

ANNA UNIVERSITY:: CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
M.TECH. PLASTICS TECHNOLOGY
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS
SEMESTER I

S. No	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4112	Mathematics for Plastic Technology	FC	4	0	0	4	4
2.	PA4101	Plastics Materials Technology	PCC	3	0	0	3	3
3.	PA4102	Manufacture of Plastic Products	PCC	3	0	0	3	3
4.	PA4103	Polymer Characterization	PCC	3	0	0	3	3
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Audit Course I	AC	2	0	0	2	0
PRACTICALS								
8.	PA4111	Polymer Characterization Laboratory	PCC	0	0	4	4	2
9.	PA4112	Plastic Processing Laboratory	PCC	0	0	4	4	2
TOTAL				20	0	8	28	22

*Audit Course is Optional

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PA4201	Plastics Testing	PCC	4	0	0	4	4
2.	PA4202	Polymer Composites	PCC	4	0	0	4	4
3.	PA4203	Plastic recycling Technology	PCC	3	0	0	3	3
4.	PA4204	Plastic Product and Mould Design	PCC	4	0	0	4	4
5.	PA4205	Additive Manufacturing	PCC	3	0	0	3	3
6.		Professional Elective II	PEC	3	0	0	3	3
7.		Audit Course II	AC	2	0	0	2	0
PRACTICALS								
8.	PA4211	Plastics Testing Laboratory	PCC	0	0	4	4	2
9.	PA4212	Product Design Laboratory	PCC	0	0	4	4	2
10.	PA4312	Internship (2 weeks)	EEC					0
TOTAL				23	0	8	31	25

*Audit Course is Optional

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective III	PEC	3	0	0	3	3
2.		Professional Elective IV	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	PA4311	Project Work I	EEC	0	0	12	12	6
5.	PA4312	Internship (2 weeks)		0	0	0	0	1
TOTAL				9	0	12	21	16

SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	PA4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS:75

LIST OF PROFESSIONAL ELECTIVES

SEMESTER I, ELECTIVE I

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PA4001	Rheology in Polymer Processing	PEC	3	0	0	3	3
2.	PA4002	Plastics Packaging	PEC	3	0	0	3	3
3.	PA4003	Additives and Compounding	PEC	3	0	0	3	3
4.	PA4004	Polymer nanocomposites	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PA4005	Secondary Processing Operations	PEC	3	0	0	3	3
2.	PA4006	Rubber Technology	PEC	3	0	0	3	3
3.	PA4007	Science and Technology of Advanced Coatings	PEC	3	0	0	3	3
4.	PA4008	CAD/CAM/CAE Applications in Mould / Die Designs	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE III

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PA4009	Reverse Engineering	PEC	3	0	0	3	3
2.	PA4010	Mechanical Behaviour of Materials	PEC	3	0	0	3	3
3.	PA4011	Advanced Plastics Processing	PEC	3	0	0	3	3
4.	PA4012	Fracture Mechanism and Analyses in Polymers	PEC	3	0	0	3	3

SEMESTER IV, ELECTIVE IV

S. No.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	PA4013	Biomedical Plastics	PEC	3	0	0	3	3
2.	PA4014	Shape Memory Polymers	PEC	3	0	0	3	3
3.	PA4015	Conducting Polymers	PEC	3	0	0	3	3
4.	PA4016	Liquid Crystalline Polymers	PEC	3	0	0	3	3

AUDIT COURSES - I (AC)

REGISTRATION FOR ANY OF THESE COURSES IS OPTIONAL TO STUDENTS

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

COURSE OBJECTIVES :

- To understand the basic concept of numerical methods in solving ordinary differential equations.
- To understand the basic concept of numerical methods in solving partial differential equations.
- To understand the basics of random variables with emphases on the standard discrete and continuous distributions.
- To introduce the basic concept of Markovian Queueing Systems.
- To apply small and large sample tests through tests of hypotheses.

UNIT I NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Solution of first order ordinary differential equation - Taylor's method - Euler's method - Runge - Kutta method of fourth order - Predictor – Corrector Methods - Milne's and Adam's – Bashforth methods - Introduction to numeric use of the above techniques in plastics engineering and calculations.

UNIT II NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of second order linear partial differential equations - Elliptic equations – Solution of Laplace equations – Solution of Poisson's equation - Parabolic equations – Solution of one - dimensional heat equation - Hyperbolic equations – Solution of wave equation.

UNIT III PROBABILITY AND STATISTICS 12

Probability – Addition theorem - Multiplication theorem - Conditional probability – Baye's theorem - Distribution functions - Binomial distribution - Poisson distribution - Normal distribution - Uniform distribution - Curve fitting – Fitting a straight line and second degree curve - Fitting a non linear curve - Correlation and regression.

UNIT IV QUEUEING MODELS 12

Poisson process – Markovian queues – Single and multiserver models – Little's formula – Steady state analysis – Self service queue.

