Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 1: What are polymers? What are their unique features?	1	Why are polymers so common?	Advantages and disadvantages of polymers Advanced applications Course modules	Applications of polymers	Video: https://youtu.be/54urJPOnaeU?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	2	Polymers: Molecular structure	Description of modules How to describe polymers? Molecular architecture	Monomers, functionality, repeating unit, degree of polymerization, branching, networking	Video: https://youtu.be/-W3SYP7U0yc?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	3	Process, structure, property	Processing Structure and properties Examples of process-structure-property relations	Process-structure-property, process-structure, structure-property, process-property	Video: https://youtu.be/_rrI_0o0wdA?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	4	Biopolymers	Classes of polymers What are biopolymers? Types of biopolymers * Some examples	Polymers: classification, biopolymers - examples	Video: https://youtu.be/RCnyrD5FPVs?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	5	Molecular weight and distribution	Effect of macromolecule size Molar mass: definitions * Molar mass distribution * Average molar mass	Average molecular weight, polydispersity, distribution	Video: https://youtu.be/-3LBG1XhFi8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	6	Polymerization	Molecular structure control Step polymerization Polymerization for polyolefins	Polyester polymerization, extent of polymerization, Flory distribution, active center, polyolefin polymerization	Video: https://youtu.be/rkT_6sIskPc?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	7	Macromolecular nature	Nature of bonding in polymers Reduction in molecular weight	Multiple scales in polymers, degradation, sustainable polymers	Video: https://youtu.be/C15YbiQLI2c?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 2: Simple concepts related to single macromolecule	8	Renewable sources for polymers	Renewable sources Natural fibers Examples of polymers from renewable sources	Natural fibers, renewable sources for polymers, poly (lactic acid), poly (hydroxybutyrate)	Video: https://youtu.be/drvmCXYsMeY?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	9	Polymerization / depolymerization	New ways to think about polymerization	Polymerization and depolymerization, polymers as sustainable materials in natural cycles	Video: https://youtu.be/hCoFRv5XwqQ?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	10	States of interest	Physical states Liquidlike states Solid-liquidlike states Solidlike states	States of interest for polymeric materials: solution, melt, rubbery, glassy	Video: https://youtu.be/oRNs6mloX5w?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	11	Application based terms	Types of Polymers Thermoplastics, thermosets, rubbers; Polymers for electronics, fuel cells and batteries, sensors and actuators; Solutions, dispersions and gels Polymers in composites	Types of Polymers Thermoplastics, thermosets, rubbers Polymers for electronics, fuel cells and batteries, sensors and actuators Solutions, dispersions and gels Polymers in composites	Video: https://youtu.be/9dhbhWuOGGU?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	12	Reuse and repurpose	Sustainability: Circular economy and footprint Reuse of plastic waste	Sustainability: Circular economy and footprint Reuse of plastic waste	Video: https://youtu.be/7jBiYsuw5Es?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	13	Molecular conformations	Conformation Single macromolecule: statistical properties	Conformation, end-to-end distance, orientational correlation	Video: https://youtu.be/9zCbjdphGEI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	14	Size, mobility and flexibility	Single macromolecule: ideal chain Different models for a single macromolecule Size and shape of a macromolecule Flexibility of a macromolecule	Radius of gyration, expanded chain, Gaussian distribution, Hookean spring	Video: https://youtu.be/KOrAcggXgK4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	15	Polyelectrolytes	Polymeric systems containing ions Fuel cell membrane	Polyelectrolytes, PEO electrolytes, sulfonated polymers, applications	Video: https://youtu.be/BXpfGWhR0Zs?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 3: Molecular arrangements and states of polymers	16	Structures in biopolymers	Molecular structure of biopolymers Molecular structure of nucleic acids Molecular structure of proteins Molecular structure of polysaccharides	DNA as engineering molecule, proteins and polysaccharides, casein, pectin	Video: https://youtu.be/CvAQSnpT2y0?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	17	Amorphous / crystalline states 1	Crystallization in polymers Spherulites	Single crystal and polycrystalline materials, folded chain crystal, crystal lamella, spherulite	Video: https://youtu.be/6rckTwpqHnY?