Faculty of Science

First Semester, 2021 – 22
Course Handouts

Table of Contents

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC 121	**Physics II (Digital Electronics & Microprocessor 8085)**	**4**	**2**	**5**

Instructor In-charge: Dr. RAVI SHRIVASTAVA

Learning Outcomes:

Physics II form the Second half of a two-semester comprehensive course on core level physics to be taught to all B.Sc. students.
The objective of the course is to impart knowledge of the basic tools for the design of digital circuits and to provide methods and procedures suitable for a variety of digital design applications. The course also introduces fundamental concepts of computer organization. The course also provides laboratory practice.

Scope & Objective of the course:

Textbook (s) T1	Digital Design, M. Morris Mano, PHI, 3rd Edition, 2002.
T2	The 8085 Microprocessor Architecture, Programming and Interfacing by K. Uday Kumar & B.S. Uma shankar, Pearson Publication (2008)
Reference book (s) R1	Digital and Analogue Techniques by Navneeth, Gokhale & Kale, Kitab Mahal, 2002.
R2	Microprocessor, Architecture, programming and application with the 8085 by Ramesh Gaonkar
R3	https://www.tutorialspoint.com/microprocessor/microprocessor_8085_instruction_sets.htm

Lecture-wise plan:

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-3	Provide the basics of Digital electronics	Number Systems – Decimal, Binary,	(1.1-1.4) (T1)
4-5		Octal, Hexadecimal, 1's and 2's complements,	1.5-1.15, 3.1-3.5 (T1)
6-7		Boolean theorems	4.4-4.8 (T1)
8-12		Logic Gates, Universal gates, Sum of products and product of sums	4.3, 6.1-6.4 (T1)
13-15	To make the students learn about Combinational Circuit Design	Min terms and Max terms, Karnaugh map Minimization.	6.6 (T1)
16-17		Design of Half and Full Adders, Half and Full Subtractors	7.3 (T1)
18-19		Multiplexer	8.1 (T1)
20-21		De-Multiplexer, Decoder, Encoder	8.2-8.3 (T1)
21-23	To make the students learn	Flip flops – SR	10.3 (T1)

24-27	about Synchronous Sequential Circuits	JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF,	10.5-10.8 (T1)
28-33	Analysis and design of clocked sequential circuits, circuit implementation	Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.	11.1-11.3, 11.12-11.13 (T1)
34-35	Introduction to 8085	8085 - Microprocessor architecture and its operations, Addressing modes of 8085, 8085	13.3-13.5 (T1)
36-39	Concept of Assembly level programming and programming practice	Instructions (Data transfer, Arithmetic), 8085 Instructions (Logical, Branch Control operations), Machine Control Instructions, Stack and Subroutine	6 – 8 (T2)
40-42		Programming the 8085	(R3)

Evaluation Scheme:
Physics I (Lab)

S. No.	Name of Experiment
1	To verify the Truth Table of Basic Logic Gates (NOT/OR/AND) using Breadboard.
2	To verify the Truth Table of Universal Gates (NAND/NOR) using Breadboard.
3	To create AND gate using NOR Gate (s).
4	To create AND gate using NOR Gate (s).
5	To create OR gate using NAND Gate (s).
6	Write a Program to Add 2 (8 bit) numbers using assembly level language (8085) with suitable Simulator.
7	Write a Program to Subtract 2 (8 bit) numbers using assembly level language (8085) with suitable Simulator.
8	Write a Program to generate Fibonacci series using assembly level language (8085) with suitable Simulator.
9	Write a Program to Add 2 (16 bit) numbers using assembly level language (8085) with suitable Simulator.
10	Write a program to Store 8-bit data in memory using assembly level language (8085) with suitable Simulator.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Lab Tests conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	19.11.2021	1-10	CB
Test 2	60 Minutes	8	10.12.2021	11-20	CB
Test 3	60 Minutes	8	21.01.2022	21-30	CB
Lab	Throughout the Semester	20			CB
Comprehensive Exam	3 Hours	56	09.02.2022	1-42	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. RAVI SHRIVASTAVA
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC112	**Chemistry I (Basic Chemistry)**	**4**	**2**	**5**

Instructor-in-charge: Dr. PIYUSH THAKUR

Learning Outcomes:

This first level course is offered in the first semester for the students of bachelor of sciences.

1. Chemical reactions and strategies to balance them.
2. The fundamental properties of atoms, molecules, and the various states of matter.
3. The electronic structure of atoms and its influence on chemical properties.
4. Predict and explain patterns in shape, structure, bonding and hybridization of molecules.
5. Understand the reactivity for hydrocarbons, halocarbons, alkenes, dienes, and arenes.

Textbook (s) T1	Concise Inorganic Chemistry, J.D.Lee, Black Well Science, OUP, 5th Edition, 1996
T2	Organic Chemistry, Reactions and Reagents, O.P. Agrawal, Krishna's Educational publishers, fifty fourth edition, 2016.
T3	University Chemistry, Bruce M. Mahan and Rollie J. Meyers, AWL publication, fourth edition, 1998.
Reference book (s) R1	Organic Chemistry, Francis A. Carey, seventh Edition, The McGraw-Hill, 2008.
R2	Physical Chemistry, Ira N. Levine, Fifth Edition, Tata McGraw-Hill , 2002
R3	Ernest L Eliel, Stereochemistry of Carbon Compounds, Tata McGraw-Hill Edition, 2002.
R4	Huheey, Keiter&Keiter, Inorganic Chemistry, Pearson Education, 2003.

.

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-3	The fundamental properties of atoms, molecules, and the various states of matter.	Idea of de-Broglie matter waves, Heisenberg uncertainty principle , Radial and angular wave functions and probability distribution curves	T1:10 – 21
4-5		Atomic orbitals, Bohr theory	T1:4 – 10
6-8		Aufbau and Pauli exclusion principles, Hund's multiplicity rule, effective nuclear charge.	T1: 21 – 24
9-14	To understand the periodic behavior of elements	**Periodic Properties** Atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavior	T3:656 – 678
15 – 16	Predict and explain patterns in shape, structure, bonding and hybridization of molecules.	Hybridization,	T1: 81 – 89
17-18		Bond lengths and bond energy	T2: 15 – 29
19-20		Hydrogen bonding , Van der Waals interactions.	T2: 81 – 94
21-23		Resonances, hyper conjugation, aromaticity, inductive and field effects.	T2: 32 – 59
24-25	Understand the physical properties and chemical reactions of alkanes	IUPAC nomenclature of branched and unbranched alkanes, Isomerism in alkanes	R1: 64-76
26-27		physical properties and chemical reactions of alkanes,	R1: 80-82
28-29		Cycloalkanes – Nomenclature, methods of formation, chemical reactions	R1: 77-78 R1: 80-82
30-31		Ring strain in small rings (cyclopropane and cyclobutane	R1: 111-112
32-34		Nomenclature of alkenes, Structure and Bonding in alkenes	R1: 182-188

35-37	Understand the physical properties and chemical reactions of dienes, and arenes	Physical and Chemical reactions of alkenes	R1: 189-205
38		Nomenclature, structure and bonding in alkynes	R1: 355-359
39-40		Chemical reactions of alkynes, acidity of alkynes	R1: 364-372

Evaluation Scheme: Chemistry I (Lab)

