DAV UNIVERSITY JALANDHAR

Course Scheme & Syllabus

For

B.Sc. Chemistry

(As per NEP 2020)

1st TO 2nd SEMESTER

2023–2024

2023-2024

PROGRAM EDUCATION OBJECTIVES (PEO)

PEO-1 To provide the students an in-depth understanding of the basic concepts of chemical sciences.

PEO-2 To develop student skill in problems solving, critical thinking and analytical reasoning.

PEO-3 To pursue higher studies, research and analysis in various disciplines of chemistry.

PEO-4 To attain entrepreneurship andself-empowerment in the area of chemical sciences.

PEO-5 To Provide a contemporary grounding in professional responsibility and ability to find solutions in a global, economic, environmental and societal context.

Programme Outcomes

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes (PSO)

PSO-1 The students will understand the existence of matter in the universe as solids, liquids, and gases which are composed of molecules, atoms and sub atomic particles.

PSO-2 Students will learn to estimate inorganic salt mixtures and organic compounds both qualitatively and quantitatively using the classical methods of analysis in practical classes.

PSO-3 Students will grasp the mechanisms of different types of reactions both organic and inorganic and will try to predict the products of unknown reactions.

PSO-4 Students will learn to synthesize the chemical compounds by maneuvering the addition of reagents under optimum reaction conditions.

Scheme of Courses- Bachelor of Chemistry

Credit Details			
S.No.	**Course Category**	**Course Category Abbreviation**	**3-Yr B.Sc chemistry / (Credits)**
1.1	Discipline Specific Courses-Core	DSC	58
1.2	Discipline Specific-Skill Enhancement Courses- Core	DS-SEC	5
1.3	Discipline Specific-Value Added Courses-Core	DS-VAC	0
Total of Discipline Specific Core Courses			63
2.1	Minor Courses	MC	
OR			
2.2	Interdisciplinary Courses	IDC	22
3	Multidisciplinary Courses	MDC	9
4	Ability Enhancement Course-Common	AEC-C	8
5	Value Added Courses-Common	VAC-C	6
6.1	Skill Enhancement Courses- Common	SEC-C	8
6.2	Skill Enhancement Courses-Summer Internship	SEC-SI	4
Total of Skill Enhancement Courses			
Total Credits			**120**

Scheme of Courses- Bachelor of Honours in Chemistry/(Hons/(Hons. with Res.)

Credit Details

S.No.	Course Category	Course Category Abbreviation	4-Yr B.Sc Chemistry (Hons.)/(Credits)	4-Yr .Sc Chemistry (Hons/(Hons. with Res.) (Credits)
1.1	Discipline Specific Courses-Core	DSC	98	86
1.2	Discipline Specific-Skill Enhancement Courses-Core	DS-SEC	5	5
1.3	Discipline Specific-Value Added Courses-Core	DS-VAC	0	0
	Total of Discipline Specific Core Courses		103	91
2.1	Minor Courses	MC		
OR				
2.2	Interdisciplinary Courses	IDC	22	22
3	Multidisciplinary Courses	MDC	9	9
4	Ability Enhancement Course- Common	AEC-C	8	8
5	Value Added Courses-Common	VAC-C	6	6
6.1	Skill Enhancement Courses- Common	SEC-C	8	8
6.2	Skill Enhancement Courses-Summer Internship	SEC-SI	4	4
6.3	Skill Enhancement Courses- Research Project/Dissertation	SEC-RP	--	12
Total of Skill Enhancement Courses				
Total Credits			**160**	**160**

Semester 1

			In hours				
S.No	**Paper Code**	**Course Title**	**L**	**T**	**P**	**Cr.**	**Course Category**
1.	CHM101	Physical Chemistry-I	3	-	2	4	DSC
2.	CHM102	Organic Chemistry-I	2	-	2	3	DSC
3.	PHS152	Modern Physics (Physics)	3	-	2	4	IDC
4.		Multidisciplinary Courses	-	-	-	3	MDC
5.		Ability Enhancement Course-Common	-	-	-	2	AEC- C
6.		Skill Enhancement Courses-Common	-	-	-	2	SEC-C
7.		Value Added Courses-Common	-	-	-	3	VAC-C
						21	