UNIT V TESTING OF HYPOTHESIS 12

Sampling distribution – Large sample and small samples - Testing of null hypothesis - Type I and Type II errors - "t" test and Chi square test - Goodness of fit - Fisher's "F" test.

TOTAL : 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

- CO1 Develop a good understanding of the various methods used for the numerical solution of scientific problems.
- CO2 Learn various numerical methods of solving partial differential equations.
- CO3 Analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
- CO4 Formulate the various kinds of Non-Markovian, Markovian Queueing Models.
- CO5 Apply the basic principles underlying statistical inference. (estimation and hypothesis testing)

REFERENCES:

1. Burden, R. C. and Faires, J. D., "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.
3. Gupta, S. C. and Kapoor, Y. K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, 2020.
4. Gross, D., Shortle, J.F., Thomson, J. M. and Harris, C. M., "Fundamentals of Queuing Theory ", 4th Edition, Wiley, 2014.

PA4101**PLASTICS MATERIALS TECHNOLOGY****L T P C****3 0 0 3****COURSE OBJECTIVES:**

- To understand the mechanism of polymerization, techniques of polymerization and the significance of different molecular weight averages.
- To provide in depth knowledge about different kinds of plastic materials based on their structure and properties
- To make the student familiar about properties and end application of different plastics materials

UNIT I POLYMER CHEMISTRY**9**

Introduction to polymers- homopolymers, Copolymers. Different types of polymerizations -addition, condensation and stereoregular polymerization. Initiators, important steps involved, kinetics and mechanism of addition, condensation and stereoregular polymerizations. Copolymerization and its kinetics. Polymerization techniques- emulsion, bulk, solution and suspension, Molecular weight & its determination.

UNIT II COMMODITY THERMOPLASTICS**9**

Introduction, source of raw materials, Manufacture, General Properties, processing and applications of Olefine Polymers such as Polyethylene - Polypropylene and their copolymers-Styrene Polymer such as Polystyrene and Copolymers (Styrene Acrylonitrile, Acrylonitrile Butadiene Styrene) -Vinyl polymers such as Poly Vinyl Chloride, Poly vinyl acetate- Acrylic and copolymers-Cellulose Polymers.

UNIT III ENGINEERING AND HIGH PERFORMANCE THERMOPLASTICS**9**

Introduction, source of raw materials, Manufacture, General Properties, processing and applications of engineering thermoplastics such as- Acetal-Homopolymer & Co-polymer , polycarbonates, polyamides- Nylon 6, 66, 610, 11 and 12, Polyesters (Poly Ethylene Terephthalate & Poly Butylene Terephthalate) polyimides, Poly (benzimidazoles), polyphenylene oxide, Poly(aryl ether ketone), Poly(ether ketone), Poly(aryl ether sulfone), poly (phenylene sulfides), Polysulfones - Fluoropolymers (Poly Vinyl Fluoride, Poly Vinylethane Fluoride, Poly Tetra Fluoro Ethylene, Polychloro Tri Fluoro Ethylene), Liquid crystalline polymers and Thermoplastic Polyurethane.

UNIT IV THERMOSETTING PLASTICS**9**

Introduction, source of raw materials, Manufacture, General Properties, processing and applications of Phenolic resin - Urea Formaldehyde - Melamine Formaldehyde – Unsaturated Polyesters-Epoxy resins- Polyurethane and Silicones.

UNIT V POLYMER BLENDS AND ALLOYS**9**

Introduction to polymer blends and alloys- Definitions, compatibilization mechanism and methods, criteria for making polymer blends, Selection of polymer for blend, Types of polymer blends. Thermodynamics of polymer miscibility, Blend preparation techniques, Commercial polymer blends such as plastic-plastic, rubber-plastic, rubber-rubber blends, High performance polymer blends.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

- CO1 Apply suitable polymerization technique to prepare the plastics as per the requirement.
- CO2 Select the plastic materials for particular end use based on properties.
- CO3 Predict the behavior of different kinds of plastics material based on their structure and property relationship.

REFERENCES:

1. Brydson, J A. *Plastics Materials*. Oxford: Butterworth-Heinemann, 1999.
2. Paul, Donald R, and Clive B. Bucknall. *Polymer Blends: Vol 1*. New York: Wiley, 2000.
3. Utracki, L A. *Polymer Blends Handbook*. , 2003.
4. R.P.Singh, C. K. Das, S. K. Mustafi, *Polymer Blends and Alloys an Overview*, Asian Books Pvt., New Delhi, 2002.
5. Simon, George P., ed. *Polymer blends and alloys*. Routledge, 2019.
6. Gilbert, Marianne, and J A. Brydson. *Brydson's Plastics Materials*. , 2017.

PA4102**MANUFACTURE OF PLASTICS PRODUCTS****L T P C
3 0 0 3****COURSE OBJECTIVES:**

- To understand the functions of each of these additives, technical requirements, types & mechanism, and their effective evaluation are dealt with in this subject.
- To select suitable plastics material compounding and mixing techniques like two roll milling, internal blender, single / twin screw extruder, etc.

