KALINGA UNIVERSITY

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SCHEME & SYLLABUS FOR

Bachelor of Vocational Studies (B.Voc.) Plastic and Polymer Science

NAAC GRADE B+ Accredited University

nirf RANKING 2024 Ranked in Top 151-200 Universities

Kalinga University, Naya Raipur, Chhattisgarh

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B.VOC IN PLASTIC AND POLYMER SCIENCE

Semester-01								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS101	Communication Skills	3	3	0	0	30	70	100
BVPPS102	Fundamentals of Information Technology	3	3	0	0	30	70	100
BVPPS103	Polymer Science and Engineering	3	3	0	0	30	70	100
BVPPS104	Material Science	3	3	0	0	30	70	100
BVPPS105P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

Semester-02								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS201	Plastics Materials-I	3	3	0	0	30	70	100
BVPPS202	Environmental Studies	3	3	0	0	30	70	100
BVPPS203	Hydraulics and Pneumatics	3	3	0	0	30	70	100
BVPPS204	Chemistry and Applications of Colorants	3	3	0	0	30	70	100
BVPPS205P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

Semester-03								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS301	Plastics Materials-II	3	3	0	0	30	70	100
BVPPS302	Plastics Processing Technology-I	3	3	0	0	30	70	100
BVPPS303	Strength of Materials	3	3	0	0	30	70	100
BVPPS304	Color Physics and Color Harmony	3	3	0	0	30	70	100
BVPPS305P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

Semester-04								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS401	Plastics Testing-I	3	3	0	0	30	70	100
BVPPS402	Plastics Processing Technology-II	3	3	0	0	30	70	100
BVPPS403	High Polymer Chemistry	3	3	0	0	30	70	100
BVPPS404	Additives for Polymers	3	3	0	0	30	70	100
BVPPS405P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

Semester-05								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS501	Plastics Testing-II	3	3	0	0	30	70	100
BVPPS502	Plastics Recycling and Waste Management	3	3	0	0	30	70	100
BVPPS503	Technology of Thermoplastic Polymers	3	3	0	0	30	70	100
BVPPS504	Design and Fabrication of Molds	3	3	0	0	30	70	100
BVPPS505P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

Semester-06								
Course Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Internal Marks**	**End Semester Exam Marks**	**Total Marks**
BVPPS601	Plastics Product and Mould Design	3	3	0	0	30	70	100
BVPPS602	Advanced Plastics Processing Techniques	3	3	0	0	30	70	100
BVPPS603	Technology of Thermoset Polymers	3	3	0	0	30	70	100
BVPPS604	Mould Manufacturing	3	3	0	0	30	70	100
BVPPS605P	**Industrial Training/On Job Training/Workshop**	18	0	0	36	50	150	200
Total		**30**	**12**	**0**	**36**	**170**	**430**	**600**

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SEMESTER-01

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BVPPS101
COMMUNICATION SKILLS

Course Objective:
The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Course outcomes:
- The purpose of this course is to introduce students to the theory, fundamentals and tools of communication
- To develop vital communication skills which should be integral to personal, social and professional interactions.
- One of the critical links between human beings.
- An important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal.
- In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Unit - 1 **06**
Introduction: Theory of communication, types and modes of communication, mediums and channels of communication, barriers to communication, English as a global language, the lingua franca, social influences on English

Unit - 2 **06**
Language of Communication: Verbal and non-verbal (spoken and written) personal, social and business barriers and strategies intra-personal, inter-personal and group communication, varieties of English, language, accent, dialect, colloquialism, historical influences on English

Unit - 3 **06**
Speaking Skills: Monologue dialogue group discussion effective communication/ mis-communication interview public speech, regional influences on English, convergence and divergence, linguistic imperialism

Unit - 4 **06**
Reading and Understanding Close reading, reading analysis of a text - audience and purpose, content and theme, tone and mood, stylistic devices, structure comprehension- analysis and interpretation translation (from Indian language to English and vice-versa) literary/knowledge texts

Unit - 5 **06**

Writing Skills: Documenting report writing making notes letter writing, writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters it will enhance language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note taking etc. while, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. it is hoped that after studying this course, students will find a difference in their personal and professional interactions.

References:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas

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BVPPS102
FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course objective:
This is a basic course for commerce students to familiarize with computer and it's applications in the relevant fields and exposes them to other related courses of IT.

Course Outcomes:
- Gain a foundational understanding of key IT concepts, including hardware, software, and networks.
- Develop proficiency in using common computer applications, such as word processing and spreadsheet software.
- Explore the ethical and security considerations in IT, emphasizing responsible digital behaviour.
- Acquire problem-solving skills by applying IT knowledge to real world scenarios.
- Prepare for further studies in IT or related fields by establishing a strong IT knowledge base.