S. No.	Name of Experiment
	Qualitative analysis of mixture containing 08 radicals including two less common metals from among the following by semi micro method
Basic radicals:	AgI, PbII, BiIII, CuII, CdII, AsIII, SbIII, SnII, FeIII, AlIII, CrIII, ZnII, MnII, CoII, NiII, BaII, CaII, MgII, NaI, KI, CeIV, ThIV, ZrIV, WVI, TeIV, TiI, MoVI, UVI, VV, BeII, LiI, AuI, PtIV,
Acid radicals:	Carbonate, sulphide, sulphate, nitrite, nitrate, acetate, chloride, fluoride, bromide, iodide, borate, sulphonate, oxalate, phosphate, silicate, thiosulphate,
2	To detect the presence of functional groups in the given organic compound.
3	To detect the presence of elements in the given organic compound.
4	To determine the strength of given HCl solution by titrating it against NaOH solution.
5	To verify the Beers-Lambert Law

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	18.11.2021	1-15	CB
Test 2	60 Minutes	8	09.12.2021	16- 30	CB
Test 3	60 Minutes	8	21.01.2022	31- 40	CB
Lab	60 Minutes	20		**	CB
Comprehensive Exam	3 Hours	56	07.02.2022	1- 40	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Date: 29/10/2021

Dr. PIYUSH THAKUR
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC113	**Mathematic I (Calculus)**	**4**	**0**	**4**

Instructor-in-charge: Dr. SHANTI SWARUP DUBEY

Learning Outcomes:

After successful completion of the course student will be able to

1. Convergence of sequence and series.
2. Basic concept of limit and continuity.
3. Expansion of function.
4. Linear system of equation, rank of matrices.

Text Book T1	Differential Calculus,By Shanti Narayan& P K Mittal, S Chand & Com Ltd.
Text Book T2	Engineering Mathematics, Dr HariArora, S K Kataria& Sons
Text Book T3	Applied Mathematics, N P Bali, University Science Press

Lecture wise plan

Lecture Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-2	Sequence and series	Definition of Sequence and series	T2 Ch-8 237-276
3-4	Condition of convergence	Convergence and divergence of infinite series.	T2 Ch-8 237-276
5-6	Test for convergence	Comparison test, D'Alembert ratio test, Cauchy's root test	T2 Ch- 237-276
7-9	Integration	Integration of irrational algebraic functions and transcendental functions, Reduction formulae, Definite integrals.	T3 Ch 11 188-309
10-13	Concept of Limit and Continuity	Limit and Continuity ε-δ definition of limit of a real valued function, Limit at infinity and infinite limits;.	T1 Ch-2 69-117
14-19	Types of discontinuity; Uniform continuity.	Continuity of a real valued function, Properties of continuous functions, Intermediate value theorem, Geometrical interpretation of continuity, Types of discontinuity; Uniform continuity.	T1 Ch-2 114-117
20-24	Differentiability of a real valued function	Differentiability of a real valued function, Geometrical interpretation of differentiability,	T1 Ch-4

		Relation between differentiability and continuity	134-194
25-27	Differentiability of a real valued function	Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem	T1 Ch-4 134-194
28-32	Differential Calculus	Successive differentiations, Leibnitz's theorem, Maclaurin's and Taylor's theorem.	T 1 Ch-5 204-246
33-34	Definition of Matrix	Types of Matrix, Systems of linear equations, Row reduction and echelon forms, Linear independence, The rank of a matrix and applications.	T 2 Ch-12 441-560
35-37	Introduction to linear transformations,	Introduction to linear transformations, The matrix of a linear transformation, Matrix operations, Determinants.	T 2 Ch-12 441-560
38-40	Inverse of a matrix	The inverse of a matrix, Characterizations of invertible matrices	T 2 Ch-12 441-560
41-43	Eigen values and Eigen vectors	Eigen vectors and eigen values of a linear transformation, Characteristic polynomial and Cayley–Hamilton theorem, Minimal polynomial.	T 2 Ch-12 441-560

Evaluation Scheme:
Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	17.11.2021	1-12	CB
Test 2	60 Minutes	8	08.12.2021	13- 28	CB
Test 3	60 Minutes	8	24.01.2022	29- 42	CB
Quizzes (2)	20 Minutes each	20	**	**	CB
Comprehensive Exam	3 Hours	56	14.02.2022	1- 42	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.
General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. SHANTI SWARUP DUBEY
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC 114	**Computer Science I (Computer Organization)**	**4**	**2**	**5**

Instructor in charge: Mr. NAVEEN KUMAR VAISHNAV

Learning Outcome –

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

1. To understand basic concepts and implementation of Computer Organization.
2. To understand about Number Systems, logic gates, Boolean algebra and Advanced Concepts.

Textbook T1	Computer Fundamental, Pradeep K. Sinha Sixth Edition BPB Publication.
Referencebook(s) R1	Computer Architecture & Organization by Moriss Manno, 3rd edition, Print ice Hall of India Pvt Ltd.
R2	Digital Computer electronics: An Introduction to microcomputers by Albert Malvino and Jerald Brown, Tata Mcgraw Hill.
NPTEL	http://www.nptelvideos.in/2012/11/computer-organization.html
SWAYAM	https://onlinecourses.swayam2.ac.in/cec19_cs06/preview

Lecture-wiseplan:

Lect Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-2	Introduction to Computer Organization	Computer system concepts, Computer architecture	T1 : Chap 1, Chap 2
3-6	Concept of Data	Concept of data & data Storage, Types of programming languages	T1 : Chap 12
5-9	Computer Number Systems	Decimal numbers, binary numbers, Octal, Hexadecimal	T1 : Chap 3
10-12	Binary arithmetic & Conversion	binary arithmetic, 1's and 2's complements, inter-conversion of number system	T1 : Chap 5
13-17	Digital codes	Binary coded decimal (BCD), Gray code, Excess-3 code, Format of ASCII code.	T1 : Chap 4
20-25	Logic Gates	Positive and negative logics, NOT gate, OR gate, AND gate, NAND gate, NOR gate, EX-OR and EX-NOR gates	T1 : Chap 6
26-28	Circuit diagram and Universal Gates	Truth table, Circuit diagram, universal property of NAND and NOR gates.	T1 : Chap 6

29-32	Boolean Algebra	Boolean operation, logic expressing, rules and laws of Boolean algebra	T1 : Chap 6
32-36	Simplification & K-Map	Demorgan's theorems, simplification of Boolean expression using Boolean algebra techniques, Karnaugh map techniques	R1 : 1.4
37 - 40	Combinational & Sequential Circuits	Half adder, Full adder, Multiplexer, Flip-Flops, registers, Shift registers, counters	R1 : 1.5-1.7

Evaluation Scheme:

Computer Science I (Lab)

S. No.	Name of Experiment
1	To verify the Truth Table of Basic Logic Gates (NOT/OR/AND) using Breadboard.
2	To verify the Truth Table of Universal Gates (NAND/NOR) using Breadboard.
3	To create AND gate using NOR Gate (s).
4	To create AND gate using NOR Gate (s).
5	To create OR gate using NAND Gate (s).

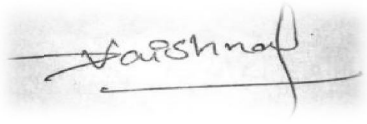
Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lecture No)	Remarks
Test 1	60 Minutes	17	18.11.2021	1-14	CB
Test 2	60 Minutes	17	09.12.2021	15- 25	CB
Test 3	60 Minutes	16	21.01.2022	26-40	CB
Quizzes (2)	20 Minutes each	10	**	**	CB
Comprehensive Exam	3 Hours	40	07.02.2022	1- 40	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.



