Topic	Comments
12 Infrared Spectroscopy	
12.1 Electromagnetic Radiation	Definitions; wavelength; frequency; Hz
12.2 Molecular Spectroscopy	Definitions; absorption, ground state; excited state; relaxation
12.3 Infrared Spectroscopy	region of IR spectrum (4000 to 400 cm-1); requirements for IR activity; Hookes law
12.4 Interpreting Infrared Spectra	Correlation tables and their use; absorption intensities (i.e. m, s, w)
12.5 Solving Infrared Spectral Problems	functional group diagnostic peaks; effect of H-bonding in the IR spectrum
13 Nuclear Magnetic Resonance Spectroscopy	
13.1 Nuclear Spin States	Energy states and their orientation; spin #'s; units for magnetic field;
13.2 Orientation of Nuclear Spins in an Applied Magnetic Field	effect of nuclear spins in magnetic fields
13.3 Nuclear Magnetic Resonance	concept of resonance; signals; diamagnetic current; sheilding-deshielding; ppm & TMS
13.4 An NMR Spectrometer	basic parts
13.5 Equivalent Hydrogens	be able to label classify; upfield & downfield
13.6 Signal Areas	integration and its use
13.7 Chemical Shift	electronegativity effects; hybridization and diamagnetic effects; ring current
13.8 Signal Splitting and the (n + 1) Rule	application and use
13.9 The Origins of Signal Splitting	theory of splitting and recognition of patterns (s, d, t, etc); multiple splittings
13.13 Interpretation of NMR Spectra	Major functional groups; splitting patterns; multiple splitting
15 Organometallic Compounds	
15.1 Organomagnesium and Organolithium Compounds	Rxns with carbonyls & epoxides (Mechanism)
15.2 Lithium Diorganocopper (Gilman) Reagents	Coupling with halides
15.3 Carbenes and Carbenoids	Insertion reactions: carbene & dihalocarbenes; Simmons-Smith rxn
CUT-OFF for XM 1	
16 Aldehydes and Ketones	
16.1 Structure and Bonding	Polarity properties; bond characteristics
16.2 Nomenclature	trivial names of compounds on slides; basic nomenclature
16.3 Physical Properties	solubility trends; BP & or MP trends
16.4 Reactions	Reaction theme: addition to give tetrahedral intermediate
16.5 Addition of Carbon Nucleophiles	Grignards; R-Li; acetylide; cyanide-use of cyanohydrins (**mechanisms**)
16.6 The Wittig Reaction	use with carbonyls
16.7 Addition of Oxygen Nucleophiles	Hydrates; hemi-acetal; acetal formation & hydrolysis; **mechanisms**
16.8 Addition of Nitrogen Nucleophiles	imines and enamines-formation and hydrolysis; **mechanism**
16.9 Keto-Enol Tautomerism	acidity of α hydrogens (significance)
16.10 Oxidation	RHO & ROH-use of all Cr^{+6} reagents; Silver oxide;O_2
16.11 Reduction	metal hydride reductions; cat H_2; Clemmenson; Wolff-Kishner
16.12 Reactions at an α-Carbon	racemization-**mechanism;** halogenation, acidic & basic conditions-**mechanism**

Topic	Comments
17 Carboxylic Acids	
17.1 Structure	Formulas; carbonyl & OH interactions
17.2 Nomenclature	trivial names of compounds on slides; basic nomenclature, otherwise
17.3 Physical Properties	solubility trends; BP & or MP trends; spectral properties
17.4 Acidity	pKa values & use; stability of anions; equilibrium
17.5 Preparation of Carboxylic Acids	Grignard route (from CO_2)- and oxidations of alcohols
17.6 Reduction	LAH; selectivity of reductions
17.7 Esterification	Fisher esterification-mechanism
17.8 Conversion to Acid Chlorides	from $SOCl_2$ ~~mechanism~~
17.9 Decarboxylation	typical acids vs. β-keto acids; mechanism
CUT-OFF for XM 2	
18 Functional Derivatives of Carboxylic Acids	
18.1 Structure and Nomenclature	Formulas; carbonyl & OH interactions
18.2 Acidity of Amides, Imides, and Sulfonamides	trivial names of compounds on slides; basic nomenclature, otherwise
18.3 Characteristic Reactions	Nucleophilic acyl substitution-general mechanism
18.4 Reaction with Water: Hydrolysis	of acid Cl; anhydrides, esters, amides, CN; mechanisms of all
18.5 Reaction with Alcohols	to form esters; transesterification-mechanisms
18.6 Reactions with Ammonia and Amines	to form amides-mechanism
18.7 Reaction of Acid Chlorides with Salts of Carboxylic Acids	to form anhydrides-mechanism
18.8 Interconversion of Functional Derivatives	know reagents to convert functional groups into each other
18.9 Reactions with Organometallic Compounds	with esters & how that differs from ketones & aldehydes-mechanism
18.10 Reduction	LAH with acids, esters, nitriles and amides
19 Enolate Anions and Enamines	
19.1 Formation and Reactions of Enolate Anions	Enol vs enolates-generation and conditions
19.2 Aldol Reaction	Mechanism-both acidic and Basic conditions; intramolecular
19.9 Crossed Aldol Rxns with LDA	Kinetic vs Thermodynamic enolates
19.3 Claisen and Dieckmann Condensations	Mechanism-why the product formation is irreversible
19.6 Acetoacetic Ester Synthesis	mechanism-use for synthetic targets (ketones)
19.7 Malonic Ester Synthesis	mechanism-use for synthetic targets (ketones)
19.8 Conjugate Addition	Mechanism-types of nucleophiles used; **Robinson ring annulation**
to α, β-Unsaturated Carbonyl Compounds	
CUT-OFF for XM 3	

Topic	Comments
21 Benzene and the Concept of Aromaticity	
21.1 The Structure of Benzene	Geometry; bond angles; hybridization in benzene
21.2 The Concept of Aromaticity	4n+2 rule; explaination of stability in aromatic systems (omit Frost circles)
21.3 Nomenclature	IUPAC; common names-phenols, toluene etc
21.4 Phenols	using resonance theory to explain acidity of phenols
21.5 Reactions at a Benzylic Position	oxidation; halogenation; debenzylation (hydrogenolysis)
22 Reactions of Benzene and Its Derivatives	
22.1 Electrophilic Aromatic Substitution	Mechanism; energy profiles; generation of electrophiles; MONOsubstitition Rxns
22.2 Disubstitution and Polysubstitution	Theory of directing effects; results of disubstitution;
	Using resonance theory to predict o & p vs m isomers (mechanisms)
23 Amines	
23.1 Structure and Classification	1^o, 2^o, 3^o and aromatic vs aliphatic
23.2 Nomenclature	IUPAC and aniline
23.4 Physical Properties	solubility; pKa relationships; chemistry of basic nitrogen
23.5 Basicity	resonance effects upon basicity; **pKa of anilines**
25 Carbohydrates	
25.1 Monosaccharides	Nomenclature; D & L assignments; anomeric C; α, β
25.2 The Cyclic Structure of Monosaccharides	α, β notation; Fisher projections; Haworth proj.
25.3 Reactions of Monosaccharides	oxidation; reductions; glycoside (mechanism); mutarotation (mechanism)
END OF COURSE	