L- Lectures T- Tutorial P- Practical Cr.- Credits

Semester 2

			In hours				
S.No	**Paper Code**	**Course Title**	**L**	**T**	**P**	**Cr.**	**Course Category**
1	CHM111	Inorganic Chemistry-I	3	-	2	4	DSC
2	PHS153	Optics and Lasers (Physics)	3	-	2	4	IDC
3		Multidisciplinary Courses	3	-	-	3	MDC
4		Ability Enhancement Course-Common	-	-	-	2	AEC- C

5		Skill Enhancement Courses-Common	-	-	-	3	SEC-C
6		Value Added Courses-Common	-	-	-	3	VAC-C
						19	

L- Lectures T- Tutorial P- Practical Cr.- Credits

Course Code	**CHM101**						
Course Title	**Physical Chemistry -I**						
Hours	L:3, T:0, P:2						
Credits	4						
Type	**Core**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: Derive mathematical expressions for different properties of gas and understand their physical significance** **CO2: Explain different physical properties of liquids and their applications in day to day life and Explain the crystal structure and calculate related properties of cubic systems.** **CO3: Explain the concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt.** **CO4: Apply the concepts of physical properties of liquids, pH and electrolytes while studying other chemistry courses and everyday life.**						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**-**	**25%**	**-**	**35%**	**25%**	**5%**

Examination Mode	Theory + Practical	
Syllabus	**Unit 1: Gaseous State** • Kinetic molecular model of a gas: Postulates of kinetic theory of gases, Derivations of gas laws; Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable); effect of temperature on distribution of molecular velocities; Expansivity and compressibility; Derivation for expression for average, root mean square and most probable velocity. • Collision frequency; collision diameter; mean free path, viscosity of gases including its temperature and pressure dependence; relation between mean free path and coefficient of viscosity, calculation of mean free path with temperature and pressure. Degrees of freedom, law of equipartition of energy, heat capacities of an ideal gas • Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases; causes of deviation from ideal behavior, van der Waals equation of state, its derivation and application in explaining real gas behaviour, virial coefficients and calculation of Boyle temperature. PV isotherms of real gases, and their comparison with vander Waals isotherms, continuity of states, critical constant; relation between critical constants and vander Waals constants, law of corresponding states.	**CO1**
	Unit 2: Liquid State and Solid State • Physical properties of liquids; vapour pressure, surface tension, viscosity and their determination. Young-Laplace equation, Effect of addition of various solutes on surface tension and viscosity; Explanation of cleansing	**CO2**

	action of detergents; Effect of Temperature and pressure on viscosity of liquids; Reynolds number, Refraction and optical activity. • Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, X-ray diffraction, Bragg's law	
	Unit 3: Ionic Equiliria • Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts; Buffer solutions; derivation of Henderson equation and its applications; Solubility and solubility product of sparingly soluble salts- applications of solubility product principle; Qualitative treatment of acid-base titration curves (calculation of pH at various stages).	**CO3**
	Unit 4: Practical • Surface tension measurements. Determine the surface tension by (i) drop number (ii) drop weight method. Study the variation of surface tension of detergent solutions with concentration. Determine cmc. • Viscosity measurement using Ostwald's viscometer. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. • pH metry Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.	**CO4**

	pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. Determination of dissociation constant of a weak acid.	

Text Book/s

1. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press.

2. Ball, D. W. (2017), Physical Chemistry, 2nd Edition, Cengage Learning, India.

3. Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.

4. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 1, 6th Edition, McGraw Hill Education.

5. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

6. Kapoor, K.L. (2019), A Textbook of Physical Chemistry, Vol.7, 1st Edition, McGraw Hill Education.

7. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P.(2003), Experiments in Physical Chemistry, 8th Edition, McGraw-Hill, New York.