UNIT I COMPOUNDING OF THERMOPLASTICS**9**

Compounding- Importance, ingredients, masterbatch, equipments - Twin screw extrusion, compression moulding and compounding lines -compounding of polyolefins, polystyrene and styrene copolymers, engineering polymers, natural fiber filled plastics, post compounding operations.

UNIT II INJECTION MOULDING AND EXTRUSION PROCESS**9**

Injection Moulding: processing outline- Types-effect of processing parameters on moulding quality, Troubleshooting. Basic principles of extrusion–Types of extruders, general features of extruders. Melt fracture & Bambooing. Production of blown film, cast film/slot film, BO film, coextruded film. Tube/pipe-sizing take off equipment, extrusion coating, wire & cable covering–pretreatment of conductor, cooling, constructional features of dies for the above processes and trouble shooting. Applications of extrusion and new developments.

UNIT III BLOW MOULDING, COMPRESSION & TRANSFER MOULDING PROCESS**9**

Basic principles of blow moulding–Injection Blow moulding, extrusion blow moulding, Parison programming, Advantage & disadvantage of blow moulding. Basic principles of compression and transfer moulding-Bulk factor-Curing time-Mould temperature and Pressure requirements-Preforms and preheating-Techniques of preheating- Machines used-Types of compression mould-Common moulding faults and their correction. Advantages of transfer moulding over compression moulding-Equipment used-Moulding faults–causes and remedies.

UNIT IV THERMOFORMING, CALENDERING AND ROTO MOULDING PROCESS 9

Basic principles –Raw materials & types of thermoforming processes, Thermoforming moulds processing parameters—faults, causes and remedies. Calendaring - Principle and process description, types of calendar units 2, 3 and 4 rolled calendars, Design of calendar roll, Heating and temp control, roll crown, roll crossing and roll bending, materials for calendaring, calendaring sheets and films, embossing, coating and lamination by calendar. Rotational moulding - Introduction-principle-process-machinery used-materials-moulds process parameters-merits & demerits of roto moulding.

UNIT V SELECTIVE LASER SINTERING (SLS) PROCESS 9

Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy. Applications; Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications. Other Additive Manufacturing Systems: Shape Deposition Manufacturing (SDM), Ballistic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting;

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- CO1 On completing this course, the students would acquire the knowledge of processing of plastic materials by injection moulding, extrusion, and blow moulding.
- CO2 Students can will understand processing techniques like compression molding and transfer moulding of thermoset plastics.

REFERENCES:

1. Fisher, Edwin George., and E. C. Whitfield. Extrusion of Plastics: [by] E.G. Fisher, Assisted by E.C. Whitfield. 1976.
2. Hornsby, P R. "Plastics Extrusion Technology. Edited by Friedhelm Henson, Carl Hanser Verlag, Munich, 1988.
3. Donald V. Rossato, Injection Moulding Hanbook, International Thomson Publishing Co., 1995.
4. M.S. Welling, Injection Moulding Technology, VDI–Verlag Gmbh, 1981.
5. Seymour S. Schwartz & Sidney H. Goodman, Plastics Materials and process, Van Nostr and Reinhold Company, New York, 1982.
6. Innovation in Polymer Processing By Stevenson.,1996.
7. Extrusion The definitive Processing Guide and Hand Book By Giles, H.H & Others.,2004.
8. Iyesew, A.I., Compression Molding
9. Bruins Basic Principle of Rotational Molding
10. Brycle, D.M, Basic Principle of Thermoforming

PA4103

POLYMER CHARACTERIZATION

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To develop knowledge of National & International standards for testing methods.
- To create the knowledge about the conditioning of samples and sample preparation techniques for testing various properties of plastics materials.
- To enable the students to learn about the evaluation of thermal, electrical, optical and mechanical properties of plastics materials.
- To create knowledge about testing of plastics products as per the standards.