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	18	Amorphous / crystalline states 2	Thermodynamics of crystallization Kinetics of crystallization	Equilibrium melting temperature, Measurement using DSC, scattering and density, polyethylene unit cell, crystallization rate	Video: https://youtu.be/X5491NHx9h8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	19	Orientation	Orientation Orientated polymers: applications and processing	Orientation in polymers and composites, measures of orientation, uiaxial and biaxial orientation, examples of biaxially oriented polymers	Video: https://youtu.be/X5491NHx9h8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	20	Interactions	Molecular interactions Simple models for intermolecular interactions Empirical approaches – interactions	Attractive and repulsive interaction, hard sphere and square well potentials, Mark Houwink relation, solubility parameter	Video: https://youtu.be/-V7kZGF_MS0?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	21	Kinetics of crystallization	Thermal transitions Rate of Crystallization	Rate of crystallization, thickness of lamella, Avrami model, Ozawa model, isothermal and dynamic crystallization	Video: https://youtu.be/3CFwI9gCXZ8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	22	Glass transition I	The amorphous state Glass transition temperature	Glass transition, segmental relaxation, volume Vs temperature behaviour, glass transition in semi-crystalline temperature	Video: https://youtu.be/t-SVmoLbI-o?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 4: Polymeric systems of different kind	23	Glass transition II	Relaxation Free volume theory Sub-segmental relaxations	Glass transition, activated and cooperative processes, stretched exponential relaxation, free volume, WLF equation, sub-segmental relaxations	Video: https://youtu.be/ripUB8O7c10?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	24	States in environment	Biogeochemical cycle Different states of polymers	Plastics in environment, plastics in nitrogen cycle, macroplastics and microplastics	Video: https://youtu.be/gmGoQJMKQCU?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	25	Liquid crystalline polymers	Liquid crystalline state Examples: liquid crystalline polymers Liquid crystalline polymer processing	Mesogens, Free energy change in liquid crystalline polymers, kevlar, liquid crystalline polyesters, orientation during processing	Video: https://youtu.be/N7HCjnR7Iig?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	26	Copolymers 1	What are copolymers? Some examples of copolymers	Copolymers, sequencing in copolymers, silicone ethers, chitin and chitosan, LLDPE	Video: https://youtu.be/1vUnJUQ22LI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	27	Copolymers 2	Copolymerization Behaviour of copolymers Block copolymers	Reactivity ratios, Block copolymers, Tg of copolymers	Video: https://youtu.be/_bvj6NPwl0o?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	28	Blends 1	Polymer blends Partial miscibility Theta temperature	Polymer blends, partial miscibility, blends of plastics and rubbers, theta temperature, coacervates	Video: https://youtu.be/JYOxeMr2UqI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	29	Blends II	Thermodynamics of mixing Flory Huggins Theory UCST and LCST	Gibbs free energy change of mixing, chi - interaction parameter, Latiice theory, phase diagram, critical temperature, miscibility gap / partial miscibility, Fox Flory equation	Video: https://youtu.be/9C6qLY0rKR0?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 5: Blends, copolymers and composites	30	Microstructure in polymers	Microstructure Phase separation mechanisms	Phase separation, nucleation and growth, critical nucleus size	Video: https://youtu.be/3z1_WcXkM78?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	31	Composites	Wood: a natural composite of polymers Size of reinforcement Composites in aerospace	Composites, Wood, load transfer and critical fiber length, aerospace composites, epoxies and bismalaimides	Video: https://youtu.be/CYTw82NMxHo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	32	Stress strain response	Stress strain curves Strength and toughness Qualitative terms for mechanical response	Stress strain response, brittle, ductile response, modulus, strength and toughness, macromolecular mechanisms	Video: https://youtu.be/Rquh0TMG_ic?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	33	Additives for polymeric systems	Polymer additives Environmental impact of additives	Additives during polymerization and processing, additives for performance, plasticizers, limiting oxygen index, plasticizers and effect on Tg, stabilizers, exchange of additives to surroundings	Video: https://youtu.be/dyGwLPHkhV4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	34	Blends / composites in recycling	Polymeric products: lifecycle Heterogeneities in polymeric products Blends/composites in recycled products	Polymeric materials - overall cycle, Mechanical and chemical recycling, Blends and composites using renewable polymers	Video: https://youtu.be/mAeZ7GtVdOA?