Mr. NAVEEN KUMAR VAISHNAV
Instructor-In-charge

Date - 28/10/2021

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC 211	**Physics III (Wave & Optics)**	**4**	**2**	**5**

Instructor In-charge: Dr. RAVI SHRIVASTAVA

Learning Outcomes:

Physics III form the first half of a two-semester comprehensive course on core level physics to be taught to all Bachelor of Science (Mathematics) students.

The course aims at:-

1. Developing an understanding of the basic principles of Optics
2. Developing the detailed knowledge about the interference, diffraction and polarization.
3. Improving the concepts geometrical optics also.

Textbook (s) T1	Unified Physics for B.Sc. 1st by R.P. Goyal, ShivlalAgrawal & Company
T2	Engineering Physics by Dattu Prasad Ramanlal Joshi, McGraw Hill (Seventh Reprint) 2016
Reference book (s) R1	Physics for Degree Students B.Sc. First Year by C.L. Arora, S. Chand Publication
R2	A Textbook of Engineering Physics, by Avadhanulu M.N. & Kshirsagar P.G., 2010 Edition

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos. of Text Book)
1-3	To learn Basics of Waves and Interference	Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves	T1 (5.1)
4-5		Plane Progressive (Travelling) Waves. Wave Equation.	T1 (5.2)
6-8		Particle and Wave Velocities. Superposition of two perpendicular Harmonic Oscillations	T1 (5.5, 6.1, 6.2)
9-12		Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses.	T1 (6.4, 6.5)
13-15		Interference: Division of amplitude and wave front. Young's double slit experiment	T2 (1.1 – 1.9)
16-17	Understanding formation of	Fresnel's Bi-prism. Phase change on reflection	T2 (1.10)

18-19	interference patterns and its application	Stokes' treatment. Interference in Thin Films, parallel and wedge-shaped films	T2 (1.12-1.13)
20-21		Newton's Rings: Measurement of wavelength and refractive index.	T2 (1.16)
22-23	Understanding formation of Diffraction patterns and its application	Fraunhoffer diffraction: Single slit.	T2 (2.1-2.5)
24-27		Fraunhoffer diffraction: N slit.	T2 (2.6)
28-33		Resolving power of grating	T2 (2.7)
34-35	Understanding ray optics for a system of lenses	Geometrical Optics, Cardinal points of an coaxial optical system, Newton formula	R2 (40.1-40.9)
36-39	Learning about the Polarization and its application	Polarized light, Polarization by Reflection, Brewster's law, Malus Law, Double refraction, Uniaxial and Biaxial Crystals	T2 (4.1-4.6)
40-42		Light propagation in Uniaxial Crystals, Principal Section, Principal Plane, Nicole Prism, Types of Polarized light, Phase Retardation	T2 (4.7-4.9)

Evaluation Scheme: Physics I (Lab)

S. No.	Name of Experiment
1	To Find the refractive index of the material of prism using spectrometer.
2	To determine the dispersive power of prism using spectrometer.
3	To determine the grating element of a grating using spectrometer.
4	To verify Kirchhoff's Law of Voltage and Current.
5	Resonance in LCR circuit
6	I-V Characteristic of a Solar Cell
7	I-V Characteristic of PN Junction Diode.
8	To find the frequency of a wave inputted from a function generator using Cathode Ray Oscilloscope (CRO)

Evaluation Scheme:

Student evaluation is based on the series of Tests and Lab Tests conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	23.09.2021	1-12	CB
Test 2	60 Minutes	8	17.11.2021	13-26	CB
Test 3	60 Minutes	8	08.12.2021	27-42	CB
Lab	Throughout the Semester	20	*TBD	-	CB
Comprehensive Exam	3 Hours	56	06.01.2022	1-42	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

***TBD – To be decided**

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. RAVI SHRIVASTAVA
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
HSC 211	**Physics (H1) (Elements of Spectroscopy)**	**4**	**2**	**5**

Instructor In-charge: Ms. VARSHAVERMA

Learning Outcomes:

(Physics H1) form the first half of a two-semester comprehensive course on core level physics to be taught to all the students of B.Sc. (H).

The course aims at:-

1. Developing an understanding of the basic principles of Spectroscopy.
2. Developing the application of concepts to problems of practical interest.
3. Improving the concepts and improving the problem solving skills of students.

Textbook (s) T1	Atomic and Molecular Spectra : LASER, by Raj Kumar, KedarNath Ram Nath Publishers, Reprint (2018)
Reference book (s) R1	Introduction to Magnetic Resonance Spectroscopy ESR, NMR, NQR by D. N. Sathyanarayana,

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-3	To understand the various atomic models.	Bohr's Model of an atom	Ch. 01
4-5		Hydrogen spectra, Somerfield's Model, Vector atom model of an atom	Ch. 02
6-7	To learn the spectroscopy terms and coupling	Spectroscopic Terms, L-S coupling, J-J Coupling, Selection Rule for LS	Ch. 09
8-12		JJ Coupling, Equivalent and Non-equivalent electrons.	Ch. 09
13-15		Land g Factor, Term separation in Doublet, Alkali	Ch. 09
16-17	Understanding Spectral analysis under the presence of external electric and magnetic field	Atom Spectra, Zeeman Effect	Ch. 12
18		Paschen Back Effect	Ch. 12
19		Stark Effect	Ch. 13

20-24	Understanding the Hyperfine splitting	Hyperfine Splitting, Broadening of Spectral line, X-ray spectra	Ch. 16
25-29	Learning molecular spectra	Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.	Ch. 17-18
30-32		Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, an-harmonicity,	Ch. 19
33-34		Fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration	Ch. 19
35-36		Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.	Ch. 20
37-39		Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence.	Ch. 21
40-42	Learning some techniques of characterization of materials	Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy.	R1 (PART 02 (Ch. 10-15))

Evaluation Scheme:

Physics I (Lab)

S. No.	Name of Experiment
1	Performance characteristics of a spectrophotometer.
2	Spectrophotometric analysis of a mixture.
3	Study the absorption of monochromatic light using colorimeter.
4	To verify the Beer-Lambert's law of absorption.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Lab Tests conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	28.09.2021	1-12	CB
Test 2	60 Minutes	8	20.11.2021	13-26	CB
Test 3	60 Minutes	8	11.12.2021	27-42	CB
Lab	Throughout the Semester	20	TBA*	-	CB
Comprehensive Exam	3 Hours	56	10.01.2022	1-42	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

***TBA: - To be announced**

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Ms. VARSHAVERMA
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC212	**Chemistry III (Physical Chemistry)**	**4**	**2**	**5**

Instructor-in-charge: Dr. PIYUSH THAKUR

Learning Outcomes:

This course is offered in the first semester for the Second year students of bachelor of sciences.