Reference Book/s

1. Moore, W.J. (1972), Physical Chemistry, 5th Edition, Longmans Green & Co. Ltd.

2. Glasstone, S. (1948),Textbook of Physical Chemistry, D. Van Nostrand company, New York

3. Halpern, A. M. and McBane, G. C. Experimental Physical Chemistry 3rdEd.; W.H. Freeman & Co.: New York, 2003.

Course Code	**CHM102**						
Course Title	**Organic Chemistry -I**						
Hours	L:2, T:0, P:2						
Credits	3						
Type	**Core**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: Gain the knowledge of basics concepts of organic Chemistry and stereochemistry of organic compounds** **CO2: Learn about chemistry of alkanes and cycloalkanes** **CO3: Learn about chemistry of alkenes, cycloalkenes and dienes** **CO4: Students will gain the practical knowledge of basics techniques of organic chemistry**						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**-**	**25%**	**-**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: Fundamentals of Organic Chemistry** • Hybridization, nature of bonding in organic compounds; Curved arrow notation, drawing electron movements with arrows half-headed and double-headed a						**CO1**

	• rrows, homolytic and heterolytic bond breaking; and electronic effects in Organic molecules. • Types of reagents – electrophiles and nucleophiles; Types of organic reactions and Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes, ketenes, benzyne (with examples). Assigning formal charges on intermediates and other ionic species. • Types of reactions and mechanism in organic chemistry; Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies). • Aromaticity: Concept of aromaticity, Huckel's rule, Homo-aromatic, non-aromatic and anti-aromatic systems. Aromaticity in benzenoid and non-benzenoid molecules, Annulenes. • Stereochemistry of Organic Compounds: Concept of isomerism. Types of isomerism. Optical isomerism – Conformation and configuration of molecules, elements of symmetry and concept of chirality. Stereogenic center, optical activity, projection formulae - Fischer, Saw-horse, Newman and Flying wedge representations; Interconversion of these formulae. • Enantiomers and diastereomers and their properties; chiral and achiral molecules with two stereogenic centers; threo and erythro isomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. • Relative and absolute configuration, sequence rules, D & L; R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.	

	• Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivative.	
	Unit 2: Alkanes and Cycloalkanes • IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes. • Methods of formation of alkanes (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids) • Physical properties and chemical reactions of alkanes. • Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. • Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring; banana bonds.	**CO2**
	Unit 3: *Alkenes, Cycloalkenes, Dienes* • Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rules, Hofmann elimination. • Physical properties and relative stabilities of alkenes. • Chemical reactions of alkenes – mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4, Polymerization of alkenes; Substitution at the allylic and	**CO3**

	vinylic positions of alkenes; Industrial applications of ethylene and propene. • Cycloalkenes: Methods of formation, conformation and Chemical reactions of cycloalkenes. • Dienes: Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions– 1,2 and 1,4 additions, Diels-Alder reaction.	
	Unit 4: Organic Chemistry Lab I **Calibration of Thermometer** 80-82^{o} (Naphthalene), 113-114^{o} **(**acetanilide**)**, 132.5-133^{o} (Urea), 100^{o} (distilled Water) **Determination of melting point** Naphthalene 80-82^{o}, Benzoic acid 121.5-122^{o} Urea, 132.5-133^{o}, Succinic acid 184-185^{o} Cinnamic acid 132.5-133^{o}, Salicylic acid 157-5-158^{o} Acetanilide 113-5-114^{o}, m-Dinitrobenzene 90^{o} p-Dichlorobenzene 52^{o}. Aspirin 135^{o}. **Determination of boiling points** Ethanol 78^{o}, Cyclohexane 81.4^{o}, Toluene 110.6^{o}, Benzne 80^{o}. **Mixed melting point determination** Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1) **Distillation** Simple distillation of ethanol-water mixture using water condenser, Distillation of nitrobenzene and aniline using air condenser. **Crystallization** Concept of induction of crystallization Phthalic acid from hot water (using fluted filter paper and stemless funnel), Acetanilide from	**CO4**

	boiling water, Naphthalene from ethanol, Benzoic acid from water. **Decolorisation and crystallization using charcoal** Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration. Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorising carbon) from ethanol. **Sublimation** Camphor, Naphthalene, Phthalic acid and Succinic acid. **Extraction** Isolation of caffeine from tea leaves **Steam distillation** Purification of aniline/nitrobenzene by steam distillation	

Text Book/s

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).