- UNIT I STANDARDS AND IDENTIFICATION OF PLASTICS 9**
 Application of national and international standards (BIS-ASTM-ISO) for testing and their significance, Knowledge and exposure on Sectorial Testing Standards. National and International standards Identification of plastics-Determination of necessary manufacturing conditions-Assessment of properties of finished products in relation to service requirements-Standard and specification- Test specimen preparation-Preconditioning and test atmosphere.
- UNIT II MECHANICAL PROPERTIES 9**
 Density and dimensions-Hardness-tensile strength-compressive strength-shear strength-flexural strength-impact strength-dynamic stress-strain Properties- creep-relaxation and set tests-friction and wear-abrasion test-fatigue-burst strength and folding endurance.
- UNIT III THERMAL PROPERTIES 9**
 Specific heat and thermal conductivity, thermal dependent properties- thermal Endurance-glass transition temperature-thermal yield tests-Heat deflection temperature-Vicat softening temperature-Marten's heat resistance test-low temperature brittle point and flexibility test-coefficient of thermal expansion-shrinkage-Thermal stability- Thermal ageing and flammability. Permanence Properties: Water absorption-soluble and insoluble matter-chemical resistance environmental stress cracking resistance-ageing-gas permeability-water vapour permeability and weathering.
- UNIT IV OPTICAL AND ELECTRICAL PROPERTIES 9**
 Refractive index-light transmission-haze-clarity-gloss-colour guard and microscope. Electrical Properties- Insulation resistance-power factor-permittivity – dielectric strength- tracking resistance-arc resistance and antistatic test, volume and surface resistivity.
- UNIT V PRODUCT TESTING 9**
 Testing of Pipe and fittings-film and sheets-container and FRP based products. Factors for designing tests for newer products, Factors affecting the quality of materials and products. Analysis of failure and its measurements. Techniques of characterization-Principles, equipments and application of DSC,DMA,TGA and FTIR, Concepts of non-destructive testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- CO1 Ability to test the plastics materials for its chemical, mechanical, electrical, optical, thermal, and permanence properties as per the standard.
- CO2 Ability to identify the plastic materials by reverse engineering for some specified applications with the knowledge of testing.
- CO3 Ability to control the quality of plastics products by testing.

REFERENCES:

1. D. Campbell and J. R. White 'Polymer Characterization, Physical Techniques' Chapman and Hall, 1989.
2. Arza Seidel 'Characterization and Analysis of Polymers', Wiley Interscience 2008.
3. Techniques for Polymer Organization and Morphology Characterization, by R. A. Pethrick and C. Viney, Wiley Interscience, 2003.
4. Peter A. Mirau 'A practical Guide to understanding the NMR of polymers', Wiley Interscience, 2005.
5. Edith A. Turi Thermal Characterization of Polymeric Materials, 2nd Edition, Vol. 1-2, 1982.

6. Allen; W.S and Baker; P.N, Hand Book of Plastics Technology, Volume 2, Identification Testing & Recycling of Plastics, CBS Publishers and distributors, New Delhi 2004).
7. Brown; Paul F (Ed), Hand Book of Plastics Test Methods, Longman Scientific and Technical, Harlow (1988).
8. Brown; Roger P (Ed.), Hand Book of Polymer Testing, Marcel Dekker, Inc, New York (1999).
9. ASTM test standards for plastics Vol.8.01 to 8.04, 9.01 & 9.02, 2002.
10. ISO test standards, 1998.
11. Shah, Vishnu, Hand Book of Plastics Testing Technology, John Wiley and Sons, SPE Monograph (1984).

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C
2 0 0 2

UNIT I RESEARCH DESIGN 6

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES 6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING 6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS 6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL: 30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent Searching: Tools & Techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of Parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

COURSE OBJECTIVES:

- To get practice in testing the Physico-mechanical properties of plastic materials.
- To provide hands on experience on various polymerization techniques.
- To make the student understand simple experimental procedures to determine molecular weight and molecular weight distribution of polymers.
- To make the student familiarize with the thermal properties of polymers.
- To make the student understand simple techniques to identify the plastic materials.

LIST OF EXPERIMENTS:

1. Identification of Plastics materials.
2. Density determination.
3. Bulk polymerization - Preparation of polymethyl methacrylate.
4. Solution Polymerization - Preparation of polyacrylamide.
5. Preparation of Phenol-Formaldehyde, UF and MF resins.
6. Synthesis of copolymers by Emulsion, Bulk, solution & suspension Polymerization.
7. Measurement of viscosity of polymer solutions and determination of molecular weight of the polymer.
8. End group analysis.
9. Determination of acid value of a resin.
10. Study of Molecular weight distribution (GPC).
11. Determination of cure of a phenolic moulding (percentage acetone soluble matter).
12. Study of Thermal Stability of polymers.
13. Determination of K-value for PVC.
14. Viscosity and Molecular Weight Determination
15. Determination of Filler content

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

- CO1 Ability to measure viscosity of polymer solutions.
CO2 Ability to synthesize various types of polymers by using suitable polymerisation techniques.
CO3 Capability to identify plastics materials by simple methods.

EQUIPMENT REQUIRED:

Glassware for reactions and spot tests, Ostwald/Ubbelohde viscometer,

REFERENCES:

1. ASTM test standards for plastics Vol.8.01 to 8.04, 9.01 & 9.02, 2002.
2. ISO test standards, 1998.
3. Vishu Shah, Hand Book of Plastics Testing Technology, John Wiley & Sons. Inc. New York, 1998.
4. Saunders, K J. The Identification of Plastics and Rubbers. London: Chapman and Hall, 1970.
5. R.P. Brown, Hand Book of Plastics Test Methods, George Godwin Ltd., London, 1981.