Unit - 1 **06**
- **Computer characteristics:** Speed, storage, accuracy, diligence; digital signals, binary system, ASCII; historic evolution of computers;
- **Classification of computers:** microcomputer, minicomputer, mainframes, supercomputers;
- **Personal computers:** desktop, laptops, palmtop, tablet; hardware & software; von Neumann model.

Unit - 2 **06**
- **Hardware:** CPU, memory, input devices, output devices.
- **Memory units:** RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory;
- **Auxiliary storage:** Magnetic devices, optical devices; floppy, hard disk, memory stick, CD, DVD, CD/DVD-Writer**;**
- **Input devices -** keyboard, mouse, scanner, speech input devices, digital camera, touch screen voice input, joystick, optical readers, bar code reader;
- **Output devices:** Display device, size and resolution; CRT, LCD, LED;
- **Printers:** Dot-matrix, inkjet, laser; plotters, sound cards & speaker.

Unit - 3 **06**

- **Software:** System software, application software; concepts of files and folders, introduction to operating systems, different types of operating systems: single user, multitasking, time-sharing multi-user; booting, POST;
- **Basic features of two GUI operating systems:** Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases;
- **Application software:** Generic features of word processors, spread sheets and presentation software; generic introduction to latex for scientific typesetting; utilities and their use; computer viruses & protection, free software, open source.

Unit - 4 **06**

Computer Networks and Internet: Connecting computers, requirements for a network: server, workstation, switch, router, network operating systems; internet: brief history, world wide web, websites, URL, browsers, search engines, search tips; internet connections: isp, dial-up, cable modem, well, dsl, leased line wireless and Wi-Fi connectivity ; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, web pages, web programming languages.

Unit - 5 **06**

- **Information Technology and Society:** Indian IT Act, intellectual property rights, issues. application of information technology in railways, airlines, banking, insurance, inventory control, financial systems, hotel management, education, video games, telephone exchanges, mobile phones, information kiosks, special effects in movies.
- **Programming Concepts & Techniques:** Program concept, characteristics of programme, stages in program development, tips for program designing, programming aids, algorithms, pseudo code, notations, design, flowcharts, symbols, rules, compiler & interpreter. introduction to programming techniques, top-down & bottom-up approach, unstructured, & modular programming, cohesion, coupling, debugging, syntax & logical errors, linking and loading, testing and debugging, documentation.

References:

1. Programming in C, R.S. Salaria, Khanna Publishing House
2. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
3. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House

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BVPPS103
POLYMER SCIENCE AND ENGINEERING

Course Objective:
Develops plastics diploma technocrat students in Polymerisation of Monomers. Polymerization reaction and its mechanism will help students to classify polymers for different industrial applications.

Course Outcomes:
- The students will be able to develop knowledge on polymerization techniques, chemical reaction of polymers and determine the molecular weight of the polymer.
- An ability to understand the influence of polymer structure in its properties and to determine solvents for polymer using solubility parameter.
- To understand and gain knowledge on the influence of rheology in polymer properties and handling rheological instruments.
- An ability to understand thermal analysis.

Unit - 1 **06**
Basics of Polymer Science:
- Understanding of Basics of Polymer Science Monomers & its requirement- Broad Classifications of Polymers - Bonding in Polymers –Polymer structure–Isomerism, Molecular Weight and its Distribution.
- Thermal Transitions – Tg & Tm

Unit - 2 **06**
Basic Polymerisation Techniques:
Understanding of basics of Polymerization - Chain growth - Step Growth Mechanism - Ziegler Natta Catalyst- Coordination Polymerization

Unit - 3 **06**
Other Polymerisation Techniques:
Knowledge of different Polymerization techniques viz Bulk, Solution, Suspension, Emulsion Polymerisation, Melt Polycondensation, Solution Polycondensation.

Structure - Property Relationship:
- Knowledge of Polymer Structure Relationship, Polymer solutions and solubility.
- State of Polymer – Crystalline, Amorphous

Unit - 4 **06**
Basics of Polymer Rheology:
Understanding of basics of Polymer Rheology, Concept of Viscoelasticity

Characterisation of Polymerisation:
Identify and characterize Polymers, determine Molecular Weight & Melt Flow Characteristics

Unit - 5 **06**

Thermal Analysis:

Study of Thermal Analysis -DSC, TGA and Dynamic Mechanical Analysis of polymers.

References:

1. Fundamentals of Polymers: Raw Materials to Finish Products, Niranjan Karak (Author) PHI, 1 December 2009
2. Polymer Blends and Alloys: An Overview, R. P. Singh (Author) Asian Books Private Ltd, 1 December 2002
3. Fundamentals of Polymer Engineering, Anil Kumar (Author), Rakesh K. Gupta (Author) Third Edition, 3rd Edition, CRC Press10 December 2018

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BVPPS104
MATERIAL SCIENCE

Course Objectives:

- To understand the classification of materials, bonding and the crystal structure.
- To understand the Properties of conducting, insulating, semiconducting, dielectric and semiconductor materials.