1. pinpoint the historical aspects of development of quantum mechanics
2. understand and explain the differences between classical and quantum mechanics
3. understand the idea of wave function
4. understand the uncertainty relations
5. Explain thermodynamically the operation of a concentration cell, and be able to predict the concentration in the cell based on the cell potential

Textbook (s) T1	The Elements of Physical Chemistry, Peter Atkins and Julio de Paula, Fourth edition, Oxford University Press, 2005.
T2	Concise Inorganic Chemistry, J.D.Lee, Black Well Science, OUP, 5th Edition, 1996
T3	Organic Chemistry, R.T. Morrison and R.Boyd, Prentice- Hall, Sixth Edition, 2002.
T4	Physical Chemistry, G.K. Vemulapalli, PHI learning private limited, 2002.
Reference book (s) R1	Physical Chemistry, Ira N. Levine, Fifth Edition, Tata McGraw-Hill, 2002.
R2	Ernest L Eliel, Stereochemistry of Carbon Compounds, Tata McGraw-Hill Edition, 2002.
R3	Huheey, Keiter & Keiter, Inorganic Chemistry, Pearson Education, 2003.

.

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos. of Text book)
1-3	To understand the transformation of energy from heat into work and vice versa	**Thermodynamics** - first law Work & heat, internal energy and enthalpy.	T1:2.1 – 2.8
4-6	To understand the role of enthalpy in chemistry	**Thermo chemistry** Enthalpy changes accompanying Physical Change and Chemical Change	T1:3.1 – 3.7
7-10	To understand the concept of entropy and Gibbs energy	**Thermodynamics** – Second Law Entropy and second law, absolute entropies and Third law, The Gibb's energy	T1: 4.1 – 4.11
11 - 14	To understand the redox reactions involved in electrochemical cells, cell potentials and applications of standard potentials	**Electrochemistry** - The migration of ions, electrochemical cells, The cell potential. Application of standard potentials	T1:9.2 – 9.13
15– 18	Principles of quantum mechanics to calculate observables on known wave functions.	Elementary Quantum Mechanics-l Black body radiation, Planck's radiation law, photoelectric effect	R1: 591 – 594
19 -20		Bohr's model of hydrogen atom and its defects.	T2: 4-10
21-24		De Broglie Hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation,	R1: 595-599
25- 28	Solve time-dependent and time-independent Schrödinger equation for simple potentials.	Schrodinger's wave equation and its importance, Postulates of quantum mechanics.	T4: 366-373
29 - 30		Particle in a one dimension box.	R1: 606-610
31-33		Quantum numbers and their importance, radial wave function, angular wave function.	T2: 15-20
34-35	Knowledge about fundamental quantum mechanical process for forming of Molecular orbitals from Atomic orbitals.	Molecular orbital theory (basic idea) , Criteria for forming M.O. and A.O.,wave functions,	T2: 98- 117
36 - 38		Physical picture of bonding and and antibonding wave function, Concept of л,л*,σ,σ* orbitals and their characteristics, Construction of M.O's by LACO-H2 ion	T2: 89 – 98

39 - 40		Hybrid orbitals-sp,sp2 , sp3 Introduction to valence bond model of H2	T2: 80-87

Chemistry III (Lab)

S. No.	Name of Experiment
1	To determine the enthalpy of neutralization of strong acid (hydrochloric acid) and strong base (sodium hydroxide).
2	T To determine the composition of a given binary mixture (ethanol-water) from the study of the viscosity-composition curve at lab temperature.
3	To determine the strength and normality of given acid solution (approx. N10 HCl) by titrating it against standard 0.5 NaOH solution conductometrically.
4	To determine the strength of given weak acid (CH_3COOH) solution by titrating it against standard base (NaOH) solution conductometrically.
5	To detect the presence of elements in the given organic compound.
6	To determine the strength of given HCl solution by titrating it against NaOH solution using pH meter
7	To standardize the given acid solution (like HCl) pH metrically
8	To determine the strength of given mono basic acid (like HCl) potentiometrically
9	Determine experimentally the partition coefficient of I2 in CCI4 and water.
10	To determine the enthalpy of neutralization of a weak acid (say acetic acid) versus strong base (say NaOH) and determine the enthalpy of ionization of the weak acid.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	24.09.2021	1-15	CB
Test 2	60 Minutes	8	18.11.2021	16- 30	CB
Test 3	60 Minutes	8	09.12.2021	31- 40	CB
Lab	60 Minutes	20	**	**	CB
Comprehensive Exam	3 Hours	56	08.01.2022	1- 40	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Date: 29/10/2021

Dr. PIYUSH THAKUR
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
HSC212	**Chemistry (Honors) (Spectroscopy I)**	**4**	**2**	**5**

Instructor-in-charge: MS. VARSHA VERMA

Learning Outcomes:

This course is offered in the first semester for the second year students of bachelor of sciences.

1. To understand the basic principles of spectroscopy
2. Recognize spectroscopy in microwave, Rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.
3. Explain vibration of diatomic molecules, the vibrational spectra of diatomic molecules.
4. Explain working principle, taking spectra and outline of UV spectroscopy device.
5. understands the physical principles underlying the NMR phenomenon and realizes the possibilities of NMR spectroscopy in analyzing the structures of molecules

Textbook (s) T1	Organic Spectroscopy, William Kemp, Third Edition, Palgrave 1991.
T2	Spectroscopy, H. Kaur, Tenth Edition, Pragati Prakashan 2015.
Reference book (s) R1	Fundamentals of molecular spectroscopy. Colin N. Banwell and Elaine M. Mccash McGraw-Hill , 2016.
R2	Applied Electran Spectroscopy for chemical analysis Ed. H. Windawi and F. I. Willey Interscience.2018

Lecture-wise plan:

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-2	To understand the basic principles of spectroscopy	**Unifying Principles:** Electromagnetic radiation, interaction of electromagnetic radiation with matter absorption, emission, transmission, reflection, dispersion, polarization and scattering.	T2: 1-29
3-5		Natural line width and natural broading, transition probability, results of the time dependent perturbation theory, transition moment, selection rules,	
6-7		Intensity of spectral lines. Born-Oppenheimer approximation, rotational, vibration & electronic energy levels.	

8-12	To understand the Rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines	**Microwave Spectroscopy:** Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, non- rigid rotor, stark effect, nuclear & electron spin interaction and effectof external field. Applications.	R1:31 – 52
13-15		**Photoelectron Spectroscopy:** Basic principles, photo- electric effect, ionization process, Photoelectron spectra of simple molecules. Auger electron spectroscopy – basic idea.	T2: 636-649
16– 18	Study of Vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator.	Infrared Spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules.	T1: 19 – 27
19-20		force constant and bond strengths, anharmonicity, Vibration rotational spectroscopy, P, Q, R, Branches.	T2: 120-130
21-23		Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band	T2: 132 – 159
24-25	Understand the Scattering of light and Raman Spectrum	**Raman Spectroscopy:** Classical and quantum theories of Raman effect, Selection rules.	R1:100 – 124
26-27	Understand the electronic spectra of diatomic molecules	Molecular Spectroscopy: Energy levels, molecular orbital, vibronic transitions, vibrational progressions and geometry of the excited states	T2: 258-262
28-29		Frank - Condon principle, electronic spectra of poly atomic molecules and spectra of transition metal complexes	T2: 263- 277
30-31		Charge- transfers spectra, Electronic spectra and application.	T2: 311 – 314
32-34	Understands the physical principles underlying the NMR phenomenon and realizes the possibilities of NMR spectroscopy in analyzing the structures of molecules	**Nuclear Magnetic Resonance** Spectroscopy: Nuclear spin resonance, saturation, shielding of magnetic nuclei.	T1: 101-155
35-37		Chemical shifts and its measurements, factors influencing chemical shifts	
38		Deshielding, spin-spin interactions.	
39-40		Factors influencing coupling constant ‘J” Classification, basic ideas about instrument.	