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	35	Physical / chemical crosslinking	Crosslinking Examples of crosslinked polymers Different modes of mechanical testing	Types of crosslinks, chemical and physical crosslinks, decrosslinking, crosslinking in pectin	Video: https://youtu.be/W8XbpEus5-8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	36	Mechanical properties I	Different modes of mechanical testing Linear elasticity Non-linear elasticity	Modulus of polymers, Linear and nonlinear elasticity, Hookes law, Mooney Rivlin model, Neo Hookean model	Video: https://youtu.be/slzF9pljxlo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	37	Mechanical properties II	Overall mechanical response	Overall mechanical response, rate and temperature effects, Fracture, Fatigue and Impact	Video: https://youtu.be/rjtE09Ho-jI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 6: Physico-chemical, mechanical and electrical properties of polymers	38	Physical and chemical aging	Aging processes in polymers Accelerated testing	Physical and chemical aging, degradation in biological systems, aging in naturla rubber, property change with physical aging, accelerated testing and lifetime prediction	Video: https://youtu.be/IPz56M686O8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	39	Solutions: properties	Intrinsic viscosity Theta temperatures and solubility parameters Persistence length	Intrinsic viscosity, solubility parameter, persistence length, persistence chain	Video: https://youtu.be/7W0embQoMOg?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	40	Conducting polymers	Electronic and ionic conduction Example devices	Conducting polymer, charge carriers, ions and electrons, all polymer device, conductivity and permittivity	Video: https://youtu.be/nSAvyQajVzE?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	41	Dielectric response	Types of response Complexity in response of polymers * Viscoelasticity * Conducting-dielectric	Dielectric and conducting response, viscoelastic response, linear response, energy storage and dissipation in materials, loss factor	Video: https://youtu.be/ZQaTK_a9iyQ?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	42	Dielectric response II	Electromagnetic response Debye relaxation	Electric displacement and polarization, Complex permittivity, loss factor, Debye relaxation, orientational, atomic and sub-atomic polarization	Video: https://youtu.be/xaNYeu5Wi6E?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	43	Plasticity	Plasticity Models for plasticity	Elastic and plastic deformation, yield stress and yield strain, mechanisms of plasticity, crazing and shear banding, Eyring model, Ramberg-Osgood model	Video: https://youtu.be/osSIBT3I2IA?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	44	Properties of composites	Types of fillers Mixing rules Percolation	Types of fibers used in composites, Mixing rule, modulus of composites, percolation, electrical and thermal conductivity	Video: https://youtu.be/-sKlGmYyPhI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 7: Viscoelasticity in polymers	45	Viscoelasticity: introduction	Time, temperature, rate, frequency Deborah number	Viscoelasticity, viscous and elastic behaviour, Deborah number, creep and recovery	Video: https://youtu.be/lBCuxFK0j_Y?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	46	Thermal response	Thermal response of polymers Thermal analysis Thermal conductivity	Thermal events in polymeric events, transitions, annealing, thermal analysis, DSC, TGA, thermal conductivity	Video: https://youtu.be/OMj1wxIZOcM?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	47	Viscoelasticity: characterization	Static and dynamic testing Creep Stress relaxation	Static and dynamic tests, theory and experiments for viscoelastic characterization, creep compliance, relaxation modulus	Video: https://youtu.be/QeHJJUyhQ1Y?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	48	Viscoelasticity – simple models	Linear viscoelasticity Voigt model Maxwell model	Linear viscoelastic models, Voigt model, creep response of Voigt Kelvin model, Maxwell model, stress relaxation, multiple relaxation modes	Video: https://youtu.be/i7EKNxvItIw?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	49	Dynamic mechanical analysis	Oscillatory testing Regions of viscoelasticity	Oscillatory response, dynamic mechanical analysis, regions of viscoelasticity, storage and loss modulus, loss tangent	Video: https://youtu.be/2Ji4TUrit_s?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	50	Damping Applications	Dissipation Standard linear solid model	Energy dissipation during cycle, damping and loss tangent, standard linear solid model, example damping materials	Video: https://youtu.be/82chDXiLYH4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	51	Time Temperature superposition	Boltzmann superposition principle Time temperature equivalence	Time temperature superposition, Boltzmann superposition principle, Integral Maxwell model, Effect of frequency on Tg	Video: https://youtu.be/Je8Z8r0Ge7A?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	52	Impact and energy absorption	Energy absorption Impact testing	Impact strength, fracture, compatible blend, Izod and charpy impact tests	Video: https://youtu.be/TEf7HLWBl0o?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 8: Viscoelasticity in polymers / Interaction of polymers with other materials	53	Testing for applications	Trade tests for mechanical properties Surface resistivity	Trade tests, hardness testing, shore and Rockwell hardness, volume and surface resistivity	Video: https://youtu.be/5_vHXYLugCU?