2.Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3.Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

4.Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.

5.Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.

6.McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Reference Book/s

1.Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

2.Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry,5th Ed., Pearson (2012)

Course Code	**CHM111**						
Course Title	**Inorganic Chemistry -I**						
Hours	L:3, T:0, P:2						
Credits	4						
Type	**Core**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: Students will comprehend the structure of atom and the role of quantum mechanics in its understanding..** **CO2: Understand and utilize the knowledge of the periodic table and periodic properties** **CO3: Understand about different types of bonding and theories explaining these bondings.** **CO4: The course will help them to understand the difference between qualitative and quantitative analysis They will use titration as a skill for quantitative analysis. Students will also learn to perform the test for qualitative estimation of various acid and basic radicals.**						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**-**	**25%**	**-**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: Atomic Structure** • The Bohr's theory of atomic structure and how it was developed						**CO1**

	• Wave Mechanics: The wave-nature of electrons, The uncertainty principle and its significance, de Broglie equation, The Schrodinger wave equation, • Quantum numbers and their necessity in explaining the atomic structure: concept of orbitals • Writing electronic configuration and the rule's used: Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, The aufbau principle and its limitations	
	Unit 2: Periodic Properties • The long form of periodic table, • Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table • Periodic properties & trends in the periodic properties: Atomic and ionic radii, Ionization energy, factors affecting it, Electron affinity, Electronegativity, Pauling's and Mulliken's electronegativity scales. Variation of electronegativity with bond order, the inert-pair effect • Applications in predicting and explaining chemical behaviour	**CO2**
	Unit 3: Chemical Bonding • Covalent Bond: Lewis structures, Valence Bond theory, Hybridization of atomic orbitals, Resonance, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N2, O2, C2, B2, F2; heteronuclear diatomic Molecules HF, CO and NO. Formal charge, Valence shell electron pair repulsion theory (VSEPR) and shapes of molecules, Limitations of the VSEPR model.	**CO3**

	• Covalent character in ionic compounds: polarizing power and polarizability. Fajan's rules and Consequences of polarization. • Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. • Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. • Non-covalent bonds: vander Waals forces, Dipole moments, dipole-dipole interactions, dipole-induced dipole forces. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force on the melting and boiling points, solubility energetics of dissolution process. • Bonding in metals and semiconductors: Qualitative idea of band theories for metals, Semiconductors and insulators	
	Unit 4: Practical • Qualitative Analysis: Semi-micro analysis of salt mixtures containing two acidic and two basic radicals • Quantitative Analysis: Calibration and use of apparatus, • Preparation of solutions of different Molarity/Normality of titrants. • Acid-Base Titrations Estimation of carbonate and bicarbonate present together in a mixture. Estimation of free alkali present in different soaps/detergents. • Oxidation-Reduction Titrimetry	**CO4**

	Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution Estimation of oxalic acid and sodium oxalate in a given mixture.	