COURSE OBJECTIVES:

- To gain practical knowledge about hand operated injection moulding, semi automatic & automatic injection moulding machine, Blow moulding process.
- To identify defects, causes & remedies of the process.
- To select the suitable process parameters for a particular process.
- To learn about microprocessor controlled injection moulding machines, Blow moulding process, rotational moulding, thermoforming with different moulds and material.
- To understand the possible defects, its causes and setting of process parameters.

LIST OF EXPERIMENTS

1. Injection Moulding (Hand Operated ,Semi -Automatic)
2. Microprocessor controlled Injection moulding operation
3. Extrusion Process
4. Compression Moulding
5. Blow Moulding
6. Vacuum Forming
7. Rotational Moulding
8. Coating of Plastics
9. Welding & Sealing of Plastics
10. Screen Printing
11. FRP – Hand layup process
12. Co-extrusion process
13. Machine Maintenance
14. Mould Study

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

CO1 Ability to select the suitable process parameters.

CO2 Understand all the manufacturing techniques, machine components, their function and setting of process parameters.

CO3 Analyze the cycle time and process parameters to overcome the trouble shoots.

REFERENCES:

1. A.S. Athaly, Injection Moulding Practice, Multi-Tech. Publishing Co., New Delhi, 1997.
2. Lee, Blow Moulding Design Guide, Hausar Publishers, Munich, 1998.
3. Friedhelm Hensen, Plastics Extrusion Technology, Hansar Publishers, Vienna, 1988.
4. Irvin Rubin, Injection Moulding Theory and Practice, A. Wiley interscience Publication.1972.

LABORATORY REQUIREMENTS

1. Injection moulding machine (conventional) - 2Nos.
2. Plastic tube extrusion machine - 1No.
3. Plastic film extrusion machine - 1No.
4. Compression moulding machine - 1No.
5. Microprocessor controlled inj. moulding machine - 1 No.

6. Blow moulding machine (Automatic) - 1 No.
7. Vacuum forming machine - 1 No.
8. Rotational moulding machine - 1 No.
9. Plastics coating machine - 1 No.
10. Ultrasonic welding machine - 1 No.
11. Plastic sealing machine - 1 No.
12. Printing machine (on plastics) - 1 No.
13. Machine maintenance kit - 1 No.
14. Moulds maintenance kit - 2 Nos.
15. Moulds for plastic products - 1 No.
16. FRP hand layup kit - 1 No.
17. Plastic co-extrusion film plant - 1 No.

PA4001

RHEOLOGY IN POLYMER PROCESSING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the conformational property of polymer chain using different models
- To study the chain conformation in polymer solution and melt based on thermodynamics
- To introduce fundamental flow properties and methods used to investigate the flow behaviour under stress
- To understand the flow behaviour in different processing methods

UNIT I MOLECULAR CONFORMATION AND CONFIGURATION 9

Potential and conformational energy of molecules-polymer conformation and configuration-isomerism in polymers- stereo isomerism, geometrical isomerism, sequential isomerism. Conformation of an ideal chain-mean square end to end distance-freely jointed and freely rotating chain model, worm like chain model, hindered rotation model. Radius of gyration of an ideal chain. Real chain- excluded volume, Flory theory of polymer in a solvent, deforming real and ideal chains.

UNIT II ELASTICITY 9

Thermoelasticity-Thermodynamics of rubbers-Flory construction- entropic and energetic contributions to the elastic force in rubbers-unentangled rubber elasticity-Affine network model- Phantom network model-entangled rubber elasticity-Edwards tube model-Mooney-Rivlin model

UNIT III SOLUTION PROPERTIES 9

Polymer solutions-theta condition-Thermodynamic view of miscibility-upper critical solution temperature (UCST)-lower critical solution temperature (LCST)-Concentration regimes in polymer solutions Viscoelasticity-elastic deformation-irrecoverable deformation-models of viscoelasticity-Voigt-kelvin-Maxwell-Burger models-WLF equation-TTS curve-Boltzman superposition principle, stress relaxation-creep and creep recovery-

UNIT IV FLOW BEHAVIOUR

9

Basics of rheology- shear stress-shear strain-strain rate-different types of fluids-Newtonian and Non-Newtonian fluids- flow behaviour of different Non- Newtonian fluids-zero shear viscosity steady shear and oscillatory shear experiments. Methods to measure flow properties-capillary rheometer-parallel plate rheometer-cone and plate rheometer-Cup and cone viscometer. Measurement of normal stresses. Theories of viscosities of dilute and concentrated Solutions.