Chemistry H_1 (Lab)

S. No.	Name of Experiment
1	To Determination of λ max by Job's method.
2	To verify the Beers-Lambert Law for $KMnO_4$
3	To determine the percentage of Available Iron in the given sample by calorimetrically.
4	To determine the composition of a given binary mixture (ethanol-water) by calorimetrically.
5	Determination of copper by colorimetric method.
6	Study of mole ratio method by colorimetric method.
7	To verify the Beers-Lambert Law for $K_2Cr_2O_7$.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	27.09.2021	1-15	CB
Test 2	60 Minutes	8	19.11.2021	16- 30	CB
Test 3	60 Minutes	8	09.12.2021	31- 40	CB
Lab	60 Minutes	20		**	CB
Comprehensive Exam	3 Hours	56	10.01.2022	1- 40	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Date: 29/10/2021

Ms. VARSHA VERMA
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC213	**Mathematics III (Differential Equation)**	**4**	**0**	**4**

Instructor-in-charge: Dr. SHANTI SWARUP DUBEY

Learning Outcomes:

After successful completion of the course student will be able to

1. Solution of first & first degree differential equation.
2. Solution of Exact differential equations.
3. Second Order Linear Differential Equations
4. Basic concept power series method.

Text Book T	Ordinary & Partial Differential Equation, M D Raisinghania, S Chand & Company, New Delhi
Reference book(s) R1	B. Rai, D. P. Choudhury & H. I. Freedman (2013). A Course in Ordinary Differential Equations (2nd edition). Narosa.
Reference book(s) R2	Daniel A. Murray (2003). Introductory Course in Differential Equations, Orient.

Lecture wise plan

Lecture Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-4	First Order Differential Equations	Basic concepts and genesis of ordinary differential equations,	T 1 Ch-1 1.3-1.35
5-8	To find the order and degree of a differential equation	Differential equations of first order and first degree.	T1 Ch-2 2.1-2.76
9-14	Homogeneous Linear differential Equation	Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form	T1 Ch-2 2.6
15-19	Exact differential equations	Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p.	T1 Ch-2 2.12
20-21	Picard's method of successive approximations	Picard's method of successive approximations and the statement of	T1 (Part-II) Ch-1 1.3-1.25

		Picard's theorem for the existence and uniqueness of the solutions of the first order differential equations. .	
22-26	Second Order Linear Differential Equations	Statement of existence and uniqueness theorem for linear differential equations, General theory of linear differential equations of second order with variable coefficients;.	T1 Ch-10 10.1-10.58
27-30	Method of variation of parameters	Method of variation of parameters and method of undetermined coefficients, Reduction of order, Coupled linear differential equations with constant coefficients	T1 Ch-7 7.1-7.26
31-33	Higher Order Linear Differential Equations	Principle of superposition for a homogeneous linear differential equation, Linearly dependent and linearly independent solutions on an interval, Wronskian and its properties	T1 Ch-10 10.1-10.58
34-38	Series Solutions of Differential Equations	Power series method, Legendre's equation, Legendre polynomials, Rodrigue's formula, Orthogonality of Legendre polynomials, Frobenius method,	T1 CH7,7.1-7.6, Ch-9 9.1-9.50
39-43	Bessel's equation, & Recurrence relations.	Bessel's equation, Bessel functions and their properties, Recurrence relations.	T1 Ch-11 11.1-11.45

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	27.09.2021	1-12	CB
Test 2	60 Minutes	8	19.11.2021	13- 28	CB
Test 3	60 Minutes	8	10.12.2021	29-43	CB
Quizzes (2)	20 Minutes each	20	**	**	CB
Comprehensive Exam	3 Hours	56	12.01.2022	1-43	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. SHANTI SWARUP DUBEY
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
HSC213	**Mathematics (H1) (Set theory and Metric Spaces)**	**4**	**0**	**4**

Instructor-in-charge: Ms. YogitaChandrakar

Learning Outcomes:

After successful completion of the course student will be able to

1. About SETs.
2. Metric Spaces.
3. Compactness and Connectedness of SETs

Text Book(T)	Mathematical Analysis , S C Malik and SavitaArora.
Reference book(s)	S.Kumaresan(2011). Topology of Metric Spaces.
Reference book(s)	Set Theory and Metric Spaces by Irving Kaplansky.

Lecture wise plan

Lecture Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-10	Set Theory	Definitions of Set, finite and Infinite set, Countable and Uncountable Set, Zorn's lemma, Cantor's theorem, POSET.	T /Ch-1/1-43
11-22	Metric Spaces	Definitions and examples of Metric spaces. Point Set Topology of Metric spaces	T /Ch-19/ 706-731
23-30	Complete Metric Spaces and Continuous Functions.	Cauchy and Convergent sequences, Completeness of Metric spaces, Dense sets, Continuous and Uniformly continuous functions	T/ Ch-19/732-754
31-35	Compactness	Compact Spaces, sequential compactness, BWP, Heine-Borel theorem, Totally bounded sets, Equivalence of compactness and sequential compactness, continuous function on compact spaces.	T/ Ch-19/ 755-771
36-41	Connectedness	Separated set, connected and disconnected sets, continuous functions on connected sets,	T/ Ch-19/ 772-780

Evaluation Scheme:
Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	17	28.09.2021	1-12	CB
Test 2	60 Minutes	17	20.11.2021	13- 28	CB
Test 3	60 Minutes	16	11.12.2021	29- 42	CB
Quizzes (2)	20 Minutes each	10		**	CB
Comprehensive Exam	3 Hours	40	10.01.2022	1- 42	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Ms.YOGITA CHANDRAKAR
Instructor-in-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC 311	**Physics V (Mechanics of Rigid Bodies and Fluids)**	**4**	**2**	**5**

Instructor In-charge: Dr. RAVI SHRIVASTAVA

Learning Outcomes:

Physics V form the first half of a two-semester comprehensive course on core level physics to be taught to all B.Sc. students.

The course aims at:-

1. Developing an understanding of the basic principles of Elasticity and rigid mechanics & fluid mechanics.
2. Developing the application of concepts to problems of practical interest.
3. Improving the concepts and improving the problem solving skills of students.

Textbook (s) **T1**	Unified Physics for B.Sc. 1st by R.P. Goyal, ShivlalAgrawal& Company
Reference book (s) **R1**	Physics for Degree Students B.Sc.First Year by C.L. Arora, S. Chand Publication

Lecture-wise plan:

