IS-104 Islamic Studies/Ethics (for non-Muslims)	<p>1. The Holy Quran</p> <p>a. Significance of the Holy Quran</p> <p>b. topics of the Holy Quran</p> <p>c. Miracles (Ijaz) of the Holy Qur'an</p> <p>d. Principles of interpretation (Tafseer)</p> <p>e. Textual Study of Sura Al-Hujurat (Complete) (Meanings of Arabic text, translation & explanation)</p> <p>Focus: Impact of the teachings and commands mentioned in Sura Al-Hujurat on human life.</p> <p>Main points of discussion</p> <ul style="list-style-type: none"> <input type="checkbox"/> Commands of Allah regarding meeting with the Holy Prophet peace be upon him. <input type="checkbox"/> Reports from wicked person to be tested. <input type="checkbox"/> Brotherhood, equality, effort to compose the quarrels of groups and reconciliation between them. <input type="checkbox"/> Elimination of social evils such as to laugh at people in contempt, calling others by offensive nick names, suspicion and back biting. <input type="checkbox"/> All people (mankind) are one and the most righteous gets most honour before Allah. <input type="checkbox"/> Qualities of believers. <input type="checkbox"/> Knowledge of Allah about the secrets of the heavens and the earth and out actions. <p>f) Textual study of Surah Al-Maida (Verse:1 to 6) (Meaning of Arabic text, translation & explanation)</p> <p>Focus: Impact of the teachings and commands mentioned in Sura Al- Maida on human life.</p> <p>Main Points of Discussion:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Stress on fulfillment of uqud (obligations)

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		<ul style="list-style-type: none"> <input type="checkbox"/> Concept of halal (lawful) and haram (forbidden) in Islam <input type="checkbox"/> Halal and haram animals and food <input type="checkbox"/> Symbols of Allah Almighty <input type="checkbox"/> Emphasis on helping one another in righteousness and piety <input type="checkbox"/> Rules of hunting the animals for food. <input type="checkbox"/> Social relationship with non-Muslims <input type="checkbox"/> Relationship between Muslims and Ahl Al-Kitab (people of the Book) <input type="checkbox"/> Rules of purity and cleanliness <p>g) Textual Study of Sura Al-Fur'qan: verses: 63 to77, Al-Mominoon 1-11. (Meaning of Arabic text, translation & explanation)</p> <p>Focus: Impact of the teachings and commands mentioned in Sura Al-Fur'qan and al-Muminoon on human life.</p> <p>Main Points of discussion: Characteristics of Ibad-ur-Rehman (Slaves of Allah) and true believers.</p> <p>h) Subjective Study of Surah-al-Noor and other Surahs Al-Baqra 178, 179, Al-Nisa: 92,93, Al-Maidah: 8, 31-34,38. Al-Noor: 1-31,60 Al- Ahzab 32,33,53,55,59.</p> <p>Focus: Impact of the teachings and commands mentioned in surah Al-Noor and other surahs on human life</p> <p>Main Points of discussion:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hudood. Zina (adultery, fornication), <input type="checkbox"/> Qad'f (false accusation). <input type="checkbox"/> Li'an (accusation of a wife of zina), <input type="checkbox"/> Drinking intoxicating liquors, narcotics <input type="checkbox"/> theft, Dacoity, Robbery, Murder, Apostasy and Rebellion <input type="checkbox"/> Ifk story (slander) <input type="checkbox"/> Privacy, Hijab (woman's veil) <p>2) Al-Hadith</p> <p>a) The need & Importance of Hadith</p> <p>b) Compilation of Hadith</p> <p>c) Brief Introduction of Sihah Sittah</p> <p>d) Textual study of Hadith: Arbaeen-e-Navavi by Imam Nawawi, Hadith: 1 to 42 (Meanings of Arabic text, translations and explanation)</p> <p>Focus: Impact of teaching and commands mentioned in Ahadith on human life.</p> <p>Main points of discussion:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Importance of intention (Niyya) in human actions <input type="checkbox"/> Islam, Iman (belief), Ihsan (excellence) and the Hour.

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		<ul style="list-style-type: none"> <input type="checkbox"/> Rejection of Innovation (Al-Bid'ah) in religion (Din) <input type="checkbox"/> Lawful, unlawful and doubtful matters <input type="checkbox"/> Sincerity to Allah, his books, his messengers, leaders of the Muslims and common people <input type="checkbox"/> Protection of lives and property of people <input type="checkbox"/> Obedience of the Holy Prophet peace be upon him <input type="checkbox"/> Importance of lawful food, drink, clothing and nourishing <input type="checkbox"/> True believer is who likes for his brother what he likes for himself. <input type="checkbox"/> Honour of the blood of Muslims and others <input type="checkbox"/> Respect of neighbours and guests <input type="checkbox"/> Importance of good talk and silence <input type="checkbox"/> Prohibition to become angry and furious <input type="checkbox"/> Ihsan (excellence) with regards to everything <input type="checkbox"/> Good behavior towards people <input type="checkbox"/> All kinds of expectation, help and benefit from Allah <input type="checkbox"/> Importance of modesty (Al-Haya) <input type="checkbox"/> To stand firm on Islam <input type="checkbox"/> A guideline for a Muslim <input type="checkbox"/> Obligatory deeds, Charity and minor acts <input type="checkbox"/> Proof and Oath <input type="checkbox"/> Islamic brotherhood <input type="checkbox"/> Pardoning of mistakes and forgetfulness <input type="checkbox"/> عَنْ ابْنِ عُمَرَ رَضِيَ اللَّهُ عَنْهُمَا قَالَ قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ بُنِيَ الْإِسْلَامُ عَلَى خَمْسٍ(بخارى ح 7) <input type="checkbox"/> حَدَّثَنِي أَبِي عُمَرُ بْنُ الْخَطَّابِ قَالَ بَيْنَمَا نَحْنُ عِنْدَ رَسُولِ اللَّهِ -صلى الله عليه وسلم- ذَاتَ يَوْمٍ إِذْ طَلَعَ عَلَيْنَا رَجُلٌ شَدِيدُ بَيَاضِ الثِّيَابِ.....(مسلم حديث 8) <input type="checkbox"/> عَنْ مُعَاذِ بْنِ جَبَلٍ - قَالَ بَعَثَنِي رَسُولُ اللَّهِ -صلى الله عليه وسلم- قَالَ «إِنَّكَ تَأْتِي قَوْمًا مِنْ أَهْلِ الْكِتَابِ». مسلم ح 19) <input type="checkbox"/> عَنْ مُعَاذِ بْنِ جَبَلٍ قَالَ قَالَ رَسُولُ اللَّهِ -صلى الله عليه وسلم- «يَا مُعَاذُ أَتَدْرِي مَا حَقُّ اللَّهِ عَلَى الْعِبَادِ» مسلم 30) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ أَنَّ النَّبِيَّ -صلى الله عليه وسلم- قَالَ «الرَّجُلُ عَلَى دِينِ خَلِيلِهِ.....»(ابو داود ح 4833) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ قَالَ قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ بَدَأَ الْإِسْلَامَ غَرِيبًا.....(مسلم 208) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ عَنِ النَّبِيِّ - صلى الله عليه وسلم - قَالَ «إِذَا أَحَبَّ اللَّهُ عَبْدًا نَادَى جَبْرِيْلًا.....»(بخارى 6040) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ قَالَ قَالَ رَسُولُ اللَّهِ - صلى الله عليه وسلم - «إِنَّ اللَّهَ قَالَ مَنْ عَادَى لِي وَلِيًّا.....»(بخارى 6502) <input type="checkbox"/> عَنْ سَهْلِ بْنِ مُعَاذٍ بِنِ أَنَسِ الْجُهَنِيِّ عَنْ أَبِيهِ أَنَّ رَسُولَ اللَّهِ -صلى الله عليه وسلم- قَالَ «مَنْ أَعْطَى اللَّهَ وَمَنَعَ بِهِ»(ترمذى 2521) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ قَالَ قَالَ رَسُولُ اللَّهِ -صلى الله عليه وسلم- «يَقُولُ اللَّهُ عَزَّ وَجَلَّ أَنَا عِنْدَ ظَنِّ عَبْدِي بِي»(بخارى 7405) <input type="checkbox"/> عَنْ أَبِي هُرَيْرَةَ عَنِ النَّبِيِّ -صلى الله عليه وسلم- قَالَ «مَنْ سَرَّهُ أَنْ يَكْتَالَ بِالْمِكْيَالِ الْأَوْفَى.....»(ابو داود 984) <input type="checkbox"/> عَنْ عَبْدِ اللَّهِ بْنِ عَمْرٍو بْنِ الْعَاصِ قَالَ سَمِعْتُ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ يَقُولُ إِنَّ اللَّهَ لَا يَقْبِضُ الْعِلْمَ انْتِرَاعًا(بخارى 98)