Course Outcomes:

After the completion of this course the student will be able to:

- Describe the fundamentals of material science and concepts of unit cell & crystallography.
- Classify materials based on their conducting, insulating, semiconducting, dielectric properties.
- Know the practical uses of various materials in different electrical engineering field.

Unit - 1 **08**

- **Introduction:** Introduction and historical importance of Materials, Classification of Materials, Engineering Materials, Advanced Materials and Future Materials like ceramics, polymers, composites, Dielectric etc.
- Bravais Lattices, Crystal Structures, Crystalline, Quasi Crystalline and Non-Crystalline Materials, Miller Indices, Miller-Bravais Indices for Planes and Directions of Cubic and Non-Cubic Structures, structure of ceramics, polymers, and composites materials. Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall Effect.

Unit - 2 **08**

- **Diffusion and Heat treatment:** Phase Diagrams: Phase Rule, Equilibrium Phase Diagrams, Phase Systems - Isomorphous, Eutectic with No and Limited Solid Solubility and Peritectic, Iron-Carbon Phase Diagram, TTT Diagram.
- **Imperfections in Solids and Strengthening Mechanisms:** Point Defects, Line Defects and Dislocations, Interfacial Defects and Bulk or Volume Defects, Recovery, Recrystallization and Grain Growth. Alteration of properties by heat treatment, Heat treatment method, Quantification of altered material properties by heat treatments.

Unit - 3 **07**

- **Mechanical behavior of Metals and Alloys:** Types of Loading, Stress-Strain Curves for Brittle and Ductile Materials, Theoretical and Observed Shear Stress, Critical Resolved Shear Stress, Deformation – Elastic, Anelastic, Plastic and Super Plastic, Yield Criteria, Macroscopic Aspects of Plastic Deformation, Toughness Measurements by S-S Curve, Impact Testing and Fracture Toughness Testing.
- **Types of Mechanical Loading and Failures**: Ductile and Brittle Fracture, Modes of Fracture Toughness, Impact Fracture, Ductile-Brittle Transition, Types of Impact Testing, Fatigue, Crack Initiation and Propagation, Fatigue Testing, Creep, Stages of Creep Curve, Stress and Temperature Effects.

Unit - 4 **07**

- **Dielectric and Magnetic Property of Materials:** Introduction, polarization of dielectric material, dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, Ferro electricity, piezoelectricity.
- Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.
- **Properties of Metals and Semiconductors:** Energy band in Metals, Semiconductors and Insulators, types of semiconductors, Intrinsic and Extrinsic semiconductors, Effect of temperature on the electrical conductivity of metals, insulator and semiconductor, thermal properties, thermal conductivity of metals and semiconductors, factors affecting the resistivity of electrical materials, electrical conductivity of doped materials, thermoelectric effects.

References:

1. C.S. Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering”.
2. P L Kapoor. A Textbook of Electrical and Electronics Engineering Materials: Khanna publishers
3. Kenneth G. Budinski, “Engineering Materials: Prentice Hall of India, New Delhi

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BVPPS105P
INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

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SEMESTER-02

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BVPPS201
PLASTICS MATERIALS-I

Course Objective:
To gain knowledge on general methods of preparation, properties and application of different speciality plastics. To know the concept of compatibility and study the structure and properties of important commercial blends. To understand the mechanism of degradation of polymers and stabilizing additives, to identify the various compounding methodologies for plastics materials and learn the maintenance of compounding machinery.

Course Outcomes:
- Students will have knowledge about the structure and property of different speciality plastics.
- Students will know the importance of reinforcement in composites and the role of compatibiliser on the properties of different polymer blends.
- Students will have clear understanding of various types of additives for plastics and their merits and demerits.
- Student able to learn about various compounding methods used in the manufacturing of compounded thermoplastics and thermoset

Unit - 1 **08**
Introduction to natural polymers-their sources, methods of manufacture, properties and applications

Unit - 2 **08**
Knowledge of Commodity Plastics –Olefinic, Styrenic and Vinyl polymers-Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications

Unit - 3 **07**
Knowledge of Engineering Plastics –Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications

Unit - 4 **07**
Thermoset Plastics- Source of Raw Materials – Methods of Manufacture – General Characteristics & Properties – Processing Behaviour and Applications

References:

1. Handbook of Plastic Materials and Technology, Irvin I. Rubin (Editor)Wiley Blackwell, 21 June 1990
2. Hand Book of Plastic Materials and Processing Technology, EIRI Board (Author) Engineers India Research Institute, 1 January 2009

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BVPPS202
ENVIRONMENTAL STUDIES

Course Outcomes:

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

Unit - 1 **06**

Introduction to Environmental Studies:

Multidisciplinary nature of environmental studies, Scope & importance; concept of sustainability & sustainable development.

