



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.



MUST KNOW CONCEPTS

MKC

BIOTECH

2020-21

Course Code & Course Name : 16BTE15 & BIOLOGICAL SPECTROSCOPY

Year/Sem/Sec : III/VI

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
Unit-I : OPTICAL ROTATORY DISPERSION				
1.	Optical rotation		The angle through which the plane of polarization is rotated when polarized light passes through a layer of liquid	
2.	Dispersion		Splitting of white light into its constituent colors	
3.	Polarized light		Light waves in which vibrations occur in a single plane	
4.	Polarization		The process of transforming unpolarized light into polarized light	
5.	ORD		Optical Rotatory Dispersion	
6.	Unpolarized light		Light waves that is vibrating in more than one plane	
7.	Types of polarized light		Linear, circular and elliptical	
8.	Optical activity		Ability to rotate the plane of polarized light by a certain substance	
9.	Dextrorotatory		Substance that rotate the plane of polarization of light towards the right	
10.	Laevorotatory		Substance that rotate the plane of polarization of light towards the left	
11.	Polarimeter		Measure angle of rotation caused by passing polarized light through an optically active substance	
12.	ORD curve		Change in wavelength of light source	
13.	Types of ORD curves		Plain and anomalous curve	
14.	Types of anomalous curves		Single cotton effect and multiple cotton effect	
15.	CD		Circular dichroism	
16.	Circular dichroism		Uses circularly polarized light to investigate structural aspects of optically active chiral media	
17.	Nucleic acid		They are the main information carrying molecules (DNA, RNA) of the cell	
18.	Protein		Large biomolecules comprising of one	

			or more long chains of amino acid residues	
19.	Peak		Highest point in a wave	
20.	Trough		Lowest point in a wave	
21.	Amplitude		Distance from the centre line to the top of a crest	
22.	Optical rotation formula		Specific rotation $[\alpha]_D^t(\text{solvent}) = \alpha/lc$, where t - temp, D - wavelength of light, α - observed rotation, l - length of sample, c - concentration	
23.	Light sources in polarimeter		Tungsten-halogen lamp, sodium lamp and mercury lamp	
24.	Light wave		Is an electro-magnetic wave that travels through the vacuum of outer space	
25.	Nucleic acids function		Information carrying molecules of cell	

Unit-II : BIOLOGICAL DATABASES

26.	NMR		Nuclear Magnetic Resonance	
27.	Chemical shift		Position on plot at which nuclei absorbs	
28.	TMS		TetraMethylSilane	
29.	Spin-spin coupling		Magnetic interaction between the spins of neighboring nuclei which cause splitting of NMR spectrum	
30.	Coupling constant	J	Spin-Spin coupling causes the spectral lines to split and the distance between two adjacent sub-peaks in split signal	Hz
31.	Complex coupling		When a set of hydrogen is coupled to two or more sets of non-equivalent neighbors	
32.	Relaxation in NMR		Spin of the electron returning to equilibrium	
33.	Types of relaxation		Longitudinal and transverse	
34.	Boltzmann distribution		$n_i / n = \frac{g_i e^{-E_i/k_B T}}{Z(t)}$	
35.	NOE		Nuclear Overhauser Effect	
36.	EPR		Electron Paramagnetic Resonance	
37.	Longitudinal relaxation		Along the axis of the external magnetic field	
38.	Transverse relaxation		Perpendicular to the external magnetic field	
39.	Oscilloscope		Signal from phase sensitive detector and sweep unit is recorded	
40.	MRI		Magnetic Resonant Imaging	
41.	Components of MRI		Superconducting magnet, gradient coils and RF coils	

42.	LCS		Laser Cooling System	
43.	FID		Free Induction Decay	
44.	Doppler effect		Change in wavelength and frequency caused by the movement of an observer relative to the source	
45.	Multidimensional NMR		NMR experiments that use multiple time dimensions to obtain data and simplify the analysis	
46.	Types of nuclei NMR		^1H , ^{15}N , ^{13}C and ^{31}P	
47.	CDCl_3		Deuteriochloroform	
48.	COSY		COrelated Spectroscopy	
49.	COrelated Spectroscopy		Identify the spins that are coupled to each other	
50.	ESR		Electron Spin Resonance	