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		<p>عَنْ حُدَيْفَةَ بْنِ أَسِيدٍ الْغِفَارِيِّ قَالَ أَطَّلَعَ النَّبِيُّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - عَلَيْنَا وَنَحْنُ نَتَذَاكُرُ فَقَالَ «مَا تَذَاكُرُونَ .» قَالُوا نَذْكُرُ السَّاعَةَ (مسلم)7467</p> <p>عَنْ أَبِي هُرَيْرَةَ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - قَالَ «حَقُّ الْمُسْلِمِ عَلَى الْمُسْلِمِ سِتٌّ.....» (مسلم)5778</p> <p>عَنْ ابْنِ عَبَّاسٍ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - قَالَ :مَنْ يُرِدِ اللَّهُ بِهِ خَيْرًا يُفَقِّهْهُ فِي الدِّينِ(ترمذى)2857</p> <p>عَنْ أَبِي هُرَيْرَةَ قَالَ قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ - مَنْ سَلَكَ طَرِيقًا يَلْتَمِسُ فِيهِ عِلْمًا.....(ترمذى)858</p> <p>عَنْ عَائِشَةَ ، أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ :مَنْ أَحَدَّثَ فِي أَمْرِنَا هَذَا مَا لَيْسَ مِنْهُ ، فَهُوَ رَدٌّ(بخارى)2697</p> <p>عَنْ عَزْبَانَ بْنِ سَارِيَةَ يَقُولُ :قَامَ فِينَا رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ ذَاتَ يَوْمٍ ، فَوَعظَنَا مَوْعِظَةً بَلِيغَةً (ابن ماجه ح 42)</p> <p>عن أمير المؤمنين أبي حفص عمر بن الخطاب رضي الله عنه قال :سمعت رسول الله صلى الله عليه وسلم يقول " :إنما الأعمال بالنيات</p> <p>.....متفق عليه</p> <p>عن أبي عبد الرحمن عبد الله بن مسعود رضي الله عنه قال :حدثنا رسول الله صلى الله عليه وسلم وهو الصادق المصدوق " متفق عليه</p> <p>عن أبي عبد الله النعمان بن بشير رضي الله عنهما .قال :سمعت رسول الله صلى الله عليه وسلم يقول " :إن الحلال بين " متفق عليه</p> <p>" عن أبي هريرة عبد الرحمن بن صخر رضي الله عنه قال :سمعت رسول الله صلى الله عليه وسلم يقول " :ما نهيتكم عنه فاجتنبوه " متفق عليه</p> <p>عن أبي هريرة رضي الله عنه قال :قال رسول الله صلى الله عليه وسلم " :إن الله طيب لا يقبل إلا طيبا..... رواه مسلم</p> <p>عن أبي هريرة رضي الله عنه قال :قال رسول الله صلى الله عليه وسلم " :من حسن إسلام المرء تركه ما لا يعنيه "حديث حسن رواه الترمذي وغيره هكذا</p> <p>عن أبي حمزة أنس بن مالك رضي الله عنه خادم رسول الله صلى الله عليه وسلم عن النبي صلى الله عليه وسلم قال " :لا يؤمن أحدكم حتى يحب لأخيه ما يحب لنفسه "متفق عليه</p> <p>عن أبي هريرة رضي الله عنه أن رسول الله صلى الله عليه وسلم قال " :من كان يؤمن بالله واليوم الآخر فليقل خيرا أو ليصمت..... متفق عليه</p> <p>عن أبي يعلى شداد بن أوس رضي الله عنه عن رسول الله صلى الله عليه وسلم قال " :إن الله كتب الإحسان على كل شيء..... رواه مسلم</p> <p>عن أبي ذر جندب بن جنادة وأبي عبد الرحمن معاذ بن جبل رضي الله عنهما عن رسول الله صلى الله عليه وسلم قال " :اتق الله حيثما كنت..... رواه الترمذي وقال :حديث حسن</p> <p>عن عبد الله ابن عمر قال قال رسول الله صلى الله عليه وسلم ألا أخبركم بأحبكم إليّ وأقربكم مني مجلساً يوم القيامة ؟ فأعادها مرتين أو ثلاثاً .قالوا :نعم يا رسول الله إقال :أحسبكم خُلُقًا وَعَنْ أَبِي الدَّرْدَاءِ عَنِ النَّبِيِّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ « :إِنَّ أَثْقَلَ شَيْءٍ يُوضَعُ فِي مِيزَانِ الْمُؤْمِنِ يَوْمَ الْقِيَامَةِ خُلُقٌ حَسَنٌ وَإِنَّ اللَّهَ يُبْعِضُ الْفَاجِشَ النَّبْذِيَّ . » (رَوَاهُ التِّرْمِذِيُّ</p> <p>عن أبي هريرة رضي الله عنه قال :قال رسول الله صلى الله عليه وسلم " :لا تحاسدوا ولا تتناجشوا ولا تباغضوا ولا تدابروا، ولا يبع بعضكم على بيع بعض وكونوا عباد الله إخوانا.....(رواه مسلم)</p> <p>عن أبي هريرة رضي الله عنه عن النبي صلى الله عليه وسلم قال " :من نفس عن مؤمن كربة من كرب الدنيا نفس الله عنه كربة من كرب يوم القيامة، ومن يسر على معسر يسر الله عليه في الدنيا والآخرة والله في عون العبد ، ما كان العبد في عون أخيه ومن سلك طريقا(مسلم)</p>

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		<p>3) The study of articles of faith & pillars of Islam and Jihad. Focus: Impact of basic articles of faith, pillars of Islam and Jihad on human life. Main points of discussion a) Six articles of faith. b) Pillars of Islam 1. Shahada (Witness) Importance and philosophy of witness that no God but Allah and Muhammad (peace be upon him) is His Messenger. Tawheed: Fundamentals and types of Tawheed, Al-Baqarah 284-286, Arguments about Tawheed in the light of Surah Luqman Prophet-hood and Finality of Prophet-hood, Al-Ahzab 6,21,40,56,58 2. Salat (Prayer) Imposition of prayer, orders and significance. 3. Saum (Fasting) Meaning of Fasting obligation of Fasting, significance, disbursement, phy and spiritual advantages. 4. Zakat: The Economic system of Islam, Importance of Zakat, Prohibition of Riba (Inter Comparison between Islamic, Economic system and socialism, Capitalism & Communism. 5. Hajj: Imposition of Hajj, commands and rites of Hajj, financial social and spiritual advantage of Hajj. c) Jihad (Striving in the cause of Allah): Importance, significance and its kinds.</p> <p>4-Seerah-Tun-Nabi ﷺ Focus: Impact of the life of the Holy Prophet peace be upon him on human life. Main points of discussion: a. Life of the Holy Prophet (Peace be upon him) at Makkah and Madina. b. The Holy Prophet (Peace be upon him) as a Perfect Man. c. Muhammadan Revolution.</p> <p>5) Islam and Modern Science Focus: Impact of the teaching regarding Modern Science on human life. Main Points of discussion: □ The Holy Quran as a guide for the modern scientific development, Surah Al-Baqra: verse 164 Aal-e-Imran verses 190-191. □ Importance of science education in the modern age. □ Introduction of Muslim Scientists, contribution of Muslim Scholars towards science.</p> <p>6) Islamic Ethics Focus: Impact of the ethics on human life. Definition, importance and significance of Ethics.</p>

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		<p>Concept of Ethics in the light of Holy Quran Al-Baqra: 83, 169 Al-Tauba: 7 Yunus: 36, Hood: 18 Al-Nah'l:112 Al-Mutaffifeen: 1,2,3</p> <p>Main points of discussion:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Kindness with parents, kindred, orphans and needy people. <input type="checkbox"/> Fair speaking to the people <input type="checkbox"/> Refrain from evil and shameful deeds <input type="checkbox"/> Abstain from killing any person except by way of law <input type="checkbox"/> Security of the orphan's property <input type="checkbox"/> Full justice in measure and weight <input type="checkbox"/> Prevention from inventing a lie <input type="checkbox"/> Fraud and its bad effects. <p>Moral values in the light of Hadith Bulugh-ul-Maram, Kitab-ul-Jamae, Babul Tarheeb Min Msav-al-Akhlaq Ahadith No. 3, 4, 7, 14, 17</p> <p>Main points of discussion:</p> <ul style="list-style-type: none"> <input type="checkbox"/> To control anger <input type="checkbox"/> Oppression is darkness <input type="checkbox"/> Telling a lie is sign of hypocrisy <input type="checkbox"/> Backbiting <p>Ethics and character building in the light of Seerah Ethical behavior of the Holy Prophet (PBUH) Significance of moral values (i) Truth (ii) Honesty (iii) Taqwa (iv) Brotherhood (v) Patience</p> <p>Note: Ethics is an alternative subject for non-Muslim students. Note: The Medium of Instruction is urdu / English</p>
3.	CE-101 Elementary Surveying	Introduction to land surveying, definitions, branches and their application. Instruments used in reconnaissance. Distance measurement: Methods and instruments. Leveling: Reduction of levels, temporary and permanent adjustments of level, precise leveling. Theodolite: Types, use, temporary and permanent adjustments. Traversing with compass and theodolite. Tachometry: with staff and sub tense

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		<p>bar. Plane Table Surveying: Parts and accessories, Methods of plane table survey, two- and three-point problems. Contouring: Methods and applications.</p> <p>Area and Volumes: Computation by various methods, cross section and L-section of roads, Layout of buildings and structures.</p> <p>Field and drawing office work based on above.</p>
4.	CE-101L Elementary Surveying	<p>Lab/Practical:</p> <ol style="list-style-type: none"> 1. To standardize one's pace in the field 2. To find out length of all lines of surveying scheme 3. To execute building surveys in the field 4. To draw conventional symbols sheet 5. To study prismatic compass 6. To observe magnetic bearings of all lines of surveying scheme 7. To set out building according to plan in the field 8. To study auto level and staff 9. To perform ordinary leveling in the field 10. To perform precise leveling in the field 11. To draw contouring sheet 12. To study electronic digital Theodolite 13. To find horizontal angles of scheme in the field. 14. To find out vertical angles of elevation and depression in the field 15. To find area of scheme by independent coordinates 16. To find area of scheme by trapezoidal and mid ordinate rule 17. To perform Tacheometry in the field 18. To perform plane Table surveying in the field and to draw topographical map 19. To perform plane table surveying in the field and to draw topographical map 20. To solve three point problem by mechanical method

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5.	EnE-101 Introduction to Environmental Engineering	<p>Introduction: Environmental Engineering Profession. Introduction to environment and factors affecting the environment. Environmental degradation processes and environmental pollution. Effects of pollution on human health, soil, surface and ground water environment. An overview of national environmental problems.</p> <p>Sustainable development: Definition and inter-relationship between its components. Strategies for sustainable development, Conference of parties (COP), SDGs. Global, regional and national environmental issues. Climate change, Acid rain, ozone depletion. Key elements of Pakistan National Conservation Strategy. environmental ethics: Review of national and international codes and ethics in environmental engineering. Mass and energy transfer: Material balances: Steady state conservative systems, steady state systems with non-conservative pollutants. Step function response. Energy fundamentals and energy balances. Mathematics of growth: Exponential growth, doubling time, half-life, resource consumption, exponential resource production rates. Safety & environmental risk assessment and management Risk benefit analysis, reducing risk, collegiality and loyalty. Environmental engineering technologies: Water sources and their quality, Introduction to basic concepts of water treatment in relation to raw water sources. Sources and characteristics of wastewater. Preliminary, primary and secondary levels of wastewater treatment with application of basic concepts in each case. Sources, classification and composition of municipal solid wastes. Basic concepts of Integrated Waste Management. Major air pollutants, their effects and basics of control measures.</p>
6.	PHY-112 Applied Physics	<p>Electrostatics: Coulomb's Law, Electric field and potential, Capacitance, Dielectrics, Electrodynamics, Magnetic field and force, Source of magnetic field, Electromagnetic induction, Inductance.</p> <p>Solid State Physics: Crystal lattices, Unit cells, Miller indices, Conductors, Semiconductors, Insulators. Semiconductors: Composition, Purity, n and p type materials, Carrier properties and distribution, Formation of energy bands, Energy band gap, Band gap tailoring.</p> <p>Optics: Optical absorption, Photoluminescence, Photoconductivity, Photoelectric effect, Lasers, LIDAR, Solar Cells, Superconductivity.</p>

Sr. No.	Subject Title	Course Outline
7.	PHY-112L Applied Physics	<p>Lab/ Practical:</p> <ol style="list-style-type: none"> 1. To study the Hall Effect in metals. 2. To find the band gap of Germanium. 3. To find the Capacitance of different metal spheres. 4. To determine the dielectric constant of different materials. 5. To study the temperature dependence of the resistance of different electrical components. 6. To determine the frequency of A. C. mains. 7. To determine the e/m of an electron by deflection method. 8. To draw the B-H curve of ferromagnetic material using galvanometer. 9. To find the variation of photoelectric current with intensity of light. 10. To determine the wavelength of Na light by diffraction grating and spectrometer.
8.	MA-115 Engineering Mathematics	<p>Scalar triple product, Vector triple product; Scalar and vector point functions; Differentiation and integration of vector point functions.</p> <p>De Moivre's Theorem, The nth roots of a number; Solution of equations. Hyperbolic Functions, Hyperbolic and Trigonometric identities and their relationship.</p> <p>Differentiation and successive differentiation and its application to rate, speed and acceleration; Leibnitz's Theorem; Equations of tangents and normals; Curvature; Centre of mass; Maxima and minima of function of one variable and its applications; Convexity and concavity; Points of inflexion; Concept of infinite series: Taylor's and Maclaurin's series and expansion of functions.</p> <p>Partial Differentiation: Partial differential coefficient and Chain rule; Partial differentiation of an implicit function; Total differential; Euler's Theorem; Statement of Taylor's Theorem of Two Independent Variable and its Applications.</p> <p>Further techniques of integration; Integration by reduction formula; Fundamental Theorem of Integral Calculus; Definite integral and its properties; Area enclosed between curves; Arc length.</p>