Ecosystems:

- What is an ecosystem? Structure and function of the ecosystem;
- **Energy flow in an ecosystem:** food chains, food webs and ecological succession.
- **Case studies of the following ecosystems**: Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit - 2 **06**

Natural Resources:

- **Renewable and Non--renewable Resources:** Land resources and land use change; Land degradation, soil erosion and desertification
- **Deforestation:** Causes & impacts due to mining, dam building on environment, forests, biodiversity & tribal populations
- **Water:** Use & over-exploitation of surface & ground water, floods, droughts, conflicts over water (international & inter-state)
- **Energy resources:** Renewable & non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies

Unit - 3 **06**

Biodiversity and Conservation:

- **Levels of biological diversity:** genetic, species & ecosystem diversity; Biogeographic zones of India; Biodiversity patterns & global biodiversity hot spots, India as a mega--biodiversity nation; Endangered & endemic species of India
- **Threats to biodiversity:** Habitat loss, poaching of wildlife, man--wildlife conflicts, biological invasions;
- **Conservation of biodiversity:** In--situ and Ex--situ conservation of biodiversity.
- **Ecosystem and biodiversity services:** Ecological, economic, social, ethical, aesthetic and Informational value.

Unit - 4 **06**

Environmental Pollution:

- Types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks
- **Solid waste management:** Control measures of urban and industrial waste. Pollution case studies.

Environmental Policies & Practices:

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- **Environment Laws:** Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit - 5 **06**

Human Communities and the Environment:

- **Human population growth:** Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.
- **Disaster management:** floods, earthquake, cyclones and landslides.
- **Environmental movements:** Chipko, Silent valley, Bishnois of Rajasthan.
- **Environmental ethics:** Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

References:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36--37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29--64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E. O. 2006.The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

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BVPPS203
HYDRAULICS AND PNEUMATICS

Course Objective:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.

Course Outcomes:

- Students can able to Draw symbols used in hydraulic systems and gain the Operation of different types of valves used in hydraulic systems
- Students can acquire knowledge on Classification of the valves used in hydraulic systems.
- Students can maintain different valves and auxiliaries and know the maintenance concepts of pumps and motors
- Students can understand the pneumatic systems & Valves including their operation and Maintenance

Unit - 1 **06**

Basics of Hydraulics:

Fluid-Concept and classification of fluid-Newton's law viscosity-Properties of fluid Density, Specific gravity, Specific Weight, Specific Volume-Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility-Fluid pressure, Pressure head, Pressure intensity Concept of absolute vacuum, gauge pressure, atmospheric Pressure - pressure, Simple and differential manometers, Bourdon pressure gauge.

Unit - 2 **06**

Dynamics of Fluids:

Fluid flow-Types of fluid flows - Continuity equation Bernoulli's theorem-Venturi meter Construction, principle of working, Coefficient of discharge, Discharge through venture meter. - Orifice meter Pitottube - Construction, Principle of working,- hydraulic coefficients-Numerical on Bernoulli's theorem, venture meter, orifice meter

Unit - 3 **06**

Hydraulic Machines:

- Hydraulic turbines- Classification of turbine Construction and working principle of Pelton wheel, Francis and Kaplanturbine. - Use of Penstock, Anchor Block, Surge tank and Drafttube. Concept of cavitations inturbines-Simple Numerical on Calculation of Discharge, Work done, Power, efficiency of Turbine (Exclude Francis turbine).
- Pumps-classification of pumps - construction and working of Centrifugal pump- Need for priming of centrifugal pump - multi stage centrifugal pump. Reciprocating pump-types-construction and working-Air Vessel-Slip-Simple Numerical on Calculation of discharge, Work done, Power, efficiency of pumps-construction and working Submersible pump

Unit - 4 **06**

Hydraulic System:

Hydraulic systems – layout of oil hydraulic systems-Advantages of hydraulic systems-Components of Hydraulic systems-Pumps-Vane pump, gear pump, screw pump,-Valves -working and symbols of Pressure control valves pressure relief valve, Direction control valves 3/2,5/2 valves, - Sequence valves.-Flow control valves-Actuators- Linear Actuators-Cylinders-single acting, double acting–Hydraulic motors Accumulators-Types.