UNIT V MELT RHEOLOGY AND RHEOMETRY

9

Rheology of dilute and concentrated suspensions, Flow behaviour of polymer melts during Injection moulding-Extrusion: Film extrusion, Sheet extrusion and Blow mouldings. Bubble inflation rheometer, compression rheometer, stress relaxation instruments. Torque rheometers, rotational & sliding surface rheometers and their use in determining processability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- CO1 Know the conformational change of polymer chains in solution and melt
- CO2 Understand and measure the basic flow properties of polymers
- CO3 Relate the polymer rheology to properties of polymeric materials and processing

REFERENCES:

1. Elements of Physical Chemistry: S. Glasstone and D. Lewis, Macmillan India Press, Madras, 1995.
2. Crawford, Roy James, and Patrick J. Martin. Plastics Engineering. Butterworth-Heinemann, 2020.
3. Introduction to Polymer Viscoelasticity: J.J. Alkonis and W.J.Macknight–Wiley InterScience, New York ,1982.
4. Polymer Melt Rheology: F.N.Cogswell, George Goodwin Ltd. and P. R. Londo, John Wiley and Sons, 1981.
5. Polymer physics: Michael Rubinstein and R.H. Colby, Oxford University press ,2003
6. Polymer Physics: Ulf W. Gedde, Chapman & Hall, 1995
7. Rheology of Polymers: G.V.Vinogradov and A.YaMalkin, Mir Pub, Moscow, 1980.
8. Viscoelasticity of Polymers: D.D.Ferry III Edn. John Willey and Sons, New York, 1981

PA4002

PLASTICS PACKAGING

**L T P C
3 0 0 3**

COURSE OBJECTIVES:

- To enable the students to understand the concepts of plastics materials used in packaging industries
- To understand the machinery used in packaging field and testing equipments used for packaging products.

UNIT I	PLASTICS MATERIALS FOR PACKAGING	9
Introduction to Packaging – Functions of packaging –Properties and Applications of major packaging materials viz. Polyolefins, Polystyrene, Polyvinyl Chloride, Polyesters, Polyamides (Nylons), Polycarbonate and Newer materials such as High Nitrile polymers, Polyethylene Naphthalate (PEN), Polyetherimide (PEI) and LCP.		
UNIT II	PROCESSING OF PACKAGING MATERIALS	9
Adhesives, heat sealing types, sealing method, extrusion blown film and cast film and sheet co extrusion, surface treatment testing and evaluation of films, flexible packaging, pouches, bulk and heavy duty bags, thermoforming, thin sheet thermoforming, blow moulding, extrusion and injection blow moulding, foams, cushioning and distribution packaging.		
UNIT III	BIO BASED PACKAGING MATERIALS	9
Edible and bio-based food packaging materials, Edible film and coating, Polysaccharide based coatings, Lipid based coatings, Protein based coating, First, Second and Third bio-based packaging materials. Permeability of thermoplastic polymers, Multilayer films, Processing, Deteriorative reaction in foods, Enzyme reactions, Chemical reactions, Physical change, Biological change, shelf life of foods, Factors controlling shelf life.		
UNIT IV	APPLICATIONS OF PACKAGING	9
Aseptic packaging of foods, Sterilization of packaging materials, Packaging of microwavable foods, Active and intelligent packaging, Modified atmospheric packaging, Packaging of fresh foods, Packaging of horticultural products. Packaging of dairy products, Packaging of cereal, snack foods and confectionery, Packaging of beverages, Comparison of polymer packaging with paper, metal and glass materials, printing processes, Safety and legislative aspect of packaging.		
UNIT V	TESTING OF PACKAGING MATERIALS	9
Mechanical properties–Tensile properties, Impact properties, Tear strength, Burst strength, Stiffness, Crease or flex resistance, Co-efficient of friction, Blocking, Orientation and shrinkage. Optical Properties–Clarity, Haze and gloss Barrier Properties–Oxygen transmission, Water vapour transmission rate – Migration.		

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- CO1 Will gain the knowledge on the plastic packaging process and materials.
- CO2 Will familiarize in testing of plastic packaging.
- CO3 Will attain the knowledge of thermoforming packaging

REFERENCES:

1. Gordon L. Robertson, Food Packaging Principles and Practice, Marcel Dekker, Inc., New York 1993.
2. Louis T. Manzione, Plastic Packaging of Microelectronic Devices, Van Nostrand Reinhold, New York, 1990
3. Plastics films -Technology and packaging applications-Kenton R, Osborn, Wilmer A Jenkins, Institute of Packaging professionals, CRC Press.2019.
4. Understanding Plastics Packaging Technology (Hanser Understanding Books) , Hanser; First edition (September 1, 1997).
5. Plastic Films in Food Packaging, 1st Edition-Materials, Technology and Applications- Sina Ebnesajjad, Elsevier, December 2012,

COURSE OBJECTIVES:

- To know about various additives like Lubricants, Fillers, Fibres, flame retardants, colourants, anti-oxidants, UV-stabilizers, plasticizers, anti-blocking agents, Nucleating agents, Flow promoters, Anti static agents etc.
- To understand the functions of each of these additives, technical requirements, types & mechanism, and their effective evaluation are dealt with in this subject.
- To select suitable plastics material compounding and mixing techniques like two roll milling, internal blender, single / twin screw extruder, etc.