Sr. No.	Subject Title	Course Outline
		<p>Cartesian, cylindrical and spherical coordinates; The ratio formula; Equations of a straight line in R3; Direction ratios and direction cosines; Angle between two straight lines, Distance of a point from a line; Equations of a plane; Angle between two planes; The sphere.</p>
9.	<p>IS-109L/IS-212LFehm-e-Quran/ Social Ethics-I</p>	<p>Proper Noun Masculine & Feminine Two kinds of plural Concept of (و) "And" Common Noun Demonstrative Noun (This & That for Masculine هذه Demonstrative Noun (This & That for Feminine) ذلك تلك) Laam for emphasis (لام التأكيد) Superlative Degree like أكبر Revision of all Quranic Sentences Emphatic Particle ان Preposition For" (في) اللام Preposition (على من إلى) Preposition (اعية) (إلا) (ما الثانية) (للجنس) (للجنس) Absolute Negation Particle Exceptive Particle حرف النداء) (as) Vocative Particle Quranic Adjective Compounds (صفة وموصوف) Quranic Possessive Construction (مضاف ومضاف إليه) Quranic Possessive Construction (مضاف ومضاف إليه) Active Participle اسم الفاعل Passive Participle اسم المفعول Dual (مثنى) Personal Pronoun He المنفصل Possessive Pronoun His المتصل Possessive Pronoun with prepositions له، منه، فيه like Pronoun "His" with prepositions like في بيته Personal Pronoun You أنت المنفصل Possessive Pronoun Your المتصل Possessive Pronoun with prepositions like في بيتك Pronoun "your" with prepositions like فيك، منك، لك Personal Pronoun She) هي المنفصل Possessive Pronoun Her المتصل Possessive Pronoun with prepositions like في بيتها like Pronoun "Her" with prepositions like لها Personal Pronoun 1 أنا المنفصل Possessive Pronoun Her المتصل Possessive Pronoun with prepositions like في بيتي like Pronoun "My" with prepositions like لي ح) Adverb جمع المذكر السالم و جمع المذكر السالم المسبوق بحرف الجر جمع المذكر السالم المسبوق بالإضافة Personal Pronoun They المنفصل Possessive Pronoun Their هم المتصل Possessive Pronoun with prepositions like في بيتهم like Pronoun "Their" with prepositions like لهم</p>

Sr. No.	Subject Title	Course Outline
		<p>Personal Pronoun You) أنتم المنفصل Possessive Pronoun Your المتصل كم Possessive Pronoun with prepositions like في بيتكم Pronoun "Your" with prepositions like لكم Personal Pronoun We) نحن المنفصل Possessive Pronoun Our المتصل نا Possessive Pronoun with prepositions like في بيتنا like Pronoun "Our" with prepositions like لنا Demonstrative Pronoun These, Those) هؤلاء أولئك ما /إلا إن /إلا إنما، ليس ما ، (أم أن يل، كان () ألا، أليس، اليوم، يومئذ، سبحان ما بينهما، قل، إذن، بنس، نعم، كلا ما أدراك، حسب أعلم ب، مصير مرجع ديننا)تميز جملة فعلية (Tense Verbal Sentence) فعل مضارع Present Tense الفعل المضارع صيغة المفرد يعلم Present Tense الفعل المضارع صيغة المفرد يعلم Present Tense الفعل المضارع صيغة الجمع يعلمون</p>
Semester-2		
10.	MA-116 Linear Algebra & Differential Equations	<p>Euclidean spaces, Vector spaces, Subspaces, Linear independence and dependence, Basis and dimensions, Normed spaces, Inner product spaces, Angle and orthogonality in Inner product spaces, Orthogonal basis; Linear transformations, Kernel and range, Inverse linear transformation, Rank and nullity of linear transformation, Eigenvalues and eigenvectors, Applications to relevant problems. Formation of differential equations; Solution of various types of first order differential equations; orthogonal trajectories, Application in physical problems. Linear differential equations of second order (Classification of DE, Implicit, Explicit and Initial Value Problems), Complementary function and particular integral. Solution of non-homogeneous linear differential equations of second order and higher by (i) the method of undetermined coefficients (ii) the method of variation of parameters. Laplace transform, Solution of initial value problems by Laplace transform. Formation of partial differential equations; Equations reducible to ordinary differential equations. Periodic functions. Even and odd functions. Fourier series of functions of period 2π and arbitrary period; Half range series.</p>
11.	CSC-100- Application of Information and	<p>Introduction to Computer Systems: Basic Definitions, Computer and Communication Technology, The applications of ICT - particularly for Engineers. Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, Output, Storage, Basic components: Hardware, Software, Data, Users, Types of storage devices. Processing Data: Transforming data into information,</p>

Sr. No.	Subject Title	Course Outline
	Communication Technologies	<p>How computers represent and process data, Processing Devices, CPU architectures. Internet Basics: The Internet, The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Email and other programs. Introduction to Embedded Systems: What is an Embedded System, Applications, Components, Programming Languages, Popular Development Platforms, Programming Languages.</p> <p>Networking Basics: Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks. Database Management: Hierarchy of Data, Maintaining Data, Database Management Systems. Protecting your privacy, your computer and your data: Basic Security Concepts, Threats to users, Threats to hardware, Threats to Data. ICT Applications: Computer controlled system, Robotics, Expert Systems, Computer aided manufacturing systems, Autonomous Vehicles, Management Information system (LMS, School Management System), Bioinformatics, Health care applications, Telemedicine and online health consultations, Digital Identity, Cyberbullying, Online harassment. Future Trends in ICT</p>
12.	CSC-100L Application of Information and Communication Technologies	<p>Computer Components</p> <p>Use MS-WORD:</p> <ul style="list-style-type: none"> • To write Application to the chairman • To write Paragraph on first day fooling <p>Use MS-WORD:</p> <ul style="list-style-type: none"> • To Design and create three folds pamphlet • To Create Bio-data form • To Create a Poster <p>Use MS-WORD:</p> <ul style="list-style-type: none"> • To make kindergarten games • To Create Lab Manual for ICS <p>Use MS-WORD:</p> <ul style="list-style-type: none"> • Explorer Review tab in MS word • Track changes into your MS word Report <p>Do MS Excel Assignments</p> <p>MS Excel Layout and Description</p> <p>Orientation of Power point</p> <p>Choose and Create: Animated story</p>

Sr. No.	Subject Title	Course Outline
		Create the Truth tables of OR, AND & XOR Develop the solar system by animation Lab Project: Group members introduction Introduction to HTML Lab Project I Inter Department Research And Communication Introduction to Latex Introduction to NetBeans Introduction to GitHub Introduction to data management tools Introduction to Video Animation Computer Graphics Lab Project II
13.	EnE-104 Environmental Chemistry	Introduction to environmental chemistry. Interactions of environmental engineering with general chemistry, physical chemistry, equilibrium chemistry, organic chemistry, colloidal chemistry. Air chemistry (important physical and chemical properties of air), soil chemistry (important physical and chemical properties of soil). Applications of chemistry in environmental engineering. Environmental contaminants i.e. Pesticides, herbicides, PCBs, PAHs, EDC, Dyes, phthalates, dioxins and heavy metals. Acids and bases: pH buffers; carbonate chemistry: alkalinity and acidity, precipitation and dissolution, solubility products, factor affecting solubility, oxidation-reduction reactions. Transfer and fate of pollutants in soil, air and water
14.	EnE-104L Environmental Chemistry	Lab/Practical: <ol style="list-style-type: none"> 1. Standardization of standard solutions. 2. Estimation of pH of water 3. Estimation of point of zero charge of material by mass transfer method 4. Potentiometric titration for acid-base reactions 5. pH curves for acid-base reaction 6. Determination of alkalinity of water 7. Determination of acidity and basicity

Sr. No.	Subject Title	Course Outline
		<p>8. To estimate the sulphates in water by gravimetric method.</p> <p>9. To determine the concentration of chlorides in water.</p> <p>10. To determine the Turbidity and conductivity of water.</p> <p>11. Estimation of percentage purity of vinegar</p> <p>12. Determination various types of hardness of water</p> <p>13. Estimation of solids by gravimetric method</p> <p>14. Estimation of fluorides in water</p> <p>15. Determination of amount of nitrite and nitrates in water.</p> <p>16. Estimation of sodium ions in water by Flame photometer</p> <p>17. Estimation of potassium ions by flame photometer</p>
15.	ME-100L Workshop Practice	<p>Basic/Elementary Machine Shop: Detailed study of center lathe and accessories, plane and taper turning, basic lath operations including turning, facing, simple screw cutting/treading, knurling, grooving (drilling and boring), cutting tools and their grinding. Brief introduction of shaper, milling shaper and surface grinding machine. Assigning of practical jobs.</p> <p>Fitting and Fabrication Shop: The use and care of fitter tools, marking out of jobs, practice in metal filing, sawing, drilling, dyeing, tapping and reaming. Brief introduction of power hack saw, arbor press, sheet rolling machine, punching machine and drilling machine. Assigning of practical jobs</p> <p>Carpentry Shop: The use and care of tools, type of timber, its defects and preservation methods practice in planning and sawing. Different types of wood joints. Study of sawing, planning, turning mortise and Tenon machines. Assigning of practical jobs.</p> <p>Electrical Shop: Electrical shocks and treatment. The use and care of tools used by electricians, types and uses of cables and electrical accessories for house wiring, practice simple house wiring, testing methods. Switch gear used on domestic installations and DB system. Earthing system. Assigning of wiring arrangement practical.</p>
16.	EnE-103 Environmental	International Law and Environment: Introduction; History and Structure of International Law, State Responsibility in International Law, International Conventions and Conservation Strategies Current status of

Sr. No.	Subject Title	Course Outline
	Laws and Policies	<p>the environment in Pakistan, Conservation strategies (NCS, SPCS), Organizational and Institutional Framework for environmental conservation and management: scope and status in Pakistan, The Pakistan Environmental Protection Act, 1997, its regulations, the Review of IEE/EIA Regulations, 2000, the Environmental Laboratories Certification Regulations, 2001 and the rules, National Environmental Quality Standards (Self-Monitoring the Reporting by Industries) Rules, 2001, Punjab Environmental Protection Administrative Penalty Rules 2013, Hazardous Substances Rules and Punjab Hospital Waste Management Rules 2014, Punjab Biosafety Rules 2014, Punjab Environmental Protection Motor Vehicle Rules 2013, Punjab Policy on controlling smog 2017,</p> <p>Pakistan Environmental policy 2005, National Water Policy 2018, Punjab Water Act 2019, Draft National Environmental Policy; National and Provincial Climate Change Policies, Other latest rules, regulations, and policies at National/Provincial level.</p> <p>Government rules of business in environment related departments (WASA, EPD, LWMC etc.)</p>
17.	EnE-105 Ecological Management	<p>Basic concepts in ecology. Structure of ecosystem. Effect of climate changes on the distribution of biological communities, Energy and material flow within ecosystem. Succession: (only basic concepts). Ecosystem productivity, food webs and food chains, Types, threats and management of ecosystem, Biodiversity and ecological sustainability (basic concepts). Nutrient cycles and Eutrophication. Populations/Communities and their dynamics and interaction. Species, extinction and habitat damage. Human as keystone species, effects of human activities on ecosystem. Mega reservoirs. Habitat evaluation & Ecological Assessment</p>
18.	IS-111 Pakistan Studies	<ul style="list-style-type: none"> * Ideology of Pakistan with reference to Quaid I Azam and Allama Iqbal * Aims and objectives of the creation of Pakistan * An overview of history of Muslim rule in subcontinent from 712 to 1857 * Sir Syed and Aligarh movement * Establishment of All India Muslim League, its objectives and major achievements * Khilafat movement 1919-1924 * Allahabad address of Allama Iqbal 1930 and Pakistan Resolution 1940 * Initial problems of Pakistan. Radcliffe award, Refugees, Water disputes, Kashmir issue * Political and constitutional development in Pakistan from objectives Resolution to 1973 constitution * Resources of Pakistan: Agricultural, Industry, Manpower