Unit - 5 **06**

Pneumatic and Electro Pneumatic Systems:

Properties of air–Perfect Gas Laws– Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators

References:

1. Hydraulics and Pneumatics: A Technician's and Engineer's Guide, Andrew Parr (Author)3rd Edition, Butterworth-Heinemann 28 January 2011
2. Hydraulic and Pneumatic Power and Control. Design, Performance, Application, Frank D. Yeaple (Author) McGraw-Hill Book Company, January 1, 1966

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BVPPS204
CHEMISTRY AND APPLICATIONS OF COLORANTS

Unit - 1 **06**

Introduction to Colorants:

- **Definition of Dyes and Pigments:**
  Understanding the difference between dyes and pigments, their solubility, and how they impart color.
- **Chromophores and Auxochromes:**
  Identifying the chemical groups responsible for color (Chromophores) and how they are modified to enhance color and solubility (Auxochromes).
- **Classification of Dyes:**
  Categorizing dyes based on their chemical structure (e.g., azo, anthraquinone, phthalocyanine), origin (natural vs. synthetic), and method of application (e.g., direct, reactive, vat).

Unit - 2 **06**

Chemistry of Dyes:

- **Structure-Color Relationships:**
  Understanding how the chemical structure of a dye molecule influences its color and properties. This includes concepts like Chromophores, Auxochromes, and bathochromic/hypochromic shifts.
- **Important Dye Intermediates:**
  Learning about the synthesis of key dye intermediates like azo dyes (diazotization and coupling).
- **Reactions in Dye Synthesis:**
  Understanding reactions like suffocation, nitration, amination, and halogenation, which are crucial in dye production.

Unit - 3 **06**

Dyeing Processes:

- **Principles of Dyeing:**
  Understanding concepts like substantively, affinity, exhaustion, and the role of auxiliaries in dyeing.
- **Dyeing Methods for Different Fibers:**
  Learning how to apply dyes to various textile fibers (e.g., cotton, wool, silk, polyester, nylon, acrylic) using different techniques.
- **After treatments:**
  Understanding the purpose and methods of after treatments to improve dye fastness and durability.
- **Dyeing Machinery:**
  Studying the different types of dyeing machines and their applications.

Unit - 4 **06**

Pigments:

- **Introduction to Pigments:**
  Understanding the properties and applications of pigments, including their use in paints, plastics, and other materials.
- **Pigment Dispersion:**
  Learning about the techniques used to disperse pigments in various media.
- **Color Measurement and Evaluation: Color Perception:**
  Understanding how the human eye perceives color and the factors that influence color perception.
- **Color Measurement Techniques:**
  Learning about instruments and methods used to measure and quantify color, such as spectrophotometry.
- **Color Fastness Testing:**
  Understanding the different types of color fastness tests (e.g., wash fastness, light fastness) and their significance.

Unit - 5 **06**

- **Environmental Aspects: Wastewater Treatment:**
  Understanding the environmental impact of dye and pigment production and the methods used to treat wastewater from dye houses.
- **Sustainable Colorants:**
  Exploring the use of natural dyes and other eco-friendly colorants.
- **Applications of Colorants: Textile Dyeing and Printing:**
  Understanding the various techniques used in textile dyeing and printing, including screen printing and digital printing.
- **Other Applications:**
  Exploring the use of colorants in other industries, such as paper, leather, plastics, and food.

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SEMESTER-03

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BVPPS301
PLASTICS MATERIALS-II

Course Objectives:

- To gain knowledge on general methods of preparation, properties and application of different speciality plastics.
- To know the concept of compatibility and study the structure and properties of important commercial blends.
- To understand the mechanism of degradation of polymers and stabilizing additives, to identify the various compounding methodologies for plastics materials and learn the maintenance of compounding machinery.

Unit - 1 **06**

Knowledge of Speciality Plastics - Sources of raw material, Method of Manufacture, General characteristics & Properties, Processing Behaviour and Applications of Speciality Plastics

Unit - 2 **06**

Understanding of concept of Polymer Blends & Alloys, reasons for making polymer blends and alloy and their applications

Unit - 3 **06**

Understanding of concept of Polymer Composite – matrix materials, reinforcements, fillers etc. and applications of composites in different fields.

Unit - 4 **06**

Knowledge of Additives and their properties for modifying the properties of plastics & compounding processes used for incorporating the additives

Unit - 5 **06**

Selection of Polymers and Compounding ingredients - General objectives - possibilities and limitations of mixing and compounding. Compounding Equipments.

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BVPPS302
PLASTICS PROCESSING TECHNOLOGY-I

Course Objectives:

- To facilitate the students to understand the various processing techniques of plastic materials.
- To learn the fundamentals and basic processing of thermoplastics by injection molding, extrusion and blow molding.
- To develop the knowledge on automation system and use of robotics in molding process.

Course Outcomes:

- The students will gain knowledge of processing of plastic materials by injection molding, extrusion and blow molding and other techniques like transfer molding of thermoset plastics.
- The students will be able to handle automation system and robotics in molding process
- The students will be able to handle the extrusion machines.
- The students will be able to handle blow molding equipments.