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-3	Understanding Basics of Elasticity and its modulus(s)	Elasticity, Effect of temperature and impurities on elasticity of a substance; Small deformation; Stress and strain; Hooke's Law; Elastic constants for an isotropic solid	Page 308-311 (T1)
4-5		Young's modulus, Modulus of Rigidity, Poisson's ratio	Page 311-314 (T1)
6-8		Relationship between the various elastic moduli	Page 315-319 (T1)
9-10		Limiting values of Poisson's ratio, experimental determination of Poisson's ratio	Page 319-321 (T1)
13-15	Learning about Bending and torsion of cylindrical shaped objects and practical examples	Torsion of a cylinder, strain energy of twisted cylinder, Determination of modulus of rigidity of a thin rod by static method	Page 321-325 (T1)
16-17		Torsion pendulum, Bending of beam and bending moment	Page 325-326, 328-330 (T1)
18-19		Cantilever, transverse oscillation of cantilever, a	Page 331-

		beam supported at its ends and loaded in the middle	333 (T1)
20-21		Determination of Young's modulus of a bean by bending method, determination of Young's modulus, modulus of rigidity and Poisson's ratio of material of a wire by Searle's method.	Page 334-336 (T1)
21-23	Understanding Basic fluid mechanics and fluid flow equations	Rotational and Irrotational flow, Equation of continuity, Energy of a flowing fluid, Euler's equation of motion for a non-viscous fluid and its integration	Page -352-357 (T1)
24-27		Bernoulli's theorem, applications based on Bernouli;s theorem-Venturimeter, Torricelli's theorem, Shape of the wings of the aero plane. Viscous flow of fluids	Page 357-361 (T1)
28-33	Learning about Viscosity and related laws	Effect of pressure and temperature on the coefficient of viscosity, Flow of liquid through a capillary tube, Poiseuille's formula, , experimental determination of coefficient of viscosity of a liquid –constant pressure difference method, variable pressure method. Two capillaries connected in series and parallel. Motion of spherical body in viscous fluid, derivation of Stock's law using dimensional method, expression for terminal velocity, falling of rain drops, falling of soldier with parachute.	Page 366-373 (T1)
34-35	Understanding surface tension, related terminologies	Intermolecular forces, cohesive and adhesive forces, with some example in daily life, Surface tension, explanation of surface tension using intermolecular forces. Surface energy	Page 366-373 (T1)
36-39		Effect of temperature and impurities on the surface tension, some other examples of surface tension-small drop of a liquid are spherical while bigger are flat, Angle of contact	Page 387-393 (T1)
40-42		Pressure difference between the two sides of a curved liquid surface, to derive an expression for excess of pressure on the curved surface, excess pressure inside spherical drop, excess pressure inside an air bubble. Determination of surface tension of a liquid using capillary rise method	Page 394-400 (T1)

Evaluation Scheme:Physics I (Lab)

S. No.	Name of Experiment
1	To determine the weight of unknown object using parallelogram law of vector edition.
2	To find the value of Young's modulus of a wire using Searle's Apparatus.
3	To find the value of Poisson's ratio of a rubber
4	To verify Newton's law of cooling.
5	To find the moment of inertia of a fly wheel.
6	To determine the frequency of alternating current using a sonometer and an electromagnet.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Lab Tests conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	23.09.2021	1-12	CB
Test 2	60 Minutes	8	17.11.2021	13-26	CB
Test 3	60 Minutes	8	07.12.2021	27-42	CB
Lab	Throughout the Semester	20	*TBD	-	CB
Comprehensive Exam	3 Hours	56	04.01.2022	1-42	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

***TBD – To be decided**

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. RAVI SHRIVASTAVA
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
HSC 311	**Physics (H3) (Data Science for Basic Research)**	4	2	5

Instructor In-charge: Dr. RAVI SHRIVASTAVA

Learning Outcomes:

Data Science for Basic Research is an elective from Physics (H3) which forms the first half of a two-semester comprehensive course on core level physics to be taught to all the students B.Sc. (H).

The course aims at:-

1. Developing an understanding of the basic principles of Data Science and its implementation in research work.
2. Developing the application of concepts to problems of practical interest using Python.
3. Improving the concepts and improving the problem solving skills of students.

Textbook (s) **T1**	Statistics (wikibooks.org)
Reference book (s) **R1**	Lecture Series from Youtube (Channel-Code basics) (YouTube links are provided)

Learning Outcomes:

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos. of Text Book)
1-3	Learn about the Basics Statistical Methods and related information	Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes variables.	https://nptel.ac.in/courses/110/106/110106064/ (Module-01)
4-5		Scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical.	13-16
6-8	Understanding the use of basic statistical techniques for preprocessing of a dataset.	Descriptive vs Inferential Statistics, Statistics for data science, Log normal distribution	https://www.investopedia.com/terms/l/log-normal-distribution.asp &

		Math	https://www.youtube.com/watch?v=dX5pw_sQUmc
9-12		Statistics for data science, machine learning, Median, Mean, Mode, Percentile Math	23-32 &https://www.youtube.com/watch?v=t4LOv9h-FJM
13-15		Statistics for data science, machine learning, Normal Distribution, Z Score, t Score	https://www.youtube.com/watch?v=okhrFgaUwio
16-17		Z test and t test for interpretation of Math, Statistics for data science, machine learning	
18-19	Understanding prediction for univariate and multivariate dataset	Introduction to Machine Learning, Linear Regression Single Variable	https://www.youtube.com/watch?v=8jazNUpO3lQ&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=2
20-21		Linear Regression Multiple Variables, Gradient Descent and Cost Function	https://www.youtube.com/watch?v=J_LnPL3Qg70&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=3 & https://www.youtube.com/watch?v=vsWrXfO3wWw&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=4
21-23		Training and Testing Data	https://www.youtube.com/watch?v=fwY9Qv96DJY&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=7
24-27		Logistic Regression (Binary Classification), Decision Tree	https://www.youtube.com/watch?v=zM4VZR0px8E&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=8 & https://www.youtube.com/watch?v=PHxYNGo8NcI&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=10
28-33		Support Vector Machine (SVM)	https://www.youtube.com/watch?v=FB5EdxAGxQg&list=PLeo1K3hjS3uvCeTYTeyfe0-rN5r8zn9rw&index=11
34-35	Learning about the minimization of factors for effective predictions	Eigen Systems, Factor Analysis, Notation	Printed Notes Contents
36-42		Principal Components Analysis (PCA) Exploratory Factor	Printed Notes Contents

		Analysis	
40-42	Understanding the	Hypothesis Testing, P-value, using one & two sample Z-test and one & two sample T-test	Printed Notes Contents

Evaluation Scheme:

Physics H3 (Data Science) (Lab)

S. No.	Name of Experiment
1	To implement the outlier removal using Z-score and percentile of a sample dataset using Python.
2	To normalize the data using various scaling techniques using Python.
3	To implement the Linear regression technique for prediction using a sample historical univariate dataset using python.
4	To illustrate the use of dummy variable for a sample dataset for prediction with Linear regression using python.
5	To implement a classification problem by means of Decision Tree using Python.
6	To implement the Logistics regression technique for prediction using a sample historical univariate dataset using python.
7	To implement Hypothesis Testing using Z-test in Python
8	To implement Hypothesis Testing using t-test in Python
9	To implement the use of Principal Component Analysis (PCA) for prediction using Python.

Evaluation Scheme:

Student evaluation is based on the series of Tests and Lab Tests conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	28.09.2021	1-12	CB
Test 2	60 Minutes	8	20.11.2021	13-26	CB
Test 3	60 Minutes	8	11.12.2021	27-42	CB
Lab	Throughout the Semester	20		-	CB
Comprehensive Exam	3 Hours	56	12.01.2022	1-42	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. RAVI SHRIVASTAVA
Instructor In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC312	**Chemistry V (Analytical Chemistry)**	**4**	**2**	**5**

Instructor-in-charge: Dr. PIYUSH THAKUR

Learning Outcomes:

This course is offered in the first semester for the Third year students of bachelor of sciences.

1. Explain the fundamentals of analytical chemistry and steps of a characteristic analysis.
2. Expresses the role of analytical chemistry in science.
3. Compare qualitative and quantitative analyses.
4. Expresses the quantitative analysis methods.
5. Expresses the qualitative analysis methods.