Sr. No.	Subject Title	Course Outline
		<ul style="list-style-type: none"> * Geostrategic importance of Pakistan location with reference to CPEC, Central Asia, Middle East and South Asia * Foreign policy of Pakistan: its determinants and principles * Relations with neighboring countries: India, China, Afghanistan, Iran * Relations with Saudi Arabia and Turkey * Relations with USA and EU * Regional organizations, SAARC, OIC, ECO, SCO
Semester-3		
19.	EnE-201 Environmental Microbiology	<p>Basic concepts in microbiology and their application in environmental engineering, Microbial classification, growth and nutrition. Influence of environment on growth including measurement of growth. Cell structures and function, Enzymes and enzyme activity. Examination and evaluation of the effects of microorganisms in water and wastewater. Study of microscopes, microbial staining and pure culture techniques, nutritional requirements cultivation and growth. Enumeration of microorganisms in water, standard plate count; Indicator organisms, Control of microorganisms by physical and chemical agents, the structure and biological functions of microorganism including bacteria, protozoa, algae, fungi and viruses. Microbiology of water and wastewater; soil and food. Biodegradation and bioaccumulation. Role of microbes in reclamation of polluted environment; role of microbes in aerobic and anaerobic biological wastewater treatment.</p>
20.	EnE-201L Environmental Microbiology	<p>Lab/ Practical:</p> <ol style="list-style-type: none"> 1. Layout of lab and description of instruments in Environmental Microbiology lab 2. To study parts, principle and working of microscope 3. Preparation of microscopic slides 4. Identification of cells (Cheek Cell) 5. Identification of cells (Onion Cell) 6. Identification of cells (Plant Cell) + Organisms in surface water / fresh water 7. Study of microscopic life in wastewater. 8. Microscopic identification of fresh and polluted water algae 9. To observe bread mold fungi through microscope 10. Open End lab 11. Study of staining technique for microorganism; Gram Staining

Sr. No.	Subject Title	Course Outline
		<p>12. To determine the quality of milk by methylene blue reduction test</p> <p>13. Determine the presence of total coliform and fecal coliform by most probable number (MPN) method in water samples.</p> <p>14. Study of microscopic life in wastewater, demonstration of Colony Counter</p> <p>15. Preparing bacterial culture</p> <p>16. Effect of pH on microbial growth</p> <p>17. Effect of temperature on microbial growth</p> <p>Open Ended Lab</p>
21.	CE-232 Fluid Mechanics	<p>Introduction: Fluid Mechanics, hydrostatics, kinematics, hydrodynamics, Hydraulics, Solids and fluids, liquids and gases, Units and dimensions, Physical properties of fluids, density, specific gravity, specific weight, specific volume, surface tension, compressibility, viscosity, units of viscosity, measurement of viscosity, Newton's equation of viscosity.</p> <p>Fluid Statics: Pressure intensity and pressure head, pressure specific weight relationship, absolute and gauge pressure, measurement of pressure, Piezo-meter, manometer, pressure transducers, Differential manometer and Borden gauge. Forces on submerged planes and curved surfaces and their applications, buoyancy and flotation, equilibrium of floating and submerged bodies.</p> <p>Fluid Kinematics: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow, Path-lines, streamlines and stream tubes. Velocity and discharge, equation of continuity for compressible and incompressible fluids.</p> <p>Hydrodynamics: Different forms of energy in a flowing liquid, energy head, Bernoulli's equation and its application. Energy line and hydraulic grade line, free and forced vortex.</p> <p>Flow Measurement: Viscometer, manometer, Orifices and mouth pieces, sharp-crested weirs and notches, pitot tube, pitot-static tube and venturi meter.</p>

Sr. No.	Subject Title	Course Outline
		<p>Steady Flow through Pipes: Darcy-Weisbach equation for flow in pipes, Losses in pipelines, hydraulic grade lines and energy lines, Pipes in series and parallel. Transmission of energy through pipes.</p> <p>Uniform Flow in Open Channels: Chazy's and Manning's equation. Bazin's and Kutter Formula, Most economical rectangular and trapezoidal sections.</p>
22.	CE-232L Fluid Mechanics	<p>Lab/Practical:</p> <ol style="list-style-type: none"> 1. To study the Layout of Hydraulics and Fluid Mechanics Laboratories. 2. To determine the Viscosity of given Oil using a Redwood Viscometer. 3. Determination of Metacentric height of a floating body and to locate the position of its Metacenter and Centre of gravity. 4. To determine the magnitude of Hydrostatic thrust exerted on a submerged Curved Surface and to locate the Centre of Pressure. 5. To determine the coefficient of discharge of Notches (Rectangular and Triangular) and hence to calibrate it. 6. To determine the coefficient of discharge of a Venturi meter and hence to calibrate it. 7. To determine the hydraulic coefficients of various orifices (coefficients of Discharge, Velocity and Contraction). 8. To experimentally verify the Bernoulli's theorem.
23.	CE-235 Soil Mechanics	<p>Significance: Soil, rock and their types and formation. Physical properties of soil: water content, Voids ratio, porosity, degree of saturation, specific gravity, unit weight and their determination, mass-volume relationships.</p> <p>Soil Classification: Importance of classification tests, Atterberg's limits, grain size distribution, classification systems.</p>

Sr. No.	Subject Title	Course Outline
		<p>Geotechnical Investigation: Soil exploration, purpose and methods of soil exploration. Probing, test trenches and pits, auger boring, wash boring, rotary drilling, and geophysical methods, soil samplers, disturbed and undisturbed samples, Introduction to geotechnical report writing.</p> <p>Permeability and Seepage: Darcy's law, factors affecting permeability, laboratory and field determination of permeability, capillary and its effects. Seepage force, Introduction to flow net, Estimation of seepage quantity, Quicksand condition and Sand boiling filters.</p> <p>Compaction: Fundamentals, Moisture density relationship, compaction standards, factors affecting compaction, field control and measurements of in-situ density, Field compaction equipment.</p> <p>Consolidation: Mechanics of consolidation, theory of one-dimensional consolidation, assumptions and validity, compression index, coefficient of compressibility, time factor, coefficient of volume change and degree of consolidation, primary and secondary consolidation, Normal and pre-consolidated soils. Creep, and differential settlement.</p> <p>Shear Strength: Concept, parameters, Coulomb's law, 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.</p> <p>Bearing Capacity of Soils: Definition of ultimate and safe bearing capacities, allowable bearing capacity, gross and net bearing capacities, Methods of obtaining bearing capacity: Presumptive values from codes; merits and demerits, From plate load test, Bearing capacity theories, Bearing capacity from SPT and CPT data.</p> <p>Introduction to Foundation Engineering: Types of slopes, Factors affecting stability and remedies. Types of failure, Methods of analysis; Swedish circular method, Taylor's slope stability number and Bishop's methods.</p>
24.	CE-235 L Soil Mechanics	<p>Lab/Practical:</p> <p>1. Determination of Moisture Content of soil</p>

Sr. No.	Subject Title	Course Outline
		2. Use of Speedy moisture meter 3. Determine the Specific gravity of soil 4. Sieve analysis 5. Particle size distribution of soil passing a particular size of sieves 6. Liquid limit of a given soil 7. Plastic limit of a given soil 8. Determine the density of soil by core cutter method 9. Determine the density of soil by sand replacement method 10. Compaction 11. Determine the coefficient of permeability of soil 12. Determine the coefficient of permeability of soil by falling head perimeter
25.	MA-242 Engineering Statistics	Introduction & role of statistics in engineering. Population & samples, Variables, Methods of displaying data sets, Stem & leaf display, Histogram, Histogram shapes, Boxplot, Bar chart, Pareto diagram, Dot diagram, Frequency distributions & their graphs, Outlier. Mean, Median, Quartile, Percentile, Range, Deviation from mean, Sample variance, Sample standard deviation, Coefficient of variation. Probability, Concepts & definitions, Basic theorems of probability, Law of total probability, Bayes theorem, Discrete and continuous random variables and their probability distributions, Density and distribution functions; Expectation. Mean & variance of discrete & continuous random variables, Binomial distribution, Poisson distribution, Normal distribution, t-distribution, Chi- square distribution, F-distribution. Sampling techniques and sampling distribution; Point estimation and interval estimation of parameters, Least square linear & polynomial regression, Linearization of nonlinear models, Correlation, Design of experiments, Analysis of variance. Use and applications of SPSS. Hypothesis testing
26.	IS-209L/IS-213L Fehm-ul- Quran/Social Ethics-II	Present Tense صيغة جمع مذكر غائب مثل يعبدون Present Tense صيغة جمع مذكر غائب مثل يعبدون Present Tense صيغة مفرد مذكر مخاطب (تعبد (و جمع مذكر مخاطب (تعبدون) Present Tense صيغة جمع مذكر مخاطب (تعبدون)

Sr. No.	Subject Title	Course Outline
		<p>صيغة المتكلم (أعبد) Present Tense صيغة جمع المتكلم (نعبد) Negative Imperative صيغة المفرد و صيغة الجمع لا تعبد لا تعبدوا (مصدر) مصدر (موول) Conditional Sentences & masdar moawal لام الجود (Laam ul jhood) (لام التعليل) Laam uttaleel Present with object pronouns & Passive Voice</p> <p>Past Tense صيغة المفرد الغائب Past Tense صيغة المفرد الغائب Past Tense صيغة المفرد الغائب Past Tense صيغة المفرد الغائب Past Tense صيغة المفرد الغائب Mid Term Past Tense صيغة الجمع للغائب عبدوا Past Tense صيغة الجمع للغائب عبدوا Past Tense صيغة الجمع للغائب عبدوا Past Tense صيغة الجمع للغائب عبدوا Past Tense صيغة الجمع للمتكلم عبدنا Past Tense صيغة الجمع للمتكلم عبدنا Past Tense صيغة الجمع للمتكلم عبدنا Past Tense</p>