Unit - 1 **08**

Introduction:

Understand Basic Principles of Melt Processing of Thermoplastics - thermal behavior, Rheology, orientation, degradation, advantages and limitations

Unit - 2 **08**

Injection Moulding:

- **Injection Moulding Process:** Basic Process Principle - Types of Machines – Parts and its functions - Operation procedure - Clamping system - Types of Screw and their function -Heating System - Ejection system, Back Pressure, Types of Nozzles.
- Understanding of Process variables - Moulding cycle - Purging - Material recommendation - Shrinkage – Annealing –Dimensional Control - Moulding Record, Trouble Shooting aspects Microprocessor controlled Injection Moulding Machines Study of Injection moulding of Thermosets Understand basics of Automation and its application Identify Types of Injection Moulds –Feeding Systems
- including Gate Types, Runner, Sprue.

Unit - 3 **07**

Extrusion Techniques:

Extrusion- Principles - classification of extruders - types of screws - L/D ratio, compression ratio-back pressure, heating & cooling systems - breaker plate - screen pack & its functions - process variables and troubleshooting.

- **Operation & Principle of:**
  - » Pipe Extrusion
  - » Profile Extrusion
  - » Film Extrusion
  - » CoExtrusion
  - » Crosshead Extrusion.
  - » Twin screw extruder
  - » Vented Barrel Extruder
- **Extrusion Accessories**
  - » hopper loading devices - Drying equipments - Process, machinery - downstream equipments - dies for producing products

Unit - 4 **07**

Study of Blow Moulding process:

Operation Principle – Process - Specification - Types - Processing parameters - Parison Programming - machine features - Cycle time –Clamping - Heating & cooling system - Mould venting – Fault Causes & Remedies

References:

1. Plastics Processing Data Handbook, D. V. Rosato (Editor)Springer, 31 January 1990
2. Plastics: Materials and Processing, 2nd Edition, Pearson

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BVPPS303
STRENGTH OF MATERIALS

Course Objectives:

- Understand the fundamentals of solid mechanics.
- Acquire elementary knowledge of stresses, strains & material properties.
- Understand & analyse the basic principles involved in the behaviour of machine parts under load in the context of designing it.
- Understand & analyse the mechanical properties of the various materials.

Unit - 1 **06**

Basic Concepts: Definition, elastic & plastic properties of material, stress & strain diagram for ductile & brittle materials, introductory remarks on fatigue, creep & fracture. Simple stresses and strains: Stress & strain, Simple stress and strain in composite sections, Thermal stresses, relation between elastic constants.

Unit - 2 **06**

Principal Planes and Stresses: Principal stresses and principal planes, Mohr's circle for biaxial stresses.

Unit - 3 **06**

Bending Moment and shearing forces: Types of beams, types of support, shear force and bending moment diagram for simply supported, and cantilever subjected to point and uniformly distributed loads, relation between intensity of loading shear force and bending moment.

Unit - 4 **06**

Bending, slope and deflection of beams: Definitions, theory of simple bending, relation between slope and deflection calculations for cantilever & simply supported beams.

Unit - 5 **06**

Torsion & Vibration: Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts, power Transmitted and stiffness of shaft. Assumptions in theory of pure Torsion, Comparison between Solid and Hollow Shafts, Theory of Failure for Brittle and Ductile material. Types of vibrations, free vibrations.

References:

1. Strength of materials – Ryder
2. Strength of materials – Sadhu Singh
3. Strength of materials – Rajput
4. Strength of materials – Bansal

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BVPPS304
COLOR PHYSICS AND COLOR HARMONY

Unit - 1 **10**

Color Physics:

Introduction to Color:

- Definition of color and its relationship to light and perception.
- The electromagnetic spectrum and the visible spectrum.
- Wavelengths of light and their association with different colors.
- The concept of spectral power distribution.

Human Color Perception:

- Anatomy of the human eye and the role of rods and cones in color vision.
- Understanding how the eye perceives color and its limitations.

Color Models:

- Additive and Subtractive color models (RGB, CMYK).
- Color spaces and gamuts.
- Color mixing (additive and subtractive).

Color Measurement:

- Introduction to color measurement systems (e.g., CIE).
- Understanding colorimeters and spectrophotometers.

Unit - 2 **10**

Color Theory:

Color Wheel:

- Understanding the organization of colors on the color wheel.
- Primary, secondary, and tertiary colors.
- Color temperature (warm and cool colors).

Color Harmonies:

- Monochromatic, analogous, complementary, split complementary, triadic, and tetradic color schemes.
- Creating visually appealing color combinations based on color theory principles.

Color Contrast:

- Understanding different types of color contrast (hue, saturation, value).
- Using contrast to create visual interest and emphasis.

Color Symbolism and Psychology:

- Cultural and historical significance of colors.
- Psychological effects of colors on mood, behavior, and perception.
- Emotional and symbolic associations of colors.

Unit - 3 **10**

Color Application:

Color in Design:

- Applying color theory principles in various design disciplines (graphic design, interior design, fashion, etc.).
- Creating color palettes for specific projects.
- Using color to communicate ideas and evoke emotions.