Text Book/s

1. Concise Inorganic Chemistry: J D Lee, 4th Edn, Wiley, (2021)

2. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, K.C. Kalia

3. Bassett, J., Denney, R. C., Jeffery, G. H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.

Reference Book/s

1. Basic Inorganic Chemistry, F A Cotton, G Wilkinson and P. L. Gaus, 3rd Edition. Wiley. India

2. Shriver and Atkins' Inorganic Chemistry, 5th Edition.

3. Pearson - Inorganic Chemistry, 5/E - Catherine Housecroft

4. Pfennig, Brian William-Principles of inorganic chemistry-Wiley (2015)

5. Svehla G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman,1996.

Course Code	PHS152							
Course Title	Modern Physics							
Hours	L:3, T:0, P:2							
Credits	4							
Type	**Interdisciplinary**							
Course Outcomes	On the completion of the course, the student will be able to CO1: Know the main aspects of the inadequacies of classical mechanics and understand the historical development of quantum mechanics and the ability to discuss and interpret experiments that reveal the dual nature of matter CO2: Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, probability density and the normalization techniques, skill development on problem-solving e.g. one-dimensional rigid box, tunnelling through a potential barrier, step potential, rectangular barrier. CO3: Knowledge about properties of the atomic nucleus, liquid drop model and nuclear shell model and radioactivity, radioactive decay like alpha, beta, and gamma decay. CO4: Correlate between theory and experimental results of basic quantum physics and apply knowledge to find out planck's constant, ionization potential, e/m ratio etc.							
Examination Mode	Theory+ Practical							
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL	Assessment Tools
Weightage	**10%**	**-**	**25 %**	**-**	**35 %**	**25 %**	**5%**	Weightage
Examination Mode	Theory + Practical							
Syllabus								**CO Mapping**
Unit 1	**Wave Particle Duality**							

	Quantum theory of light, X-rays and their diffraction, Compton effect, particle diffraction, uncertainty principle and its applications. Pair production, Wave Properties of Particles; de Broglie waves, Waves of probability, the wave equation, phase and group velocities	1
Unit 2	**Quantum Mechanics**	
	Difference between classical and quantum mechanics, wave function and wave equations, Schrodinger's equation, time dependent and steady state forms, Expectation values, Particle in a box, reflection and transmission by a barrier, tunnel effect, harmonic oscillator.	2
Unit 3	***Atomic Nucleus and Radioactivity***	
	Nuclear Properties: The neutron, stable nuclei, nuclear sizes and shapes, binding energy, meson theory of nuclear forces, Nuclear Models: liquid drop model, shell model, Radioactivity: Radioactive decay, Half-life, radioactive dating, radioactive series, alpha decay and its theory, beta decay, gamma decay, radiation hazards and radiation units	3
Unit 4	**Modern Physics Laboratory experiments:**	
	1. Determination of Planck's constant using photocell. 2. To find half-life period of a given radioactive substance using GM counter 3. To determine charge to mass ratio (e/m) of an electron by Millikan Oil Drop Method. 4. Study of excitations of a given atom by Franck Hertz set up. 5. To find the ionization potential of mercury using gas filled diode 6. Study of C.R.O. as display and measuring device, Study of Sinewave, square wave signals. 7. To find conductivity of given semiconductor crystal using four probe method. 8. To determine the Hall coefficient and mobility of given semiconductors.	4

	9. Study of Solar Cell characteristics	
Text Books	1. Shaweta MOHAN and Kulwanr S. Thind , Elements of Modern Physics, Vishal Publications, 2021 2. B.Sc. Practical Physics eBook : CL Arora	
Reference Books	1. A. Beiser, Concepts of Modem Physics: McGraw Hill, 1987 2. Ghatak and Loknatham. Quantum Mechanics:(Springer), 2004. 3. K. Hyde, Basic ideas and Concepts in Nuclear Physics: (Institute of Physics), 2004	

Course Code	PHS153							
Course Title	Optics and Lasers							
Course Outcomes	On the completion of the course the student will be able to CO1:To impart students' knowledge of interference and gain insights about the Fraunhoffer diffraction in detail. CO2 To understand the concept of polarization, and its applications in day to day life. CO3 To understand the concept of LASER, its working mechanism and various types and applications. CO4: To have hand on training of various optics experiments.							
Examination Mode	Theory+ Practical							
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL	Assessment Tools
Weightage	**10%**	**-**	**25 %**	**-**	**35 %**	**25 %**	**5%**	Weightage
Examination Mode	Theory + Practical							