Sr. No.	Subject Title	Course Outline
		صيغة الجمع للمتكلم عبدنا Past Tense صيغة الجمع للمخاطب عبدتم Past Tense صيغة الجمع للمخاطب عبدتم Past Tense صيغة المتكلم والمخاطب عيبت Past Tense صيغة المؤنث للغائب عيبت Passive Voice (Past Tense) فعل مجهول للمفرد Passive Voice (Past Tense) فعل مجهول الجمع Imperative Verb for singular فعل الأمر للمفرد Imperative Verb for plural فعل الأمر للجمع
27.	HU-200 Technical Report Writing	Introduction to Technical Communication, The Writing and Proofreading Process, Paragraph Writing, Business Correspondence and Employability Skills, Writing Practice, Writing Technical Reports, Introduction to Research Writing and Report Writing, Writing Reports, Publishing and Presenting Reports, Report Defence
Semester-4		
28.	EnE-225L Occupational Health & Safety	Principles of public health, communicable and non-communicable water borne diseases, food borne, air borne and sanitation related diseases and control measures. Industrial- Nuclear hygiene & safety, accident prevention, and elimination plans, fire protection techniques, safety equipment. Introduction to Occupational Health & Safety: Overview of occupational health and safety (OHS) concepts. Hazard Identification and Risk Assessment: Types of hazards (e.g., physical, chemical, biological, ergonomic), Hazard identification techniques, Risk assessment methodologies, Documentation of identified hazards and risks. OHS Regulations and Standards: Overview of relevant OHS regulations and standards (e.g., OSHA, ANSI, ISO), Compliance requirements for engineering projects, Safety Procedures and Protocols: Practicing the use of personal protective equipment (PPE), Implementing safety procedures for specific tasks (e.g., working at heights, excavation), Emergency response drills and simulations. Occupational

Sr. No.	Subject Title	Course Outline
		health and safety in Pakistan, Labor code of Pakistan. Risk assessment and management. HSE plan, (SWOT analysis, PDC analysis, Fish bone analysis, Preparation of HSE plan, its implementation and reporting system, HACCP Studies). Industrial nuclear and occupational rules in Pakistan, agricultural pesticides rules, 1973, agriculture pesticides ordinance, 1971, ISO-14000, ISO-14001. ISO 45001. OHSAS-18001, Pakistan nuclear regulatory authority (PNRA) Regulations Pakistan 904, 'Regulation on Radiation Protection-2004' Introduction to the principles of toxicology as applied to environmental engineering. Health hazards and toxic effects of chemicals, radioactivity, transport, storage & use of toxic chemicals-radio nuclides. Lab related standards ISO 17025. Introduction to NEBOSH.
29.	CRP-220 GIS and Remote Sensing	Introduction, Definition, Key components, Functional subsystem, Raster Data Model, Vector Data Model, Conversion Between Raster and Vector Data Models, ArcGIS supported data formats, File Geodatabase and tables, Data Sources , Data Capturing Techniques and Procedures, Data Transformation, Visualization of spatial volumes , Graphical variables , Data Classification Graphic approach , Overlay Analysis , Introduction to Global Positioning System (GPS) , Spatial Analysis , Network and Overlay analysis, 3D Analysis, Buffering , Spatial data quality and components of data quality , Micro level components , Macro level components, Sources of errors, Project work, Earth Model a. Representing the Earth b. Map Projections c. Geographic and projected coordinate systems.
30.	CRP-220L GIS and Remote Sensing	Introduction to GIS lab, Viewing, Projecting, Digitizing (editing and creating GIS data), Spatial and non-spatial Queries, Processing tabular data, Geo-processing, Geo-referencing, Spatial Analysis, Modeling, Presenting maps (labeling, layouts), ESRI online courses, Raster/Vector data display, Scanning, Digitization, Coordinated based point mapping map layout, Data classification, Handling topological errors, Overlays and Network analysis , Satellite image , Future population planning , Preparation of land use map, Viewing, Projecting, Digitizing (editing and creating GIS data), Spatial and non-spatial Queries, processing tabular data, Geo-processing, Geo-referencing, Spatial Analysis, Modeling, Presenting maps (labeling, layouts). Theissen polygon, Watershed analysis using GIS. GIS applications for water supply, sewerage, and drainage design projects/ software. Use of overlay analysis for environmental assessment
31.	ME-238 Thermodynamics	Basics of Thermodynamics: The system, working substance, heat and work, state and properties, temperature scales, processes and cycles, PV diagram, Internal energy, specific heats. Ideal gas laws. Equation of state, first law of thermodynamics, system and control volume concept. Application of processes. Second law of thermodynamics and its consequences, reversibility, heat engines, thermal

Sr. No.	Subject Title	Course Outline
		<p>efficiency of reversible and irreversible engines, the Carnot cycles, internal combustion engines and their environmental impacts, available and unavailable energy, isentropic process, enthalpy-entropy diagram.</p> <p>Physical properties of Steam: The formation of steam, the triple point, quality of steam, sub-cooled liquid, enthalpy of steam, Steam tables, P-V diagram for steam, the critical point, behavior of vapor in different thermodynamic processes.</p> <p>Air Standard Cycles: Otto, Diesel, Dual Brayton, Ericsson, Sterling cycles and their applications</p> <p>Properties of Mixtures: Dalton's law and the Gibb's Dalton law, Volumetric analysis of gas mixtures, molar mixtures and specific gas constants.</p> <p>HAVC Systems: Types, principles and their impacts on the environment</p>
32.	ME-238L Thermodynamics	<p>Lab /Practical:</p> <ol style="list-style-type: none"> 1. Calibration of bourdon pressure gage 2. Study car engine and its transmission system 3. Study of spark ignition engines 4. Study of compression ignition engines 5. Determine the brake power, fuel consumption, specific fuel consumption and air to fuel ratio of Stuart diesel engine 6. Study of characteristics curve of Ruston diesel generator set. 7. Study of heat balance sheet of matchless diesel engine. 8. Determination of area of actual PV diagram with the help of polar plan meter
33.	CE-240 Engineering Drawings and CAD	<p>Part I- Engineering Drawing:</p> <p>Need and requirements of drawings for environmental engineering projects. General nature of drawings, components and symbols and nomenclature needed for specific drawings such as architectural, structural, plumbing, electrical, roads and earth work. Drawings at different stages of projects. Field specific drawings</p>

Sr. No.	Subject Title	Course Outline
		<p>(water supply and sewerage, overhead water tank, water/wastewater treatment plant etc.) Elements of perspective drawings.</p> <p>Types of lines. Lettering, dimensioning, drawing instruments, planning of drawing sheet. Types of projections, orthographic projections, plane of projections</p> <p>Isometric and pictorial projections of solids/machine parts. Making of freehand sketches from solid objects and from orthographic projections. Sections of joints and, screw thread systems, nuts and bolts, pipe connections, preparation of pipelines and sewer profiles (longitudinal section, etc.) drawings</p> <p>Part II- Computer Aided Drawing and Drafting:</p> <p>General and basic knowhow related to computer aided drafting, e.g. coordinate system, drawings set up procedure, basic drawing commands, basic edit commands, layers, creating text and defining styles options, block and drawing import/export options, Cross hatching, save and plot 2D and isometric drawings.</p>
34.	CE-240L Engineering Drawings and CAD	Practical related to the topics covered in theoretical sections.
35.	CE-210 Structural Systems	Type of structures and types of loads, structure materials and their behaviors, stresses and strains, application of concepts of mechanics for analysis, stability and determinacy, Analysis of determinate structures, trusses, beams and frames, Basic concepts of deign of concrete and steel structures.
36.	CS-103 & 103L Introduction of Computer Programming for Data Science	Introduction to Computers and Python: Overview of Hardware and Software, Operating Systems, Python and other Programming Languages, Internet and World Wide Web, Software Technologies, How Big Is Big Data? Test-Drive: Using IPython and Jupyter Notebooks. Data Science: Case Study— A Big-Data Mobile Application. Introduction to Python Programming: Variables and Assignment Statements, Arithmetic operators, Function print and an Intro to Strings, Getting Input from the User Data Science: Basic Descriptive Statistics. Conditional Statements Boolean Operators and, or and not, The if Statement and Comparison Operators, Algorithms, Pseudocode, Control Statements, if Statement, if...else and if...elif...else Statements. Repetition Structures Sequence-Controlled Repetition, Sentinel-Controlled

Sr. No.	Subject Title	Course Outline
		<p>Repetition, Nested Control Statements, break and continue Statements, Data Science: Measures of Central Tendency— Mean, Median and Mode. Functions Defining Functions, Functions with Multiple Parameters, Random-Number Generation, Case Study: A Game of Chance, Python Standard Library, math Module Functions, Default Parameter Values, Keyword Arguments, Scope Rules, import: A Deeper Look, Function-Call Stack Data Science: Measures of Dispersion. Case Study: Processing sample dataset in python. Sequences: Lists and Tuples Lists, Tuples, Unpacking Sequences, Sequence Slicing, del Statement, Passing Lists to Functions, Sorting, Lists, Searching Sequences, Simulating Stacks with Lists, Two-Dimensional Lists Data Science: Simulation and Static Visualizations. Dictionaries and Sets Creating a Dictionary, iterating through a Dictionary, Basic Dictionary Operations, Dictionary Methods keys and values, Dictionary Comparisons, Comparing Sets, Mathematical Set Operations, Mutable Set Operators and Methods, Set Comprehensions, Data Science: Dynamic Visualizations. Array-Oriented Programming with NumPy Creating arrays from Existing Data, array Attributes, Filling arrays with Specific Values, Creating arrays from Ranges, List vs. array Performance, NumPy Calculation Methods, Indexing and Slicing, Views: Reshaping and Transposing Data Science: pandas Series and DataFrames. Manipulating Strings Formatting Strings, Concatenating and Repeating Strings, Stripping Whitespace from Strings, Other String manipulation functions Data Science: Pandas, Regular Expressions and Data Munging. Files and Exceptions Files, Text-File Processing, Updating Text Files, Serialization with JSON, Focus on Security: pickle Serialization and Deserialization, Handling Exceptions Data Science: Working with CSV Files.</p>
37.	IS-203 Ideology and Constitution of Pakistan	<p><u>Ideology of Pakistan:</u></p> <ul style="list-style-type: none"> • Definition and explanation of Ideology, Historical Background with reference to Shah Wali Ullah, Sir Syed Ahmad Khan, Ali Gargh and other movements • References from the Speeches and Statements of Allama Dr. Muhammad Iqbal and the Quaid I Azam Muhammad Ali Jinnah. • The Role of Women and Students in Freedom Movement. • Aims and Objectives of the creation of Pakistan: Sovereignty of Allah, Islamic Democracy, Balanced Economic System, Protection of Muslim Civilization and Culture, Protection of Minority Rights, Unity of Muslim World, Self Sufficiency and Rule of Law. <p><u>Ideological Awakening during 20th Century Colonial British India:</u></p> <ul style="list-style-type: none"> • Evolution of Two Nation Theory, Urdu-Hindi Controversy, Partition of Bengal, Simla Deputation. • Establishment of All India Muslim League (AIML): Objectives, Organization and Achievements. • Khilafat Movement and Non-Cooperation movement. • 14 Points of Jinnah, Iqbal’s Allahabad Address 1930 and Pakistan Resolution 1940.

