**Introduction:**

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| Course Code | CHEM311 /ENVR311 |
| Course Title | Analytical Chemistry |
| Credit Hours | Credits 4, (3+1) |
| Prerequisite | Open to Sophomores and above |
| Submitted By (Name of Faculty) | Dr. Shazma Massey Azeem  Phone:0300-6181868  Email: [shazmaazeem@fcccollege.edu.pk](mailto:shazmaazeem@fcccollege.edu.pk)  Office hours: Monday & Wednesday 12.00noon - 1.30pm  WhatsApp Messaging, Messaging or call related to course work: Any time after permission on messaging. |
| Course Hours  Lab. Hours | 8.00am -8.50 am S-210  Friday 2:00 pm to 3:50 pm S-138 |

**Course Contents:** Gravimetric and volumetric methods of analysis including buffers, complexometric titrations, redox titrations, non-aqueous titrations, Karl-Fischer titrations, UV/VIS spectroscopic analysis, IR Spectroscopy, treatment of measurement errors; usage and handling of standards, sampling, precision, accuracy, signal-to-noise ratio, limits of detection and quantitation, statistical evaluation of data; quality control and quality assurance.

**Learning Objectives:**

1. Students will have a complete knowledge of theory, applications & calculations involved in the methods of analysis. eg. Standard deviation, t test, f test, Q test, correlation coefficient.
2. They will learn about volumetric & gravimetric analysis.
3. Students will use UV-VIS and IR to determine the structure and composition of molecules.
4. To develop higher order thinking in my students.

**Text Books:**

**1. Analytical chemistry by Gary Christian (6th edition), e-book present on Moodle**

2. Fundamentals of analytical chemistry by Skoog & West (8th edition)

**Grading System:**

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|  | Percentage | Course |
| Quiz 1 &/ Assignment | 25% | Introduction to analytical chemistry + Data handling |
| Quiz 2&/ Assignment | 15% | Gravimetric analysis |
| Quiz 3 &/ Assignment | 20% | Basic spectroscopy + uv/ vis |
| Quiz 4 &/ Assignment | 20% | IR + Titration |
| Quiz 5 &/ Assignment | 20% | Practical |

**Grading System:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter grade** | **Point average** | **Numerical value %** | **Meaning** |
| A | 4.00 | 93----100 | Excellent |
| A- | 3.70 | 90----92 |  |
| B+ | 3.30 | 87----89 |  |
| B | 3.00 | 83----86 | Good |
| B- | 2.70 | 80----82 |  |
| C+ | 2.30 | 77----79 |  |
| C | 2.00 | 73----76 | Satisfactory |
| C- | 1.70 | 70----72 |  |
| D+ | 1.30 | 67----69 |  |
| D | 1.00 | 60----66 | Pass |
| F | 0.00 | 59 or below | Fail |

**Lesson Plans:**

**Course Plan:**

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| **Topic** |
| **Introduction to analytical chemistry** (From Analytical Chemistry by Gary Christian) |
| **Volumetric analysis** (From Analytical Chemistry by Gary Christian) |
| **Quantitative analysis, Data handling, significant figures, precision & accuracy, Measurement error, statistical evaluation of data.** (PowerPoint slides made from Analytical Chemistry by Gary Christian will be shared)  Paired T-test<https://www.youtube.com/watch?v=HjNXzAHIV9E&t=29s>  Correlation coefficient <https://www.youtube.com/watch?v=0bkp831rAbQ&t=1012s>  **Assignment 1** |
| **Gravimetric analysis**  <https://youtu.be/uy6uGSt7aQs>  <https://youtu.be/JTMHGvRe5QA>  <https://youtu.be/HDGTN_EVyjU>  <https://youtu.be/EUBu4U4KoHo>  <https://youtu.be/WZ4f1YQ04sI> |
| **Spectrophotometry**  Basic spectroscopy: <https://www.youtube.com/watch?v=aMJ3eAnAlyg> |
| **UV-VIS , Beers law**  Summary + Assignment<https://www.youtube.com/watch?v=ZLshyOtz9hM&t=49s>  Woodwards rule. <https://www.youtube.com/watch?v=2AS6AhtinCo&t=9s>  Beer Lambert law: <https://www.youtube.com/watch?v=zyqOJGb_QXg&t=15s>  Type of transitions possible in uv/visible:<https://www.youtube.com/watch?v=raUbBpqf74Q>  Chromophores, Auxochromes and Factors Affecting Absorption: <https://www.youtube.com/watch?v=AhKX3bVkb1c>  UV Visible Spectroscopy-Absorption and intensity shifts:<https://www.youtube.com/watch?v=2Bbvy06a-Mk>  UV Visible Spectroscopy Instrumentation: <https://www.youtube.com/watch?v=msrSIXk4REU>  Woodward Fieser Rule for Conjugated Butadienes: <https://www.youtube.com/watch?v=JYFXlFIwTNI&t=112s> |
| **IR**  IR interpretation. <https://www.youtube.com/watch?v=NHrSd1cO_WM>  IR Basics Video1. <https://www.youtube.com/watch?v=a2FgqSPGLSg&t=684s>  IR Basics Video 2. <https://www.youtube.com/watch?v=Com2aZaj-rc>  Hooks law Video 3. <https://www.youtube.com/watch?v=WV_Vl3E1P3s>  IR peaks Video 4. <https://www.youtube.com/watch?v=hOYRGg5Rq3I>  Instrumentation Video 5. <https://www.youtube.com/watch?v=9VgNhQObgMc>  Sampling techniques Video 6. <https://www.youtube.com/watch?v=xEFItMymtmU> |
| **Complexometric titration, Redox titrations, Karl-Fischer titration.** (Notes will be shared on Moodle) |

* CHEM 311: LAB ACTIVITIES
* Preparation of solutions of different molarity, normality, percentage composition (w/w and w/v) and ppm/ppb.
* Preparation of an acidic and a basic buffer solution and investigating its properties.
* Determination of λmax of different substances by colorimetric and spectrophotometric methods analysis.
* Determination of the unknown concentration of given solution of KMnO 4 by using a UV-VIS spectrophotometer.
* Sampling techniques and taking spectra in IR spectroscopy.
* Study of IR spectra of given compound and identification of major functional groups.
* To determine the total hardness of tap water by complexometric titrations.
* Estimation of Lead as Lead Chromate in the given sample solution gravimetrically.
* Determination of the concentration of FeSO4 solution by titrating against molar solution of KMnO4
* Determination of the number of x in CuSO 4 .xH2O when provided with molar solution of Na2S2O3 by Iodometric titration.
* Moisture analysis in a given sample by Karl-Fischer method.