Syllabus		CO Mapping
Unit 1	**Interference and Diffraction**	
	Types of interference, Young's double slit experiment, Fresnel's biprism, thickness of thin transparent sheet, Interference in thin films, Newton's rings and their application, Application of thin film interference Franunhoffer diffraction at a single slit and its discussion, Fraunhoffer diffraction at double slit, Diffraction of N slits and its discussion Missing orders, dispersive power, Rayleigh Criterion for resolving power, resolving power of a diffraction grating.	1
Unit 2	**Polarization**	
	Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization, Polarization by transmission and reflection, polarisers and analyzers; Malus Law, Brewster's Law ,Theory of double refraction, Quarter wave and half wave plates, Elliptically and circularly polarized light production Optical activity, specific rotation. Half shade polarimeter;	2
Unit 3	**LASERs**	
	Interaction of light with matter; Einstein relations; light amplification population inversion; active medium, pumping; metastable states; principle pumping schemes; optical resonant cavityHe-Ne Laser, Ruby Laser, laser beam characteristics and applications, shape and width of spectral lines, line broadening mechanism, natural, collision and Doppler broadening.	3
Unit 4	**Laboratory experiments**	
	1. To determine the wavelength of light using Newton's ring set up. 2. To determine the wavelength of laser source using diffraction of single slit. 3. To study the specific rotation of sugar solution Laurent's half shade polarimetermethod	4

	4. Study of C.R.O. as display and measuring device, Study of Sinewave, squarewave signals (half wave and full wave rectification) 5. To compare the focal length of two lenses by Nodal slide method. 6. Determination of Plank's constant using photoelectric effect. 7. To measure beam divergence of He-Ne Laser. 8. To determine the refractive index of the material of a given prism using Sodium light	
Text Books	1. Subramanayam, N.; Lal, B. and Avadhamulu; M. N. Textbook of Optics. New Delhi: S. Chand & Company, 2006. 2. B.Sc. Practical Physics, C. L. Arora.	
Reference Books	1.Jenkins, F.A.; White, H.E. Fundamentals of Optics. USA: McGrawHill Publication, 2. Ghatak,A. Optics. New Delhi:Tata McGraw Hill Publication, 2008	

COMMON COURSES (MANDATORY) TO BE OFFERED AS PER FOLLOWING INSTRUCTION

Mandatory Common Courses		**Sem. I**	**Sem. II**	**Sem. III**	**Sem. IV**
Value Added Courses	EVS **(3 Credits) Faculty Name: Dr. Harpreet Walia & Dr. Raj Bala)**	**BBA, B.Com., B.Sc. Health & Phy Edu.**, **B.Tech. AI & Others**, **B.A. English & JMC**	B.Tech. CSE, B.Sc. (Life Sciences & Basic Sciences BCA, B.Sc. Food & Science	___	___
	Human Values & Ethics **(3 Credits) Faculty: Sh. B.P. Bedi**	**B.Tech. CSE**, **B.Sc. (Life Sciences & Basic Sciences BCA, B.Sc. Food & Science**	BBA, B.Com., B.Sc. Health & Phy Edu., B.Tech. AI & Others, B.A. English & JMC		

Ability Enhancement Courses	Community Engagement (CEC) **2 Credits** Faculty: Dr. Sunita Paul	-	-	BCA, B.Sc. CS, BBA, B.Com., B.Tech. Engg. (All)	B.Sc. Life Sciences & Basic Sciences, B.Sc. **Agriculture,** Phy Educ. & **B.A. B.Ed. & B.Sc. B.Ed.**
	Communication Skills **(2 Credits**) Or Cambridge English-I & Cambridge English-II *(To be offered in two Semester)* ***Faculty: English Deptt.***	**Life Sciences. B.Sc. Health & Phy Edu.** **B.Tech. CSE, B.Tech. AI & Others, BCA, B.A. English, BBA, B.Com., B.Sc. Food & Science** Cambridge English-I	B.Sc. Physics, Chemistry, Math, **B.Tech. CSE, B.Tech. AI & Others, BCA, B.A. English, BBA, B.Com., B.Sc. Food & Science** Cambridge English-II		