Sr. No.	Subject Title	Course Outline
		<ul style="list-style-type: none"> • Emergence of the First Ideological Muslim State: Pakistan, Initial Problems and efforts to cope with, under the leadership of Quaid I Azam: The Governor General and Liaqat Ali Khan: The Prime Minister. <p><u>The Constitutions of Islamic Republic of Pakistan:</u></p> <ul style="list-style-type: none"> • Basic Concept of State and Constitution, Nationalism, Polity and Types of Governments (Parliamentary and Presidential), Organs of the State: The Legislature, The Executive and The Judiciary. • Distribution of Powers in the Constitution: The Federal List, The Provincial List and The Concurrent List. • Major Causes of Delay in the Process of Constitution Making in Pakistan: Geographical Position of East Pakistan and West Pakistan, Nature of the State (Islamic vs Secular), and Federalism. • The First Constituent Assembly 1947-1954: Historical Address of the Quaid I Azam in the Inaugural Session on 11th August 1947. The Objectives Resolution 1949 and Basic Principles Committee's Reports. • The Second Constituent Assembly and Parliamentary Constitution of 1956. • The Presidential Constitution of 1962. • The Constitution of 1973: Salient Features, Fundamental Rights (Articles 8-28), Principles of the State Policy (Articles 29-40), Responsibilities of the Pakistani Citizens (Article 5) and Islamic Provisions. • Procedures of Amending the Constitution, Major Amendments in the Constitution of 1973 and their Impact on Pakistan's Polity.
Semester-5		
38.	CRP-301 Sustainable Urban Planning	Introduction to urban planning and sustainable development- definitions and concepts. Process and scope of urban planning; Hierarchy of settlements; Urban forms and sustainability; Sustainability and compatibility of land uses; Urbanization-causes and impacts of urbanization/urban development on environment in general and on water resources, sanitation, solid waste management in particular; Transport and the environment; Urban planning and disaster management. Development plans in Pakistan-Master and structure plans etc. Strategies for improvement of urban environment through urban planning and urban agriculture/urban farming etc.

Sr. No.	Subject Title	Course Outline
39.	EnE-331 Water Supply and Wastewater Engineering	<p>Water supply. introduction. Significance of fresh water. Water consumption, factors affecting water consumption, variation in water consumption. Water supply and sewerage in Pakistan. Design Period. Population projections to estimate future population and water demands. Components of water supply system: (1) water source, initial investigation for selecting water source, design and construction of tube wells. Well troubles and their solution. Sources based on surface waters and design considerations; (2) Hydraulics of pipe flow Water transmission mains/rising mains and design; (3) water treatment (will be covered in 8th semester) and (4) distribution system; Hardy Cross method for pipe network analysis, design of water distribution systems and use of EPANET software, construction, testing and commissioning of distribution systems, Water hammer and its control Overhead reservoirs, their function, location and capacity. Different varieties of water supply pipes, Pipe and pumps, valves and fire hydrants used in water supply systems. Drinking water quality and human health. Water quality guidelines and standards. WHO guideline for drinking water quality. Introduction of SCADA system.</p> <p>Wastewater Engineering: Components of wastewater (1) collection system. Sewer layouts, types of sewer systems, sanitary and storm sewers. Design of partially combine sewers, Storm sewers and Storm water management. Sewer appurtenances. Hydraulics of sewers. Design of sanitary and storm sewers. Loads on sewers using Excel spreadsheet. Sewer pipes and beddings. Construction of sewers. Quality control tests. Design of (2) wastewater pumping stations. Operation and maintenance of water supply and sewerage systems. (3) wastewater treatment (will be taught in 8th term). Economics of water supply and sewerage system. Health risks/problems associated with faulty design and configurations of Water Supply and Sewage Network. Basic concepts of Plumbing in multi-storied building; design criteria, methods used.</p>
40.	EnE-331L Water Supply and Wastewater Engineering	<p>Design of Water Supply System for a given Housing Scheme using EPA.NET/Water GEMS software. Design of Sewerage System for a given Housing Scheme using Excel spreadsheet/Sewer GEMS software.</p>
41.	MGT-105 Introduction to Economics	<p>Basic Principles of Economics; Scarcity and Choice; Microeconomics Versus Macroeconomics; Market Forces of Demand and Supply; Price Elasticity; Production Function and Costs of Production; Theory of Consumer Behavior; Theory of Firm and Market Structure: Competitive Market; Monopoly; Measuring a Nations' Income; Production and Growth; The Markets for the Factors of Production (Labor Market); Supply</p>

Sr. No.	Subject Title	Course Outline
		Side Vs Demand Side Policies; Economic Cycles; Inflation Policy Measure to Tackle Inflation; Balance of Payment; The Influence of Monetary and Fiscal Policy
42.	EnE-323 Solid Waste Management	<p>Sources (municipal, industrial, hospital, nuclear, etc), Types, Generation, Compositions, and Properties: physical, chemical and biological, Waste Assessment and Characterization Studies (WACS). Regulatory compliance. Waste minimization and recycling. Waste collection, Transfer, Scavenging, Transport and Disposal.</p> <p>Disposal and Management Techniques: Composting and its types, Incineration and its impacts. Immobilization, waste to energy, refused derived fuel, and pyrolysis. Landfill types, siting and design considerations. Landfill as bioreactor. Design of landfill, Control of landfill leachate & gases – environmental monitoring system for landfill sites. Landfill closure and use. Recycling and reuse of various types of solid waste.</p> <p>Sources and nature of hazardous waste Biological Waste (hospital, pathological, slaughterhouse, poultry/animal farmhouse waste). Chemical Waste (Industrial, nuclear, radioactive) impacts on environment. Disposal of hazardous waste:</p>
43.	EnE-323L Solid Waste Management	<ul style="list-style-type: none"> • Characterization of solid waste. • Determination of moisture content of solid waste. • Determination of organic substance of solid waste. Estimation of pH of solid waste, Determination of carbon to nitrogen (C/N) ratio of solid waste for compost analysis. · Determination of Phosphorus content of solid waste. Determination of chlorides in solid. · waste, Design of an integrated solid waste management system, Field Visits. <p>Problem Based Learning (PBL)</p>

Sr. No.	Subject Title	Course Outline
		Complex Engineering Problem (CEP)
44.	EnE-325 Environmental Engineering Lab Techniques	<p>Introduction to standard methods of analysis. Quality assurance and quality control programs i.e. standard solutions preparation, calibration of instruments, QC checks etc. Collection and preservation of samples. Principles and methods for monitoring and discrete sampling of environmental media, including surface water, ground water and wastewater. Environmental significance and determination of water quality parameters like solids, BOD, COD, DO, hardness, alkalinity, turbidity, Kjeldal nitrogen, Total and fecal coliforms according to the standard methods. Data management, Methods data quality objectives, data presentations and interpretations.</p> <p>Introduction and principles of instrumental techniques such as IR, UV-Visible spectrophotometer, HPLC, GC, AAS, and MS. Application of selected instrumental techniques for the determination of particulate matter, poly aromatic hydrocarbon, toxic metals, and other trace organics. Use of field instruments and test kits e.g. coliform, fecal coliform, E.Coli. Nitrate etc.</p>
45.	EnE-325L Environmental Engineering Lab Techniques	<p>Lab/Practical:</p> <ol style="list-style-type: none"> 1. Determine the Lambda Max values of heavy metals by UV-Visible Spectrophotometer. 2. Study of Beer-Lambert's Law by UV-Visible Spectrophotometer. 3. To determine the concentration of copper in water samples by using UV-Visible spectrophotometer. 4. To determine the concentration of nickel in water samples by using UV-Visible spectrophotometer. 5. Estimation of poly aromatic hydrocarbons in air samples. 6. Estimation of total particulate matter in air. 7. Estimation of toxic metals in liquid/solid samples using Atomic Absorption Spectrometer. 8. To determine the dissolve oxygen (DO) in water. 9. To determine the BOD of wastewater. 10. To determine the COD of wastewater sample. 11. To determine the chlorine demand and residual chlorine. 12. Estimation of total nitrogen in solid/liquid sample. 13. Estimation of inorganic nitrogen in solid/liquid sample.

Sr. No.	Subject Title	Course Outline
		<p><u>Open Ended Lab</u></p> <p><u>PBL</u></p>
46.	<p>CE-333 Engineering Hydrology</p>	<p>Introduction: Hydrology, Hydrological cycle, Importance and practical uses of hydrology.</p> <p>Meteorology: The atmosphere and its composition, solar radiation as a source of heat, air temperature, relative humidity, dew point. Saturation deficit. Measuring devices of above-mentioned parameters. Global climate change.</p> <p>Precipitation: Types of precipitation, factors necessary for precipitation, measurement of precipitation, interpretation of precipitation data, and computation of average rainfall over a basin.</p> <p>Evaporation and transpiration: factors affecting evaporation, measurement of evaporation, evapotranspiration.</p> <p>Stream Flow: water stage and its measurement, selection of site for stage recorder, selection of control and metering section, methods of measurement of stream flow, interpretation of stream flow data.</p> <p>Runoff & Hydrographs: factors affecting runoff, estimating the volume of storm runoff. Characteristics of hydrographs, components of a hydrograph, hydrograph separation, estimating the volume of direct runoff, introduction to unit hydrograph concept, S-curve, Application of probability in determining maxima/minima of discharge. Types of histogram and distribution.</p> <p>Stream flow routing: Introduction to floods and its causes, frequency and duration analysis. Reservoir routing, channel routing. Flood Control.</p> <p>Groundwater: Introduction, sources and discharge of groundwater. Water table and confined and unconfined aquifers, groundwater hydraulics, pumping test.</p>

Sr. No.	Subject Title	Course Outline
47.	CE-333L Engineering Hydrology	<p>Lab /Practical:</p> <ol style="list-style-type: none"> 1. To develop relationship between Temperature and Saturation Vapor Pressure of a parcel of air and determine Saturation Deficit, Relative Humidity and Dew Point Temperature for given conditions. 2. To Check the Consistency of Precipitation Data. 3. Determine Average Precipitation over a Catchment Area using: <ul style="list-style-type: none"> • Arithmetic Mean Method • Thiessen Polygon Method • Isohyetal Method 4. . Extension of Rating Curve using Logarithmic and Chezy's methods 5. Derivation of Unit Hydrograph from Hydrograph of an Isolated Strom. 6. Construction of S-Curve. Derivation of Unit Hydrograph of various durations using S-Curve Technique. 7. Determination of Storativity and Transmissivity of confined aquifer by using Theis Methods
6th Semester		
48.	EnE-326 Environmental Impact Assessment and Management	<p>Introduction to environmental impact assessment: Definitions, Basic concepts, Types of Assessment IEE & EIA. Strategic Environmental Assessment Decision-making theory and practice: EIA as a decisions-making instrument. Implementation of EIA: Role of government (EPAs, EPDs etc.)</p> <p>Role of governments and EIA legislation . Environmental impact assessment process. Screening and scoping techniques. Importance of baseline data. Impact identification methods and techniques. Remedial measures.</p> <p>Environmental management plan (EMP). Role of public consultation and participation in EIA process. Key documents required to submit report in EPA. Guidelines for the preparation of IEE/EIA Reposts. Impact assessment methods and techniques (Adhoc, checklist, matrices, networks, overlays, GIS techniques, Introduction of air & noise modeling utilization (Simulation models), Cost benefit analysis). Mitigation (importance, approaches and methods) and identification of suitable alternatives, minimization of pollution and remedial measures, Analysis of Alternatives. LARP. Environmental impact assessment and</p>