Unit-III : TYPES OF MASS SPECTROMETRY

51.	MS		Mass spectrometry	
52.	Mass spectra		It is a plot representing a chemical analysis, where the ion signal as a function of mass to charge ratio	
53.	Types of ion sources		Gas-phase and Desorption sources	
54.	Types of gas phase sources		Electron impact ionization and chemical ionization	
55.	Types of desorption sources		Atmospheric pressure ionization and Fast atom bombardment	
56.	MALDI-TOF		Matrix Assisted Laser Desorption Ionization - Time Of Flight	
57.	ESI		Electron Spray Ionization	
58.	APCI		Atomic Pressure Chemical Ionization	
59.	APPI		Atomic Pressure Photon Ionization	
60.	Types of sample introduction		Batch inlet and direct probe	
61.	Mass analyzers		To separate ions produced in the ion source according to their mass/charge ratio	
62.	Classification of mass analyzers		Scanning and pulsed	
63.	Types of detectors		Electron multiplier, faraday cup and micro-channel plate	
64.	Parent ion		Formed by loss of one electron	
65.	Types of ion trap mass analyzers		3D quadrupole and ion cyclotron resonance	
66.	SDS-PAGE		Sodium Dodecyl Sulphate-Polyacrylamide gel electrophoresis, used for separating proteins with molecular masses between 5 and 250 kDa	

67.	Capillary electrophoresis		An analytical technique that separates ions based on their electrophoretic mobility with the use of an applied voltage	
68.	Peptide mapping		Is an identity test for proteins, especially those obtained by rDNA technology	
69.	Carbohydrates		They are sugar molecules which the body breaks down into glucose	
70.	Lipids		They are molecules that contain hydrocarbons and makeup the building blocks of the structure and function of living cells	
71.	Fatty acids		They are the building blocks of the fat in our bodies and in the food we eat.	
72.	Groups of carbohydrates		Mono, di, oligo and poly	
73.	Types of fatty acids		Saturated and un saturated	
74.	Peptide bond		It is an amide bond which links amino acids together to form proteins	
75.	Types of un saturated fatty acids		Poly un saturated fatty acids and mono un saturated fatty acids	

Unit-IV : X-RAY DIFFRACTION

76.	X-ray		Short wave length EMR produced by the deceleration of high energy electrons	
77.	Types of x-ray scattering		Rayleigh scattering, photoelectric effect, Compton effect and pair production	
78.	Diffraction		It is bending of wave around the corners of an obstacle or through an aperture into the region of geometrical shadow on the obstacle	
79.	Crystal		It is a solid material whose constituents are arranged in a highly ordered microscopic structure, forming a lattice that extends in all directions	
80.	Rayleigh scattering		The electric field of incident photon's electromagnetic wave causes all electrons in the atom oscillate	
81.	Constructive interference		It occurs when the maxima of two waves add together so that the amplitude of the resulting wave is equal to the sum of individual amplitudes	
82.	Bragg's law		It states that when the x-ray is incident onto a crystal surface, it's angle of incidence θ , will reflect back with a same angle of scattering θ	
83.	Bragg's equation		$n\lambda = 2d\sin\theta$	
84.	Collimator		Absorbs all the x-rays except the narrow beam that passes between the gap	
85.	Types of		Flat crystal and curved crystal	

	monochromators			
86.	X-ray diffraction methods		Laué's photographic, rotating crystal and powder	
87.	Filter		Absorbs undesirable radiation but allows the radiation of required wavelength to pass	
88.	Materials used in monochromators		Quartz and NaCl	
89.	Detectors in X-rays		Photographic and counter methods	
90.	XRD		X-Ray Diffraction	
91.	Unit cell		The smallest volume element that repeated regularly through translation in 3D creates the whole crystal	
92.	Lattice		Is an ordered array of points describing the arrangement of particles that form a crystal	
93.	Types of unit cell		SCC, BCC, FCC	
94.	Phase problem		When x-rays are shot at a sample the resultant waves (amplitude and phase) are due to the interaction between the incident ray and crystal structure	
95.	Anomalous diffraction		It occurs when a wavelength is selected that is in the vicinity of an absorption edge of one of the constituent elements of sample	
96.	Electron diffraction		The phenomenon resulting from the interaction between electrons and crystalline materials producing a pattern of rings that characterize the sample	
97.	Neutron diffraction		The form of elastic scattering where the neutrons exiting the experiment have more or less the same energy as the incident neutrons	
98.	SAD		Single wavelength anomalous diffraction method	
99.	MAD		Multiple wavelength anomalous diffraction method	
100.	Crystal determination		It means to determine the precise spatial arrangements of all of the atoms in a chemical compound in the crystalline state	
Unit-V : SPECIAL TOPICS AND APPLICATIONS				
101.	Microscope		Instrument used to examine objects that are too small to be seen by the naked eye	
102.	Electron microscope		That uses accelerated electrons as a source of illumination	
103.	Types of electron microscope		Scanning Electron Microscope, Transmission Electron Microscope and	