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	54	Properties of blends	Tg of blend Toughening using rubber particles Conducting processable blends	Glass transition for blends, polyethylene polypropylene blends and copolymers, synergistic effect, electrical percolation in blends	Video: https://youtu.be/ndE1sRiAiUA?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	55	Biomimetic polymers	Biomimetic materials	Biomimetic devices and materials, biomimetic lubricants, synovial fluid, collagen - multiscale assembly and structure	Video: https://youtu.be/I5KMQE9nILM?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	56	Advanced mechanics	Phenomenological models for mechanical response Advanced mechanics of polymers Failure Fatigue	Spring-dashpot-slider models, Failure of polymers, fracture, crack growth and fatigue	Video: https://youtu.be/5S0qkTMCsw8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	57	Viscoelastic response: examples	Mastercurve: example Viscoelasticity from different techniques	Examples of viscoelastic response, creep mastercurve, viscoelasticity from multiple measurements	Video: https://youtu.be/5S0qkTMCsw8?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	58	Polymer packaging	Packaging applications Barrier films Permeability	Packing, most common polymers for packaging, phenomena involved in barrier materials, OTR, COTR and WVTR	Video: https://youtu.be/hGv4erfk-Ls?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	59	Porous polymers / membranes	Membranes Foams	Porous polymers, separation membranes, different mechanisms of permeation, foams, pores	Video: https://youtu.be/vtn_1NpLlMA?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	60	Polymer at interfaces	Interfaces Surface and bulk polymer Surface tension and contact angle	Polymers at interfaces, difference between bulk and interfacial macromolecules, surface energy	Video: https://youtu.be/kt0yWc-Llg0?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	61	Diffusion in polymers	Diffusion in liquids and solids Diffusion in amorphous polymers	Diffusion in liquids and solids Diffusion in amorphous polymers	Video: https://youtu.be/VX9qlo2rvKo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 9: Interaction of polymers with other materials / Polymers processing and recycling techniques	62	Compatibilizers	Compatibilizers Fiber treatment and sizing	Compatibilizers, reactive and non-reactive compatibilizers, block copolymers, surface treatment and fiber sizing, compatibilized designed product from recycling	Video: https://youtu.be/u5dFRkve65Q?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	63	Biopolymer applications	Xanthan gum: thickener Natural rubber	Xanthan gum: thickener Natural rubber	Video: https://youtu.be/GfAmKdWepI4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	64	Adhesives and Paints	Adhesives Paints	Adhesives and paints, cohesive and adhesive failure, epoxies and urethanes, sealants, phenomena during coating, hydrophobically modified urethan ethoxylate	Video: https://youtu.be/g2K6PXxtyB4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	65	Dissolution and recovery	Mechanical and chemical recycling Dissolution	Overall cycle of polymeric materials, mechanical cycling: challenges, environmental impact of chemical recycling methods, dissolution and recovery, diffusion, relaxation and disentanglement	Video: https://youtu.be/d_dLud8wR1o?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	66	Polymerization kinetics	Polymerization operations Free radical polymerization kinetics Step growth polymerization kinetics Living polymerization kinetics	Operations involving polymerizations, reactive processing, kinetics of polymerization, effect of initiator concentration	Video: https://youtu.be/XsoIII2oS6U?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	67	Polymerization reactors	Polymerization processes Examples of industrial polymerizations	Bulk polymerization, solution polymerization, precipitation polymerization, suspension polymerization, emulsion polymerization, gas polymerization	Video: https://youtu.be/cwtkUN9Vs-Q?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	68	Polymer processing I	Processing of polymers Flow behaviour	Different operations during polymer processing, various techniques of processing, dies and moulds, shear rate in processing, melt flow index, dimensionless numbers in processing	Video: https://youtu.be/MV0MXWaxBv4?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	69	Polymer processing II	Extrusion Injection moulding	Extruder, injection moulding, operating window, idealized flows for processing analysis	Video: https://youtu.be/T-m045Rm6G0?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 10: Polymers processing and recycling techniques	70	Polymer processing III	Shaping operations Blow moulding and other techniques Mixing	Shaping: extrusion, stretching, rolling and blowing, Blow moulding, time required for processing, mixing in polymers: laminar and dispersive, internal and open mixers	Video: https://youtu.be/dhuX6N6jufg?