Sr. No.	Subject Title	Course Outline
		<p>management of selective development projects- Case Studies, Introduction of cumulative impact assessment (CIA) and strategic environmental assessment (SEA)</p> <p>PBL</p>
49.	<p>EnE-337 Principles and Design of Water Treatment</p>	<p>Types of Reactors in Environmental Engineering: Batch and continuous flow reactors. Plug flow and completely mixed flow reactors. Completely mixed flow reactors with and without solids recycle.</p> <p>Unit Operations & Processes: General process flow diagrams of typical water treatment plants for ground water, surface water and sea water sources. Water Treatment: Rationale for water treatment,</p> <p>Principles and design of physical and chemical processes for water treatment: Coagulation, Flocculation, Sedimentation, Filtration, Softening, Disinfections, Adsorption and Membrane filtration (micro filtration, ultra filtration, nano filtration, reverse osmosis and electro dialysis).</p>
50.	<p>EnE-337L Principles and Design of Water Treatment</p>	<p>Lab /Practical:</p> <ol style="list-style-type: none"> 1. Layout of laboratory 2. Experimental setup of different reactors for various detention times, overflow rates, surface loading and volumetric loading rates. 3. Comparison of actual flow through period of a completely mixed flow reactor with detention time and theoretical flow through period. 4. Study characteristics of suspensions from discrete particle settling 5. Study of the effect of pH on coagulant dose 6. Study of the effect of nature of particles on coagulant dose 7. Study of the effect of concentration of particles on coagulant dose 8. Study of the effect of pre-sedimentation on coagulant dose. 9. Determination of effective size and coefficient of uniformity of given filtration media 10. Determination of chemical requirements for removal of a carbonate hardness 11. Determination of chemical requirements for removal of non- carbonate hardness. 12. Decay of chlorine residual on different types of water

Sr. No.	Subject Title	Course Outline
		<p>13. Determination of chlorine dose for different types of water</p> <p>Complex Engineering Problem (CEP)</p>
51.	<p>ChE-320 Cleaner Production Techniques</p>	<p>Cleaner production and sustainable development. Cleaner production principles and phases. Cleaner production plans and strategies for implementing Cleaner production plans. Cleaner production and eco efficiencies. Environmental management systems, closed loop operations, Detailed chemical/ material flow analysis. Renewable energy resources. Life cycle design and impact assessment. Study of various hindrances and barriers during CP implementation, Closed loop operations, Methodology and framework for clean production, Global clean production network, Corporate social responsibility by Industry, Incentives for CP investment. Waste minimization; reuse of waste products. Specific examples from industry where the methods of Cleaner production have been applied. Software to determine carbon credits.</p>
52.	<p>CE-345 Water Resources and Irrigation Engineering</p>	<p>Water resources: Planning and development of water resources projects. Domestic industrial agricultural and other water usage. Water resources in Pakistan.</p> <p>Irrigation: Definition and types of irrigation, merits and demerits of irrigation, Indus basin irrigation system. Indus water treaty and water accord 1991.</p> <p>Canal irrigation: Canal regulator, falls, flumes, canal outlet. Cross drainage work, type, and function. Canal lining. Maintenance of irrigation canals. Monitoring of flows telemetry systems. Design of irrigation channels. Kennedy's and Lacey's theories. Comparison of various methods.</p> <p>Dams barrages & headwork: Elementary concept about canal headwork, selection of their site and layouts, weirs and barrages, various components and functions, measures adopted to control silt entry into canals, silt ejectors and excluders. Classification of dams, sedimentation control. Estimation of storage capacities of dams.</p> <p>Irrigated agricultures: Irrigation method and practices, Irrigation scheduling, management of Irrigation systems, participatory Irrigation management.</p>

Sr. No.	Subject Title	Course Outline
		<p>Water logging and salinity: Causes and effects of water logging, reclamation of water-logged soils, drains and tube wells, causes and effects of salinity and alkalinity in lands of Pakistan.</p> <p>Drainage: Definition, land reclamation, surface drainage, subsurface drainage, cross-drainage structures. Disposal of drainage effluents</p>
53.	<p>CE-346 Project Management and Construction Supervision</p>	<p>Project planning & Management: Introduction to project planning and management: Project planning and cost estimation: Preparation of feasibility reports. Rough cost and detailed estimates for environmental engineering projects including preparation of bill of quantities (B.O.Q)/Engineering Estimates. Scheduled and nonscheduled rates. Analysis of rates. Project approval processes in Pakistan. Introduction to contracting and tendering, developing project team, defining role of team players, developing leadership skills Critical path method (CPM): Principles and use of CMP in environmental projects Managing the project scope, time, work flow (Gantt Charts, Network diagram, Pert Charts, CPM, etc.), project resources, project quality, project human resource requirements, Manual versus computer analysis of Critical path method.</p> <p>Project planning, Scheduling and Controlling: Scheduling resources, delivery materials, scheduling manpower; financing the project, job layout, project control during construction, keeping equipment records, project supervision. Construction cost control, cost control records. Use of computer software like MS Project and Primavera P6 in project management Introduction to claims and conflict resolution; escalation, indexation, arbitration and litigation. Documentation of PC-1, PC-II, PC-III, PCIV PPRA rules.</p> <p>Construction Supervision: Objectives, Supervision Management, Supervision of Construction works, Duties of Client, Consultant and Contractor, Site Supervision Team, Inspection requirement. Quality Management: Principles of Quality Management, Total quality management, Application of ISO 9000 in construction. Format of Progress Report to be generated by the resident engineer for the work in progress</p> <p>Masonry Construction: Types of stone, brick and block masonry. Bonds in brick masonry. Dampness in buildings, causes and remedial measures. Concrete Construction: Batching, Mixing, Transportation and compaction of concrete, Concrete construction. Quality control in concrete construction</p>

Sr. No.	Subject Title	Course Outline
54.	MA-346 Numerical Methods	<p>Overview of numerical techniques in engineering and its applications.</p> <p>Solution of non-linear equations: Iteration, bracketing methods for locating roots, initial approximation and convergence criteria, Newton Raphson and Secant methods.</p> <p>Interpolation and polynomial approximation: Taylor series, intro to interpolation, Lagrange approximation, Newton polynomials, Chebyshev polynomials.</p> <p>Curve fitting: Least squares line, curve fitting, interpolation by spline functions, Fourier series and trigonometric polynomials.</p> <p>Numerical differentiation: approximating the derivative.</p> <p>Numerical integration: Introduction to quadrature, composite trapezoidal and Simpsons rule, recursive rules and romberg integration gauss legendre integration.</p> <p>Solution of differential equations: Taylor series method, Eulers method, Runge Kutta method and finite difference method.</p> <p>Solution of partial differential equations: Hyperbolic Equations, Parabolic Equations, Elliptic equations.</p>
Semester-7		
55.	EnE-435 Air and Noise Pollution Control	<p>Air pollution: Air pollutants (Indoor and Outdoor) and their sources. Effect of air pollution on human health and environment. Stationary and mobile sources. Fuel and engine based air pollution, vehicular exhaust emissions, test procedures and control. Air Quality Regulations: Air pollution index. Legislation and regulations in Pakistan. National standards for ambient air quality, vehicular and industrial emissions. Basic Meteorological Processes: Basic terminologies (Haze, smog, fog etc). Atmospheric lapse rate and thermodynamics, Wind velocity and wind rose, Atmospheric stability, Boundary layer concept, Effect of Meteorology on Plume Rise and Dispersion. Elementary study of dispersion models. Regional and Global air pollution Issues: Ozone Depletion and Acid Rain. Methods used for controlling air borne emissions of gases, aerosols and organic vapors. Climate Change: Causes and role of air pollution in climate change, role of CO2 concentration in climate change, global climate, change and Pakistan's water resources. Air</p>

Sr. No.	Subject Title	Course Outline
		Pollution Control Devices/ Technologies: Electrostatic, precipitators, Cyclone separators, Fabric filter, Scrubbers. Flue gas desulfurization systems. Carbon capture and storage. Radioactive pollution: Sources, causes and control. Noise pollution: Sources and effects on human health. Engine based noise pollution, noise quality standards in Pakistan. Noise dispersion modelling. Monitoring and Control strategies of noise pollution.
56.	EnE-435L Air and Noise Pollution Control	<p>Lab/Practical:</p> <ol style="list-style-type: none"> 1. Calculate the daily production of carbon monoxide, carbon dioxide, hydrocarbons, oxides of nitrogen and particulate matter by vehicles in Lahore by using Emission Factors. 2. Measurement of Noise Pollution by Noise meter. 3. Estimation of PM by weight difference method. 4. Estimation of CO and CO₂ by Cox analyzer. 5. Estimation of Oxides of Sulfur by SO_x analyzer. 6. Estimation of Oxides of Nitrogen by NO_x analyzer. 7. Study of working and principle of Air Sampler for ambient air sampling. 8. Demonstration on the use of "AERMOD" (demo version) 9. Calculations of greenhouse gases emissions by software <p>Complex Engineering Problem</p> <p>Problem Based Learning</p>
57.	EnE-436 Principles and Design of Wastewater Treatment	<p>Wastewater treatment: Rationale and need of wastewater treatment, Characterization of wastewater and flow measurement, General process flow diagrams of wastewater treatment plants. Site selection for wastewater treatment plants. Geotechnical considerations. Plant layout and landscape.</p> <p>Principles and Design of physical (preliminary and primary) wastewater treatment units: Equalization basins, Screens, Grit chambers, primary sedimentation tanks</p> <p>Principles and Design of biological (secondary) wastewater treatment processes: Role of microorganisms in wastewater, types of biological processes, kinetics of microbial growth, kinetics of substrate utilization, kinetics of biomass growth, effect of endogenous metabolism, Activated sludge process (CSTR with</p>

Sr. No.	Subject Title	Course Outline
		recycle) including secondary sedimentation tank. Aerated lagoons (CSTR without recycle). Trickling filters, Waste stabilization ponds, Constructed Wetlands, Membrane bioreactors, Advanced oxidation process Principles and Design of Tertiary treatment: Biological nitrification and denitrification. Biological phosphorous removal, Advanced oxidation processes, filtration, Disinfection Principles and Design of Sludge handling and treatment facilities: Sludge thickening, digestion (aerobic and anaerobic), sludge dewatering, Hydraulic design and hydraulic profile of wastewater treatment plants Troubleshooting of water and wastewater treatment plants
58.	EnE-436L Principles and Design of Wastewater Treatment	Lab/Practical: <ol style="list-style-type: none"> 1. Study of characteristics of wastewater 2. Statistical analysis of wastewater flowrates & calculation of mass loading 3. Design and calculations of flow measurement device 4. Design of physical unit operations (Screens and Grit Chamber) 5. Design of physical unit operations (Equalization Tank) 6. Design of physical unit operations (Primary Clarifier) 7. Design of physical unit operations (Aeration Tank) ,Aeration methods and Aeration devices 8. Design of Secondary Treatment processes 9. Design of Tertiary Treatment processes 10. Development of hydraulic profile of treatment plant 11. Design of membrane processes for wastewater treatment <p>Plant Visit (Student will submit the report and their findings related to visit)</p> <p>Complex Engineering Problem (CEP)</p>
59.	EnE-432 Environmental Modeling	Introduction: Understanding of surface water & classification of water bodies, Basic considerations of wastewater disposal into water bodies, Disposal Criteria, Modeling of surface water, Hydrodynamics. Basic concepts of modeling: Transport phenomena and chemical reaction kinetics, Mass balance and waste load allocation principle. Mathematical modeling and analysis: Mathematical models, Model selection, Spatial and temporal resolution, Statistical analysis, Model calibration and validation. Water quality modeling of