			Reflection Electron Microscope	
104.	SEM		Scanning Electron Microscope	
105.	TEM		Transmission Electron Microscope	
106.	Electron gun		It produces an electron beam when tungsten wire is heated by current	
107.	Rastering		The scanning coils deflect the electron beam horizontally and vertically over the specimen surface	
108.	Combinatorial chemistry		Large number of different but structurally similar molecules are produced rapidly and submitted for pharmacological assay	
109.	HTS		High Throughput Screening	
110.	Types of combinatorial synthesis		Solid phase and Solution phase	
111.	Types of assays		Cell based and enzyme based	
112.	Cell based assay		Any number of different experiments based on the use of live cells (cell lines)	
113.	Drug discovery		Process by which new candidate medications are discovered	
114.	Resolution in microscope		Ability to distinguish two very small and closely spaced objects as separate entities	
115.	High Throughput Screening		Identification of one or more positive candidates extracted from a pool of possible candidates based on specific criteria	
116.	Topography		The surface features of an object i.e hardness and reflectivity	
117.	Morphology		The shape and size of the particles i.e strength and shape	
118.	Composition		The elements and compounds that the object is composed of and the relative amount of them	
119.	Scanning Electron Microscope		Uses a electron probe to extract structural and chemical information from a region of interest in sample	
120.	Resolution of SEM image		Specimen is characterized at nm to μm length scales	
121.	Components in SEM		Electron optical system, specimen stage, secondary electron detector, image display unit and computer	
122.	Condenser lens		Used to adjust the width of the electron beam	
123.	BSE		Back Scattered Electrons	
124.	SED		Secondary Electron Detector or Everhart-Thomley detector	
125.	Types of SEM		Conventional, Variable pressure, Cryo and Environmental	

Placement Questions

126.	Polarimeter		Measure angle of rotation caused by passing polarized light through an optically active substance	
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135.	Oscilloscope		Signal from phase sensitive detector and sweep unit is recorded	
136.	Doppler effect		Change in wavelength and frequency caused by the movement of an observer relative to the source	
137.	SDS-PAGE		Sodium Dodecyl Sulphate-Polyacrylamide gel electrophoresis, used for separating proteins with molecular masses between 5 and 250 kDa	
138.	Capillary electrophoresis		An analytical technique that separates ions based on their electrophoretic mobility with the use of an applied voltage	
139.	Bragg's law		It states that when the x-ray is incident onto a crystal surface, its angle of incidence θ , will reflect back with a same angle of scattering θ	
140.	Rayleigh scattering		The electric field of incident photon's electromagnetic wave causes all electrons in the atom oscillate	
141.	Phase problem		When x-rays are shot at a sample the resultant waves (amplitude and phase) are due to the interaction between the incident ray and crystal structure	
142.	Anomalous diffraction		It occurs when a wavelength is selected that is in the vicinity of an absorption edge of one of the constituent elements	

			of sample	
143.	Electron diffraction		The phenomenon resulting from the interaction between electrons and crystalline materials producing a pattern of rings that characterize the sample	
144.	Cryo-SEM stands for		Frozen - Allows the sample to view in frozen state	
145.	Crystal determination		It means to determine the precise spatial arrangements of all of the atoms in a chemical compound in the crystalline state	
146.	Microscope		Instrument used to examine objects that are too small to be seen by the naked eye	
147.	Rastering		The scanning coils deflect the electron beam horizontally and vertically over the specimen surface	
148.	Combinatorial chemistry		Large number of different but structurally similar molecules are produced rapidly and submitted for pharmacological assay	
149.	Scanning Electron Microscope		Uses a electron probe to extract structural and chemical information from a region of interest in sample	
150.	Condenser lens		Used to adjust the width of the electron beam	

Faculty Team Prepared

1. **Dr. G. PRATAP KUMAR**
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Signatures

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