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	71	Flow simulations	Process modeling Governing equations Simulation softwares	Modeling of polymer processing: approaches, continuum and molecular descriptions, mass, momentum and energy balances, simulation softwares	Video: https://youtu.be/j8bDQKDkFgI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	72	Processing for recycling	Recycling processes Operations required for recycling Multiple recycling	Classification of recycling methods, operations before recycling, recycling mixed waste, property changes due to recycling	Video: https://youtu.be/Q9P4VJHbCHo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	73	Recycle, up-down cycling	Waste handling scenario Upcycling	Waste handling, polymers mixed with other waste, challnges with waste recycling, mechanical and chemical upcycling, upcycling polyolefins	Video: https://youtu.be/ZrWsARLQF_w?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	74	Recycle, up-down cycling II	Biocomposites Twin screw extruder Reaction injection molding Resin transfer moulding	Biocomposites, twin screw extruder, reaction injection moulding, resin transfer moulding	Video: https://youtu.be/YmRBYZuhnas?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	75	Flow behaviour - rheology	Flow phenomena in polymers Non-Newtonian fluids	Polymeric fluid flow as products and in processing, macromolecular mechanisms during flow, Generalized Newtonian fluid, viscoelastic fluid	Video: https://youtu.be/zoO3JUGGbAg?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	76	Crosslinking	Crosslinkers Extent of crosslinking	Crosslinkers, extent of reaction, oscillating disk rheometer (ODR) and moving die rheometer (MDR), torque with extent of crosslinking, gel time, dynamic testing of gel point	Video: https://youtu.be/AKO43mLzP04?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	77	Conversion of polymers	Conversion processes Chemolysis Incineration	Breakage of macromolecules: pyrolysis, solvolysis, factors affecting conversion of macromolecules, green solvents, chemolysis of PET, conversion to feedstock, footprint of incineration	Video: https://youtu.be/n9iAQQW1QUs?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 11: Polymers processing and recycling techniques	78	Rheology and entanglement	Rheometry Rheometer geometries Entanglements	Viscometric and rheometric flows, deformation under controlled conditions, different geometries, oscillatory shear of monodisperse polymer melts, extensional flow of branched polymers, role of entanglement	Video: https://youtu.be/-cGDw9tIzmw?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	79	Rheological models	Rheological models Viscous models Non-linear viscoelastic model	Generalized Newtonian fluids, Carreau Yasuda model, Cross model, Power law, Herschel Bulkley model, Bingham plastic, Non-linear viscoelastic models, Phan Thien Tanner (PTT) model	Video: https://youtu.be/w20elGkeyhg?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	80	Rheology and processing	Mixing and flow Die swell Normal stress differences	Mixing in shear and extensional flow, viscous dissipation, die swell or extrudate swell, normal stresses, normal stress differences, different techniques of rheology	Video: https://youtu.be/5vcuruC-kfI?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	81	Absorption and leaching	Fate and transport Absorption Leaching	Absorption and leaching, solubiilty, partitioning of solute in polymer and other phases, absorption kinetics	Video: https://youtu.be/r17SLiV4gjc?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	82	Swelling of polymers	Swelling Flory Rehner equation Kinetics of swelling	Osmotic pressure - Flory Huggins theory, Chain elasticity - ideal chain model, Swelling equilbrium, solvation, kinetics of swelling	Video: https://youtu.be/VWJiqzz2coU?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	83	Viscosity for polymer processing	Capillary rheometry Dynamic viscosity	Capillary rheometry, Hagen Poiseuille equation, Weissenberg-Robinowitsch equation, dynamic viscosity, Cox Merz rule	Video: https://youtu.be/Som5OjiDevo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB

Week	Lec No	Lecture Title	Concept Covered	Key Words	Click on Video or use the link
Week 12: Polymeric materials in nature	84	Microplastics, aerosols, sediments	Fate and transport Microplastics Aerosols and sediments	Macroplastics, microplastics, impact of microplaastics in water, soil and air	Video: https://youtu.be/0VlJMPncG3g?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	85	Biodegradation of polymers	Envrionmental degradation Biodegradation	Degradation of polymers in environment, biodegradation, factors influencing biodegradation, waste management and biodegradable polymers	Video: https://youtu.be/SlEyf0aUEDE?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	86	Biodegradable polymers 1	Biodegradable polymers: related terms Biodegradable polymers: examples	Aerobic and anaerobic biodegradation, compostable, poly (hydroxybutyrate), poly (lactic acid), starch based biodegradable polymeric systems	Video: https://youtu.be/Kthhnd5kmDo?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB
	87	Biodegradable polymers 2	Applications of biodegradable polymers	Applications and processing, examples of applications of biodegradable polymers such as PHB, PLA, starch based polymers, and polyesters	Video: https://youtu.be/Dt_k5CYrzJw?list=PLyqSpQzTE6M_KQ5MqUkoOqAxxOrdvFOMB