Sr. No.	Subject Title	Course Outline
		<p> rivers: Characteristics of rivers, Hydrodynamics processes in river, Sediments and water quality processes in river, River modeling (point and distributed sources and sinks, models for conservatives and non-conservative substances, single and coupled systems, application of river quality models, bacterial decay, BOD and DO models, River water quality surveys for model calibration and verification, determination of optimal treatment levels). Introduction to various computer models used for River water quality modeling. Water quality modeling of lakes and reservoirs: Characteristics of lakes, Hydrodynamics processes in lakes, Sediments and water quality processes in lakes, Lake modeling (thermal stratification and eutrophication, phosphorus loading concepts etc.) Water quality modeling of estuaries and coastal waters: Tidal processes, Hydrodynamics processes in estuaries, Sediments and water quality processes in estuaries, Estuarine and coastal modeling Ground water modeling: Contaminant transport, Biotransformation in groundwater, Groundwater remediation. Air quality modeling: Introduction to Air quality modeling. Gaussian plume model and its applications. </p>
60.	EnE-432L Environmental Modeling	<ol style="list-style-type: none"> 1. Introduction of Model specifications 2. Model calibration and validation 3. Discussion on Waste load allocation principle 4. Numerical problems related to Waste load allocation principle 5. Discussion on Low flows and their use in Environmental modeling (Hydrological based and biological based flows) 6. Pollutants fate and transport in environment 7. DO sources and sinks, DO sag curve, Streeter-Phelps DO model 8. Numerical problems related to BOD, DO and Coliform modelling 9. Introduction to QUAL2K software 10. Introduction to WASP software <p>Complex Engineering Problem (CEP)</p> <p>Problem Based Learning (PBL)</p>

Sr. No.	Subject Title	Course Outline
61.	HU-003 International Language	To be opted from the concerned department
62.	HU-212 Civics and Community Engagement	<p>Definitions of civics, citizenship, and civic engagement Historical evolution of civic participation and community development</p> <p>Types and characteristics of effective citizenship: active, participatory, corporate, and digital, etc.</p> <p>Attributes of a responsible citizen</p> <p>Relationships between democracy and citizenship</p> <p>Structure and functions of government in Pakistan</p> <p>The relationship between democracy, dictatorship, and civil society</p> <p>Right to vote and importance of political participation and representation</p> <p>Overview of fundamental rights and liberties of citizens under the Constitution of Pakistan 1973</p> <p>Sustainable Development Goals (SDGs) Social issues in Pakistan</p> <p>Role of media</p> <p>Islamophobia, media, and multiculturalism</p> <p>Civic responsibilities/duties (family and society)</p> <p>b) Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, and civility, etc.)</p> <p>a) Concept, nature, and characteristics of community</p> <p>b) Community development and social cohesion</p> <p>c) Approaches to effective community engagement.</p> <p>d) Case studies of successful community driven initiatives</p> <p>a) Public discourse and public opinion</p> <p>b) Role of advocacy in addressing social issues</p> <p>c) Protesting peacefully and effectively</p> <p>d) Social action movements</p> <p>a) The use of digital platforms for civic engagement</p> <p>b) Cyber ethics and responsible use of social media</p> <p>c) Cyberbullying</p> <p>d) Digital divide and disparities (access, usage, socioeconomic, geographic, etc.) and their impact on citizenship</p> <p>Climate action</p>

Sr. No.	Subject Title	Course Outline
		a) Understanding diversity in society (ethnic, cultural, economic, and political, etc.) b) Children's rights, safety, and literacy c) Youth, women, and minority engagement in social development d) Animal rights e) Addressing social inequalities and injustices in Pakistan f) Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence Final presentations and display of projects and case studies
Semester-8		
63.	ME-481 Energy Resources & Management	<p>Energy and Power: Forms of energy: Mechanical energy, electrical energy, chemical energy, nuclear and thermal energy. Perspectives of world & local energy production and consumption, types of energy resources (Renewable & Nonrenewable, conventional, and non-conventional, commercial, and non-commercial). Economic incentives of energy resources. Theory and application of different energy resources (i.e., Biofuels, direct combustion of biomass, solar energy, wind energy technology, energy from hydropower, Geothermal energy, Wave and tidal and ocean thermal energy, Hydrogen from renewable energy sources and Energy from other natural sources). Environmental impacts of energy production and utilization. Value engineering and management. Energy economic decision making. Energy management and conservation. Efficient use of energy and energy Inefficiency. Green architecture and green city. Role of energy in green economy.</p>
64.	EnE-404 Ethics and Interpersonal Skills	<p>Introduction: The nature and importance of ethics in life. Values and the relationship between values and character virtues. The central importance of character virtues in creating a good life, academically, personally, and professionally. The concepts of educational values and virtues. An examination of key character virtues integral to a positive academic experience and career success.</p> <p>Key character virtues: The pursuit of excellence, Self-responsibility, Truth, honesty, integrity, and authenticity, Courage, Self-understanding and self-honesty, Justice and fairness, Discipline and determination, Optimism and belief in personal growth, Social conscience and mutual respect, The creative and adventurous spirit, Love and the appreciative spirit, Transcendence Holism, Temperance, and Balance, Wisdom and the ethical application of knowledge to life.</p> <p>Professional Ethics: Relationship between the nature of business and ethics in business; different approaches to business ethics, such as stockholder and stakeholder theories; and the nature and extent</p>

Sr. No.	Subject Title	Course Outline
		<p>of corporate (social) responsibility to individuals, communities, and the environment. Ethics towards colleagues, Boss and subordinates. Public interest Vs. personal interest. Organizational interests Vs. personal interest. Organizational conflicts. Whistle blowing. Honesty and professional impartiality. Professional and ethical duties. Rights of employees. Ethical sensitivity and standards of conduct.</p> <p>Interpersonal Skills: Communication skills (Verbal and non-verbal communication, listening skills), Emotional intelligence, Team working, Negotiation, persuasion and influencing skills, Conflict resolution and mediation, Problem solving and decision-making. Advancement and integrity in professional life. Skills enhancement.</p>
65.	EnE-404L Ethics and Interpersonal Skills	<p>Lab Work-Interpersonal Skills:</p> <ol style="list-style-type: none"> 1. Class Activity: Identification of Personal Communication Style and Technique by the Communication Style Test (CST). 2. Class discussion and reflection on various communication styles and techniques identified by the CST. 3. Class Activity: Identification of individual Interpersonal skills levels by the Interpersonal Skills Questionnaire (ISQ). 4. Class discussion on individual interpersonal skills levels identified by the ISQ and its ramifications. 5. Class Activity: Examine the pictures below and answer the questions for each of them. Write down your responses so that they can be used during a class discussion. <ol style="list-style-type: none"> a. Do you think this person has good interpersonal skills? b. Do these professions require good interpersonal skills? c. What happens if interpersonal skills are lacking? 6. Class Presentations on Selective Topics to assess Interpersonal Skills in presentations 7. Class Interviews for internships to assess interpersonal skills in interviews 8. Class Activity on Negotiations 9. Class activity on Conflict Management Styles 10. Class activity on effective Conflict Resolution 11. Class discussion on How to make an Impact and Influence others 12. Class discussion on effective Decision Making

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66.	EnE-433 Industrial and Hazardous Waste Management	<p>Industrial Waste Management: Course introduction and need for the course, Ecology, Industrial waste types and characteristics (Liquid Waste: Physical, Chemical and Biological characteristics; Solid Waste: Physical, Chemical and Biological characteristics; Air Emissions: Physical, Chemical and Biological characteristics). Waste sources from various processes and their composition. Stream segregation and waste quantification. Industrial profile of Pakistan: Province-wise types and number of industries in Pakistan. Most polluting industries in Pakistan. National Legislation: Environmental regulations and Penalties. Industrial Waste Minimization, Management and Recycling, Waste Audits and their types. Types of treatment for various waste streams. General industrial waste treatment techniques (Preliminary techniques for SMEs, Standard Techniques for large industries). Industry Specific Waste Management technology, Pollution control in chemical processing companies, food processing companies, textile and fiber industries, Gaseous wastes and their treatment. Hazardous waste from various industries: Characteristics, handling, treatment and disposal. Hospital and Radioactive Waste handling, collection, t</p> <p>Industrial Waste Management: Course introduction and need for the course, Ecology, Industrial waste types and characteristics (Liquid Waste: Physical, Chemical and Biological characteristics.</p> <p>Solid Waste: Physical, Chemical and Biological characteristics; Air Emissions: Physical, Chemical and Biological characteristics). Waste sources from various processes and their composition. Stream segregation and waste quantification. Industrial profile of Pakistan: Province-wise types and number of industries in Pakistan. Most polluting industries in Pakistan. National Legislation:</p> <p>Industrial Waste Minimization, Management and Recycling, Waste Audits and their types. Sludge management, Bioresource recovery.</p> <p>Types of treatment for various waste streams. General industrial waste treatment techniques (Preliminary techniques for SMEs, Standard Techniques for large industries). Industry Specific Waste</p> <p>Management technology, Pollution control in chemical processing companies, food processing companies, textile and fiber industries, Gaseous wastes and their treatment.</p> <p>Hazardous waste from various industries: Characteristics, handling, treatment and disposal. Hospital and Radioactive Waste handling, collection, treatment and disposal mechanisms and SOPs/protocols.</p>

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		<u>CEP</u>
67.	EnE-426 Wastewater Disposal and Reuse	<p>Basic considerations for wastewater disposal into water bodies. Classification of water bodies. Disposal criteria. Wastewater disposal into water bodies (rivers, lakes, reservoirs, estuaries, and oceans), their associated impacts and controls.</p> <p>Disposal of wastewater onto land: Slow rate systems, rapid infiltration system and overland flows system</p> <p>Wastewater reclamation and reuse. Potential uses of wastewater. Public health and environmental issues related to wastewater reuse. Agricultural and landscape irrigation with reclaimed water. Evaluation of irrigation water quality. Storage of treated effluent for reuse. Industrial water reuse. Water and salt balance in cooling towers. Ground water recharge with reclaimed water. Planning wastewater reuse projects.</p> <p><u>PBL</u></p>
68.	MGT-349 Entrepreneurship	Introduction to management and entrepreneurship; functions of management; developing successful business ideas; recognizing opportunities and generating ideas; feasibility analysis; developing an effective business model; industry and competitor analysis; writing a business plan; moving from an idea to an entrepreneurial firm; preparing the proper ethical and legal foundation; assessing a new venture's financial strength and viability.
69.	EnE-427 Climate Change, Adaptation, Mitigation and Sustainable Development	Climate Change: Introduction, evidence and its climatic effects, Basic understanding of the physical science of climate change, climate change impacts and the human response to climate change, natural and anthropogenic drivers of climate change and direct observations of recent climate change. Global Warming: causes, effects and control. Adaptation to climate change, Potential adaptation strategies in different sectors. Climate change mitigation strategies, Carbon sequestration and its types, Climate change policy and social change, international climate change negotiations, regulatory instruments, voluntary agreements and social change. Climate change and food production, climate change and its effects on Pakistan's water resources. The Corporate Sustainability Due Diligence Directive (CSDDD), CSR directive

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70.	EnE-428 Review of Environmental Engineering (Optional)	<p>Causes of Environmental Pollution: Population, economic growth, industrialization, urbanization and energy-use.</p> <p>Review of international and national environmental laws, policies, and treaties. National and provincial standards, rules and regulations related to water, air, waste management, and noise pollution.</p> <p>Air Pollution: Review of climate change adaptation and mitigation, climate resilience, acid precipitation, ozone depletion, air toxics, and ground-level ozone and fine particulates (photochemical smog).</p> <p>Dispersion of air pollutions (models). Air pollution control devices. Review of solid waste management: Components of SWM, comparative analysis of collection and disposal methods. Resource an energy recovery from SW.</p>