Textbook (s) T1	Textbook of quantitative Chemical Analysis, Vogel's, Sixth Edition, Pearson Education, 2003.
T2	Research methodology methods and techniques, C.R. Kothari and GauravGarg, New Age international publishers, 2019.
T3	University Chemistry, Bruce M. Mahan and Rollie J. Meyers, AWL publication, fourth edition, 1998.
Reference book (s) R1	Physical Chemistry, Ira N. Levine, Fifth Edition, Tata McGraw-Hill , 2002.
R2	Huheey, Keiter & Keiter, Inorganic Chemistry, Pearson Education, 2003.

.

Lecture Nos.	Learning objectives	Topics to be covered	Reference (Ch./Sec./ Page Nos.of Text Book)
1-3	To understand the data analysis for analytical data	Accuracy and precision, Error, types of error, systematic and random errors, minimization of errors.	T1:104-107
4-7		Mean and standard deviations, reliability of results, confidence interval, comparison of results, student T test, F test, Comparison of two samples (Paired T test),	T2: 8.1-8.2 9.3
8-9		Correlation and regression, correlation coefficient and liner regression, Sampling, the basis of sampling, sampling procedure, sampling statistics.	T2:14.2 – 14.3
10-11	To understand the concept of Acid-bases and Buffer solutions	Acid-base theories, Definition of pH and pH scale (Sorenson and operational definitions).	T3: 208-217
12-14		pH at elevated temperatures, pH for aqueous solutions of very weak acid and base, pH for salts of weak acid and weak bases, polyprotic acids.	T3:218 – 253
15		Hard and soft acids, bases.	R2: 344-353
16 -19	To understand the Volumetric analysis of chemicals	Introduction, Titrimetric analysis, classifications of reactions in titrimetric analysis, standard solutions. Preparation of standard solutions, primary and secondary standards,	T1: 292-295
20-21		Indicators, theory of indicators, Acid–base titrations in non-aqueous media.	T1: 296 – 316
22-25	To understand the quantitative analysis of chemicals	Gravimetric Analysis, Impurities in precipitates, Gravimetric calculations,	T1:398-403
26-28		Precipitation equilibria (Solubility product, common ion effect), organic precipitation.	

29-30	To understand the different types of titration	Introduction, Types of EDTA titrations, Methods of End Point Detection	T1: 326-345
31-33		Indicators (b) Instrumental methods of End point detection (Spectrophotometric, Potentiometric, High frequency titrator),	T1: 345, 373
34 - 36		Types of Complexometric Titrations (a) Direct Titration (b) Back Titration (c) Replacement titration (d) Indirect Titration (e) Applications of Complexometric Titrations.	T1: 335-343
37	To understand separation method and types of chromatography	Conventional column chromatography Introduction, stationary phase, mobile phase	T1:244-259
38-39		advantages and limitations of column chromatography	T1:213– 218
40		Ion exchange chromatography: Introduction, ion exchange equilibria,	T1:219 – 228

Chemistry V (lab)

S. No.	Name of Experiment
1	Determination of concentration of Mg^{2+} ions by EDTA using Eriochrome Black as indicator.
2	To determine the strength of ferrous ammonium sulphate (Mohr's salt) solution by using external indicator
3	Determination of the strength of given unknown oxalic acid solution by titrating it against Potassium permanganate.
4	To prepare a standard N/20 copper sulphate solution and then determine the strength of sodium thiosulphate solution iodometrically.
5	Determination of concentration of Ca^{2+} ions by EDTA using Eriochrome Black –T as indicator.
6	Preparation of acetate buffer solution (pH range 3- 6)
7	Estimation of Barium in given sample by Gravimetric Analysis
8	Estimation of Copper in given sample by Gravimetric Analysis

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	24.09.2021	1-15	CB
Test 2	60 Minutes	8	18.11.2021	16- 30	CB
Test 3	60 Minutes	8	09.12.2021	31- 40	CB
Lab	60 Minutes	20		**	CB
Comprehensive Exam	3 Hours	56	06.01.2022	1- 40	CB

Make-up Policy: Make –up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Date: 29/10/2021

Dr. PIYUSH THAKUR
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC313	**Mathematics V (Linear Algebra)**	**4**	**0**	**4**

Instructor-in-charge: Dr. SHANTI SWARUP DUBEY

Learning Outcomes:

After successful completion of the course student will be able to

1. The concept of linear independence of vectors over a field, the idea of a finite dimensional vector space.
2. Basis of a vector space and dimension of vector space.
3. Basic concept of linear transformations, the Rank-Nullity theorem.
4. The concept inner product space and orthogonality.

Text Book T	Linear Algebra by K P Gupta, PragatiPrakashan Revised Edition 2016
Reference book(s) R1	Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003). Linear Algebra (4thedition). Prentice-Hall of India Pvt. Ltd.
Reference book(s) R2	Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd Edition). Narosa Publishing House

Lecture wise plan

Lecture Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-6	To define vector space	Definition and examples vector spaces, Subspace, Linear span, Quotient space and direct sum of subspaces,	T 1 Ch-2 4-45
7-10	Dimension of vector spaces	Linearly independent and dependent sets, Bases and dimension. Rank and nullity of a linear transformation and rank-nullity theorem.	T1 Ch-3,Ch-4 46-72, 73-113
11-16	Properties of Linear Transformations	Isomorphism of vector spaces, Dual and second dual of a vector space, linear transformation,	T1 Ch-5 114-177
17-21	Eigen values and Eigen vectors	Eigen vectors and eigen values of a linear transformation, Characteristic polynomial and Cayley–Hamilton theorem, Minimal polynomial.	T1 Ch 11 380-419

22-27	Concept of Inner Product Spaces	Inner product spaces and orthogonality, Cauchy–Schwarz inequality, Gram–Schmidt orthogonalisation, Diagonalisation of symmetric matrices.	T1 Ch-10 301-379
28-33	Adjoint of a Linear Transformation	Adjoint of a linear operator; Hermitian, unitary, normal linear transformations.	T1 Ch-10 301-379
34-37	Canonical Forms	Jordan canonical form, Triangular form,	T1 Ch-8 257-282
38-42	Invariant subspaces	Trace and transpose, Invariant subspaces	T1 Ch-9 283-300

Evaluation Scheme:
Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	17	27.09.2021	1-12	CB
Test 2	60 Minutes	17	19.11.2021	13- 28	CB
Test 3	60 Minutes	16	10.12.2021	29- 42	CB
Quizzes (2)	20 Minutes each	10	**	**	CB
Comprehensive Exam	3 Hours	40	10.01.2022	1- 42	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Dr. SHANTI SWARUP DUBEY
Instructor-In-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
HSC313	**Mathematics-V (Integral Transformations and Fourier Analysis)**	**4**	**0**	**4**

Instructor-in-charge: Ms. Yogita Chandrakar

Learning Outcomes:

After successful completion of the course student will be able to

1. Find Laplace Transformations.
2. Find Inverse Laplace Transformations.
3. Convert ODEs with BVP to Integral equations.
4. Fourier Series, Fourier Sine and Cosine Series.
5. Fourier Transformations, Fourier Sine and Cosine Transformations.