Color in Art:

- Analyzing the use of color in artworks from different periods and styles.
- Developing skills in color mixing, blending, and application.
- Creating color studies and compositions.

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BVPPS401
PLASTICS TESTING-I

Course Objectives:
To create the knowledge on different testing techniques and its basic concepts for evaluating the mechanical, thermal properties of plastic materials. To enable the students to identify and compare the properties of different plastics materials.

Course Outcomes:
- Students will gain knowledge on how the plastics materials are tested for its mechanical, thermal, and permanence properties.
- Students will be able to identify the plastic materials for some specified applications based on its property.
- Students will be able to understand the mechanical properties and its testing
- Students will be able to understand the Thermal properties and its testing

Unit - 1 **06**
Concepts of Testing & Identification of Plastics:
Understanding of Concepts of Testing- Specification and Standards, Test specimen preparation - Pre-conditioning and test atmosphere

Unit - 2 **06**
Identification:
Knowledge of simple tests for Identification of plastics

Unit - 3 **06**
Basics of Characterization:
Knowledge of simple techniques used for Material Characterization–Flow Behaviour, Density

Unit - 4 **06**
Mechanical Properties:
Understanding of testing methods for determining short and long term Mechanical Properties

Unit - 5 **06**
Thermal Properties:
- Knowledge of short term test HDT, VST, and Long Term Heat Resistant Tests.
- Thermal Conductivity, Thermal Expansion and Brittleness Temperature.

References:

1. Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K..Nayak
2. Handbook of Plastics Testing Technology (Society of Plastics Engineers Monographs), Vishu Shah (Author) 2nd Revised edition, Wiley–Blackwell 18 November 1998
3. Simple Methods for Identification of Plastics, Dietrich Braun (Author) 4th Revised ed., Carl Hanser Verlag GmbH & Co 4 April 2013

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BVPPS402
PLASTICS PROCESSING TECHNOLOGY-II

Course Objective:
To impart the knowledge of Operation & Maintenance of Rotational, Compression, Transfer Mouldings & thermoforming and inculcate the concepts of FRP, Secondary Plastics Processes &Introduction to Advanced Plastics Manufacturing Techniques.

Course Outcomes:
- The students will gain the knowledge of specific processing techniques
- The students will gain the knowledge of Fibre Reinforced Plastics.
- The students will gain the knowledge of Automation and Secondary Processes.
- The students will gain the knowledge of Advanced Plastics Processing.

Unit - 1 **06**
Rotational Moulding:
Basic Principle - Material selection- Types of machines - Heating and cooling system, advantages and limitations, Process variables, defects and troubleshooting

Unit - 2 **06**
Thermo Forming:
Basic Principle - Material selection- Types of machines - Heating and cooling system, advantages and limitations, Process variables, defects and troubleshooting

Unit - 3 **06**
Compression & Transfer Moulding:
Basic Principle - Material selection- Types of machines - Heating and cooling system, advantages and limitations, Process variables, defects and troubleshooting

Unit - 4 **06**
Automation:
- Importance of Automation in Industries.
- Use of Robots in part handling, Robotics used in high production moulding process. Automated Conveyor systems.

Unit - 5 **06**
Introduction to Advanced Techniques:
- Gas Assisted and Water Assisted Injection Moulding
- Reaction Injection Moulding
- Able to Understanding of Two/Multi colour moulding
- Co-injection moulding
- Double wall Blow moulding
- Thermoset injection moulding

Basics of FRP:

- Definition. Hand Lay up& Spray Lay up Processes.
- Types of Fibres & Resins.

References:

1. Technical Manual on Plastics Processing –CIPET
2. Plastics: Materials and Processing, by A. Brent Strong (Author), 3rd Editiion, Pearson June 16, 2005
3. Compression Moulding – Iyesaw, A.I.
4. SPI Plastics Engineering Handbook of the Society of the Plastics Industry, Inc., Softcover reprint of the original, Michael L. Berins 1st ed., Springer, 12 October 2012

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BVPPS403
HIGH POLYMER CHEMISTRY

Unit - 1 **06**

Introduction to Polymers:

- Definition of polymers and monomers.
- Classification of polymers (e.g., natural vs. synthetic, thermoplastics vs. thermosets, elastomers, etc.).
- Basic concepts of polymer structure (linear, branched, cross-linked).
- Average molecular weight and its determination.
- Importance of polymers in modern technology and daily life.

Unit - 2 **06**

Polymer Synthesis and Polymerization: Polymerization Mechanisms:

- Chain-growth (addition) polymerization (e.g., free radical, ionic, coordination).
- Step-growth (condensation) polymerization.

Polymerization Techniques:

- Bulk, solution, suspension, and emulsion polymerization.
- Newer techniques (e.g., living polymerization, controlled polymerization methods).