UNIT I INTRODUCTION TO ADDITIVES**9**

Introduction-Chemistry and Mechanism- Selection Criteria-Selection of Polymers and Compounding ingredients-General objectives-possibilities and limitations of mixing and compounding. General effect on Properties-Evaluation and functions of additives.

UNIT II ADDITIVES**9**

Fillers and Reinforcement– Antioxidants-Thermal Stabilisers, Ultraviolet stabilizer– Impact Modifiers/Toughening agents. Colourants-Fire retardants-Coupling agents-blowing agents Plasticizers-Antistatic agents-Anti blocking agents-Slip and anti slip agents-processing aids - Lubricants- mould releasing agents Additives for recycling.

UNIT III COMPOUNDING EQUIPMENTS**9**

Methods of incorporation of additives into polymer materials. Mixing and mixing equipment's. Principles- Operating characteristics- Machine construction-Specifications -Process control systems and working details of Batch mixers and continuous mixers–High speed mixer -Two roll mill-Banbury Mixer–Ribbon blender – Planetary mixers-Single Screw extruder-Twin Screw extruder.

UNIT IV FORMULATIONS AND TECHNIQUES**9**

Compounding of PVC, Rubber, Polyolefins, Biodegradable plastics, Engineering plastics. Alloys and blend production - color, filler, reinforcement compounding. Reactive extrusion.

UNIT V END USE MARKET FOR PLASTICS**9**

Case studies on material suitability (e.g., Plastic Gears, Feeding Bottle, Bowels for microwave ovens). Survey and uses of plastics with reasons for their importance in major industries like Agriculture, Packaging, Building, Transport, Electrical, Electronics and Telecommunications, Medical and Furniture.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

- CO1 The student should be able to select the suitable additive as per requirement.
- CO2 Identify the suitable compounding techniques to make different grades of Plastics compounds
- CO3 Formulate the compound to solve the environmental related problems.

REFERENCES:

1. Muralisrinivasan, Natamai S. Introduction to Polymer Compounding, Volume 2: Machinery and Technology. , 2015.
2. Murphy, John. Additives for Plastics Handbook. Elsevier Advanced Technology, 2003.
3. Enrique Saldívar-Guerra and Eduardo Vivaldo-Lima, Polymer Additives, 2013
4. Zweifel, H., Maier, R., Schiller, M. Plastics Additives Handbook, 2009
5. Plastics Additives- Geoffrey Pritchard, Springer-1998.

PA4004

POLYMER NANOCOMPOSITES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To gain an understanding of materials commonly used for nano-modification such as nanoclays, carbon nanotubes, etc
- To study different manufacturing techniques of dispersion of nano particles such as sonication, high shear mixing, centrifugal mixer, twin-screw extrusion.
- To study different manufacturing techniques to produce real-life components
- To understand characterization techniques of these materials using scattering, spectroscopic and microscopic techniques

UNIT I INTRODUCTION TO NANOMATERIALS 9

Nanomaterials, Uniqueness of nanomaterials, classification of nanomaterials based on dimension (0D, 1D, 2D, 3D), different types of nanomaterials: carbon based materials (carbon nanotubes, Carbon Nanofibers, fullerenes), metal based materials (quantum dots, nanogold, nanosilver, nano aluminium oxide, nano titanium oxide) dendrimers, inorganic nanomaterials (Montmorillonite nanoclays, POSS [polyhedral oligomeric silsesquioxane], Nanosilica) -properties. Polymer Matrices: Thermoplastic based nanocomposites, Thermoset based nanocomposites, Elastomer based nanocomposites, ceramic matrix nanocomposites

UNIT II NANOMATERIAL SYNTHESIS AND CHARACTERIZATION 9

Preparation, Characterization of and functionalization of various nanomaterials such as C60, Carbon nanofiber, Carbon Nanotube, Graphene and Cellulose nanofibers. Characteristics of Polymer nanostructures materials. Processing of nanoparticles, binding mechanisms in nanoparticles, dispersion of nanoparticles, and stabilization of nanoparticles.

UNIT III PREPARATION OF POLYMER NANOCOMPOSITES 9

Processing and fabrication of polymer nanocomposites, Melt blending, solvent casting, In-situ polymerization, solution polymerization, template synthesis, high shear mixing. Homogeneous/heterogeneous nucleation, plasma promoted nucleation. Polymer nanocomposites with structural, gas barrier and flame retardant properties, carbon fibre reinforced polymer nanocomposites, elastomer and thermoplastic elastomer nanocomposites

UNIT IV CHARACTERIZATION OF POLYMER NANOCOMPOSITES 9

Mechanical properties, X-ray diffraction, Small angle X-ray Scattering, Optical Microscopy, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM). Electrical properties of polymer nanocomposites. Thermal properties of polymer nanocomposites by using DTA, TGA, DSC