Text Book(T)	Fourier Series and Integral Transforms .Dr. S. Sreenadh, S.Ranganatham, Dr. M.V.S.S.N. Prasad, Dr. V. Ramesh Babu.
Reference book(s)	James ward Brown & Ruel V. Churchill (2011).Fourier series and Boundary value Problems. McGraw-Hill Education.
Reference book(s)	J. K. Goyal And K. P. Gupta Laplace and Fourier Transforms.

Lecture wise plan

Lecture Nos.	Learning Objective	Topics to be covered	Reference (chapter/sec./Page Nos of Text/Ref. Books)
1-7	Laplace Transforms	Definition of L.T., Linearity property of LT, Change of scale property of LT,Shifting theorem, LT of Integral and Derivatives, LT of Periodic function.	T /Ch-2/ 131-199
8-15	Inverse Laplace Transforms	Definition of Inverse L.T., Linearity property of ILT, Change of scale property of ILT, Shifting theorem, ILT of Integral and Derivatives, Convolution theorem.	T /Ch-2/ 200-276
16-20	Fourier Series	Definition of Fourier series, Fourier Sine and Cosine Series	T/ Ch-1/ 3-127
21-31	Fourier Transforms and Inverse Fourier Transforms	Definition of FT and IFT, Linearity property of FT, Change of scale property of FT ,Shifting theorem, FT of Integral and Derivatives, Modulation theorem, Fourier Sine and Cosine Transformations, Inverse Fourier Sine and Cosine Transformations.	T/ Ch-3/ 279-357

32-40	Applications of Laplace and Fourier Transforms	Relation between LT and FT, solutions of ODEs And Integral equations.	T/ Ch-4/ 361-449

Evaluation Scheme:

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	17	28.09.2021	1-12	CB
Test 2	60 Minutes	17	20.11.2021	13- 28	CB
Test 3	60 Minutes	16	11.12.2021	29- 42	CB
Quizzes (2)	20 Minutes each	10		**	CB
Comprehensive Exam	3 Hours	40	12.01.2022	1- 42	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Ms.YOGITA CHANDRAKAR
Instructor-in-charge

The ICFAI University, Raipur

Faculty of Science

First Semester, 2021 – 2022

Course Handout

Course No	Course Title	L	P	U
SC314	**Computer Science- V (Data Structure and Algorithm)**	**4**	**2**	**5**

Instructor-in-charge: Mr. ASHISH KUMBHARE

Learning Outcomes:

This course introduces the core principles and techniques for Data structures. Students will gain experience in how to keep a data in an ordered fashion in the computer. Students can improve their programming skills using Data Structures Concepts. After successful completion of the course student will be able to

1. Explore basic data structures such as stacks and queues.
2. Introduce a variety of data structures such as Linked list, Trees, search trees, Graphs
3. Introduce sorting and searching algorithms.

Textbook(s) T1	Fundamentals of Data Structures by Ellis Horowitz &SartajSahni, Computer Science press.
Referencebook(s) R1	Data Structures using C by A. K. Sharma, Pearson Education
R2	Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
R3	Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.Tondo and B.Leung,Pearson
NPTEL Link	https://nptel.ac.in/courses/106/102/106102064/
SWAYAM Link	https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

Lecture-wise plan:

Lecture Nos.	Learning Objective	Topics to be covered	Reference(Ch./Sec./Page Nos.of Text Book)
1-3	To learn Introduction of Data structure and its types	Introduction of Data structure, Data types: primitive, non-primitive data types, Linear and non linear datastructure.	T1 CH-1 1.1, 1.3, 1.4
4-6	To learn application of array and various searching techniques	Array concept (one dimension, two dimension), Linear and Binary Search Algorithms,	T1 CH-2 2.4
6-7	To learn various sorting techniques	Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort	T1 CH-7 7.1, 7.2
8-10	To learn various sorting techniques using Divide and Conquer strategy.	Quick Sort, Merge Sort & Radix sort	T1 CH-7 7.3, 7.4, 7.5

11	To learn introduction to linear data structure stack.	Stack concept	T1 CH-3 3.1
12-13	To learn various stack operations.	Operations PUSH, POP, TRAVERSE, Isfull, Isempty.	T1 CH-3 3.1, 3.2
14-17	To learn Applications of stack	Infix, Prefix, Postfix representation, Conversion using stack	T1 CH-3 3.3
18-19	To learn introduction to linear data structure Queue and its types.	Introduction, and Types of Queues, Priority Queue, Circular queue, Double Ended Queue,	T1 CH-3 3.1
20	To learn various Queue operations.	Operations (INSERT, DELETE, TRAVERSE)	T1 CH-3 3.1, 3.2
21-22	To learn introduction to linear data structure Linked list and its types.	Linked List, Singly and Doubly Linear link lists, Singly and doubly circular linked list	T1 CH-4 4.1
23-24	To learn various linked List operations	Operations on linked lists insert, delete, Applications of linkedlists.	T1 CH-4 4.8,4.9
25-26	To learn introduction to Nonlinear data structure Tree and its types.	Definition of trees and their types, Binary trees, Properties of Binary trees,.	T1 CH-5 5.1, 5.2
27-30	To learn various operations and traversal technique.	Insertion, deletion, Searching and traversal algorithm, Preorder, post order, in-order traversal) , BFS, DFS	T1 CH-5 5.3, 5.4, 5.5
31-32	To learn various applications of tree	Binary Search Trees, Implementations, AVL Trees, B tree,	T1 CH-5 5.6, 5.7
33	To learn introduction to Nonlinear data structure Graph and its types.	Definition of Graph and their types	T1 CH-6 6.1
34-35	To learn various applications of Graph	Adjacency and incident (matrix & linked list) representation of graphs, Weighted Graphs,	T1 CH-6 6.2
36-38	To learn various operations and traversal technique.	Shortest path Algorithm, Spanning tree, Minimum Spanning tree,	T1 CH-6 6.3, 6.4
39-40	To learn various operations and traversal technique.	Kruskal and prims algorithms.	T1 CH-6 6.3, 6.4

Evaluation Scheme: Computer Science V (Lab)

S. No.	Name of Experiment
1	Write a program to perform the Matrix addition, Multiplication Operation. [Menu Driven]
2	Write a program to search the element using sequential search.
3	Write a program to search the element using binary search.
4	Write a program to implement bubble sort.
5	Write a program to implement selection sort.
6	Write a program to implement insertion sort.
7	Write a program to implement the concept of Stack with Push, Pop, Display and Exit operations.

8	Write a program to implement the concept of Queue with Insert, Delete, Display and Exit operations.
9	Write a program to create a single linked list and display the node elements in reverse order.
10	Write a program to create the tree and display the elements.

Student evaluation is based on the series of Tests and Quizzes conducted during the course of semester followed by a comprehensive examination.

Evaluation Component	Duration	Weightage	Date	Syllabus (Lec.No.)	Remarks
Test 1	60 Minutes	8	22.09.2021	1-12	CB
Test 2	60 Minutes	8	16.11.2021	13- 26	CB
Test 3	60 Minutes	8	08.12.2021	27- 40	CB
Lab	-	20		**	CB
Comprehensive Exam	3 Hours	56	06.01.2022	1- 40	CB

** To be announced in the class

Make-up Policy: Make up will be given only under genuine circumstances for Tests Only. However prior and proper intimation to the concerned instructor is must.

General: It shall be the responsibility of individual students to attend all sessions, to take prescribed Assessment Tests, Tests and Comprehensive Examinations, etc.

Date: 01/10/2021

Mr. ASHISH KUMBHARE
Instructor-In-charge