Common Courses

Ability-Enhance	**Cr.**	**Deptt.**	**Skill-Enhancem**	**Cr.**	**Deptt.**	**Value-Added Courses**	**Cr.**	**Deptt.**

ment Courses			**ent Courses**					
Personality Enhancement	1L+1P	CBM&E	Essentials of Entrepreneurship-Thinking and Action	2L+1P	CBM&E	Environmental Studies **(Mandatory) (EVS104)**	2L+1P	EVS & Botany
Personality Development (PSY190)	2P	Psychology	Design Thinking (MED104)	2P	Mech. Engg.	Human Values and Ethics (HVE101) **(Mandatory)**	2L+1T	English
Behavioural & Life Skills	1L+1P	Psychology	Design Thinking & Innovation (MGN102S)	2L	CBM&E	Gender Sensitization	2 Cr.	EVS & Botany
Global Citizenship in Higher Education	2L	English	Data Analytics	2L+1P	CSE	Professional Ethics	2 Cr.	CBM&E
Communication Skills (ENH151) **(Mandatory)** **OR**	1L+1P	English	Cyber Security	3 (2L+1P)	CSE	Sustainable Development	2 Cr.	Botany & EVS
	1L+1P	English	Digital Fluency (CSP191)	1L+1P	CSA	Green Technologies	2 Cr.	Elect. Engg.

Cambridge English-I (ENH111) **(Mandatory#)** & Cambridge English-II **(Mandatory#)** *# To be offered in two semesters*	1L+1P							
Technical Report Writing	2L	Chemical Engg.	Fundamentals of Computer programming & IT (FCPIT)	3 Cr 2L-1P	CSE	General Studies	2 Cr.	English
Leadership Management	2L	CBM&E	Python Programming	3 Cr. (2L+1P)	CSE	NSS	2 Cr. (1L+1P)	NSS
Creative & Critical Thinking	1L+1P	Education	Disaster Preparedness and Planning (CED100)	2L	Civil Engg.	Therapeutic Yoga	2 Cr. 1L+1P	Phy Edu.

Community Engagement & Social Responsibility **(Mandatory)**	1L+ 1P	Agriculture	Intellectual Property Rights	2 Cr.	Physics	Health & Yoga	2 Cr. 1L+1P	Phy Edu.
			Apiculture (ZOL192)	2 Cr	Zoology			
			NCC*	3 Cr. (2L+ 1P)	NCC			
			LATEX	3 Cr. (1L+ 2P)	Mathematics			
			Programming with FORTRAN	3 Cr (2L+ 1P)	Physics			

List of Multi-disciplinary open elective courses at DAV University

Sr. No.	**Course Name (Course Code)**	**Faculty/Department**
1	Basics of Physics	Physics
2	Basics of Chemistry	Chemistry
3	Basics of Biology **(ZOL194)**	Zoology & Botany
4	Introductory Biotechnology **(BTG100)**	Biotechnology
5	Introductory Microbiology **(MCR100)**	Microbiology
6	Functioning of the Human Body	Zoology
7	Introductory Botany	Botany
8	Business Management for Beginners	CBME
9	Fundamental of Mutual Funds **(MGN102M)**	CBME
10	Economics for Beginners **(ECN101M)**	CBME
11	Professional Communication **(ENH161)**	English
12	Fine Arts (EDU199)	Fine Arts & Performing Arts (Edu)
13	Jyotish: 'Eye of the Veda'	Vedic Studies
14	Mathematical Statistics	Mathematics
15	Introductory Journalism	JMC
16	Professional Photography **(MCJ151)**	JMC
17	Library Information Sciences	Library Sciences