UNIT V APPLICATION OF POLYMER NANOCOMPOSITES

9

High temperature applications: fire retardant, flame retardant nanocomposite applications, Thermoset nanocomposites for rocket ablative materials, nanomodified carbon-carbon composites, Nanocomposites for carbon fiber reinforced polymer matrix composites, Thermoplastic Elastomer nanocomposites for propulsion systems. Biomedical implants, tissue engineering scaffolds, EMI shielding application,

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- CO1 The student will Know different characterization and testing techniques and interpretation of results
- CO2 The student will have a knowledge about different structures and properties of nanocomposites
- CO3 The student will have an idea about preparation technologies and applications of nanocomposites

REFERENCES:

1. Pradeep, T., 2007. Nano: the essentials: understanding nanoscience and nanotechnology. McGraw-Hill Education.
2. Ebrahimi, F. ed., 2012. Nanocomposites: new trends and developments. BoD–Books on Demand.
3. Gogotsi, Y., 2006. Nanomaterials handbook. CRC press.
4. Tsakalakos, L., 2010. Nanotechnology for photovoltaics. CRC press.
5. Properties and Applications of Polymer Nanocomposites-Clay and Carbon Based Polymer Nanocomposites- Kumar Tripathy, Deba, Prasad Sahoo, Bibhu (Eds.), Springer 2017.



AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C
2 0 0 0

COURSE OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING

6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS

6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS

6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS

6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS

6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1 – Understand that how to improve your writing skills and level of readability

CO2 – Learn about what to write in each section

CO3 – Understand the skills needed when writing a Title

CO4 – Understand the skills needed when writing the Conclusion

CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

COURSE OBJECTIVES:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION**6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA**6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT**6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT**6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL: 30 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

- CO1 Ability to summarize basics of disaster
- CO2 Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3 Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4 Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5 Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company, 2007.
3. Sahni, Pardeep Et. Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

AX4093

CONSTITUTION OF INDIA

L T P C
2 0 0 0

COURSE OBJECTIVES:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, □ Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094

நற்றமிழ்இலக்கியம்

L T P C
2 0 0 0

UNIT I

சங்க இலக்கியம்

6

1. தமிழின்துவக்கநூல்தொல்காப்பியம்
- எழுத்து, சொல், பொருள்
2. அகநானூறு(82)
- இயற்கைஇன்னிசைஅரங்கம்
3. குறிஞ்சிப்பாட்டின்மலர்க்காட்சி
4. புறநானூறு(95,195)
- போரைநிறுத்தியஒளவையார்

UNIT II

அறநெறித்தமிழ்

6

1. அறநெறிவகுத்ததிருவள்ளுவர்
- அறம்வலியுறுத்தல், அன்புடைமை, ஒப்புறவுஅறிதல், ஈகை, புகழ்
2. பிறஅறநூல்கள்- இலக்கியமருந்து
- ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை
(தூய்மையைவலியுறுத்தும்நூல்)

UNIT III

இரட்டைக்காப்பியங்கள்

6

- 1.கண்ணகியின்புரட்சி
- சிலப்பதிகாரவழக்குரைகாதை
2. சமூகசேவைஇலக்கியம்மணிமேகலை
- சிறைக்கோட்டம்அறக்கோட்டமாகியகாதை

UNIT IV**அருள்நெறித்தமிழ்****6**

1. சிறுபாணாற்றுப்படை
 - பாரிமுல்லைக்குத்தேர்கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான்ஒளவைக்குநெல்லிக்கனிகொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
 - அன்னைக்குரியபுன்னைசிறப்பு
3. திருமந்திரம் (617, 618)
 - இயமம்நியமம்விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
 - சிறுவனேவள்ளலானான்
6. அகநானூறு (4) - வண்டு
 நற்றிணை (11) - நண்டு
 கலித்தொகை (11) - யானை, புறா
 ஐந்திணை 50 (27) - மான்
 ஆகியவைபற்றியசெய்திகள்

UNIT V**நவீனதமிழ்இலக்கியம்****6**

1. உரைநடைத்தமிழ்,
 - தமிழின்முதல்புதினம்,
 - தமிழின்முதல்சிறுகதை,
 - கட்டுரைஇலக்கியம்,
 - பயணஇலக்கியம்,
 - நாடகம்,
2. நாட்டுவிடுதலைபோராட்டமும்தமிழ்இலக்கியமும்,
3. சமுதாயவிடுதலையும்தமிழ்இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல்தமிழ்,
6. இணையத்தில்தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS**தமிழ்இலக்கியவெளியீடுகள் / புத்தகங்கள்**

1. தமிழ்இணையகல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2. தமிழ்விக்கிப்பீடியா (Tamil Wikipedia) - <https://ta.wikipedia.org>
3. தர்மபுரஆதினவெளியீடு
4. வாழ்வியல்களஞ்சியம் - தமிழ்ப்பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக்களஞ்சியம் - தமிழ்வளர்ச்சித்துறை (thamilvalarchithurai.com)
6. அறிவியல்களஞ்சியம் - தமிழ்ப்பல்கலைக்கழகம், தஞ்சாவூர்