Kinetics of Polymerization:

- Rate of polymerization, degree of polymerization.
- Factors affecting polymerization rate and molecular weight.

Unit - 3 **06**

Polymer Structure and Properties: Molecular Weight and Molecular Weight Distribution:

- Number average molecular weight, weight average molecular weight.
- Molecular weight distribution and its effect on polymer properties.

Polymer Conformation and Morphology:

- Chain flexibility, chain entanglement, and polymer conformation.
- Crystalline and amorphous phases in polymers, factors affecting crystallinity.

Glass Transition Temperature (Tg):

- Factors affecting Tg (molecular weight, chain flexibility, intermolecular forces).
- Methods for Tg determination (DSC, TMA).

Mechanical Properties:

- Tensile strength, elongation, modulus, and their relationship to polymer structure.
- Viscoelasticity, rubber elasticity.

Unit - 4 **06**

Polymer Characterization: Molecular Weight Determination:
Viscometry, light scattering, gel permeation chromatography (GPC).

Spectroscopic Techniques:
- Infrared (IR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy.
- Applications in polymer structure elucidation.

Thermal Analysis:
Differential scanning calorimetry (DSC), thermogravimetric analysis (TGA).

Other Techniques:
X-ray diffraction (XRD) for crystallinity studies.

Unit - 5 **06**

Polymer Processing and Applications: Common Polymer Processing Techniques:
- Extrusion, injection molding, blow molding, thermoforming.

Types of Polymers and their Applications:
- Commodity plastics (e.g., PE, PP, PVC).
- Engineering plastics (e.g., nylon, polycarbonate, PET).
- Specialty polymers (e.g., polymers for electronics, biomedical applications).
- Polymer blends and composites.
- Recycling of polymers.

Polymer Degradation and Stabilization: Types of Degradation:
Thermal degradation, oxidative degradation, UV degradation.

Stabilizers and Antioxidants:
Their role in preventing polymer degradation.

Biodegradable Polymers:
Principles and examples of biodegradable polymers.

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BVPPS404
ADDITIVES FOR POLYMERS

Course Outcomes:

- Ability to identify and choose various pigments and additives for a particular application
- Understanding of basic ideas, properties, dosage, techniques of dispersion for wide variety of pigments (organic and inorganic)
- Ability to understand the mechanism of color formation and effect of various factors on shade and hue of pigment.
- Should be able to perform manufacturing and synthesis of various pigments
- Ability to decide the dosage and selection criteria for various types of additives.
- Ability to identify and choose various pigments and additives for a particular application

Unit - 1 **06**

- An overview of additives, type of additives, main trends of additives and world market of additives
- Fillers, mechanical properties due to fillers

Unit - 2 **06**

- UV stabilizers, Resistance to Heat Stabilizers
- Flame Retardants

Unit - 3 **06**

- Conductivity, Antistatic and conductive Polymers
- Curing & Curing agents
- Coupling agents and Compatibilization agents

Unit - 4 **06**

- Plasticizer
- Blowing Agents
- Processing and modifier aid

Unit - 5 **06**

- Lubricants Mould Release Agents, Antislip and Antiblocking additives
- Appearance Colorants Pigments Dyes Special Effects, Appearance Black and White Pigmentation
- Additives for rubber and recycling, mixing, compounding, Health and Safety

References:

1. Text book of Polymer Science by Billmeyer, John Wiley ans Sons 1984.
2. Additives for plastic by Raymond B. Seymour, Academic Press 1978.
3. Additives for plastic handbook by John Murphy, Elsevier advance technology 1996.
4. Determination of Additives in Polymers and Rubbers by T R. Crompton, Rapra Technology Ltd 2007.
5. Polymer Modifiers and Additives by Richard F. Grossman , John T. Lutz Jr, CRC Press 2000.
6. The Complete Technology Book on Industrial Polymers, Additives, Colourants and Fillers by NIIR Board of Consultants & Engineers. Asia Pacific Business Press Inc. 2006.
7. Additives in Polymers: Industrial Analysis and Applications by Jan C. J. Bart John Wiley and Sons 2005.

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BVPPS501
PLASTICS TESTING-II

Course Objectives:

- To develop knowledge about the conditioning of samples and sample preparation techniques for testing various properties of plastics materials.
- To facilitate 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.

Course Outcomes:

- Students will gain knowledge on how the plastics materials are tested for its Properties.
- Students will gain knowledge on how the plastics materials are tested for its Weathering.
- Students will gain knowledge about the biodegradable materials and its testing.
- Students will be able to performing the product testing on different plastics products.

Unit - 1 **08**

Electrical Properties:

Dielectric strength, the Study of Dielectric constant and Dissipation factor, Insulation resistance, Volume and Surface resistivity, Arc resistance and Antistatic tests.

Optical Properties

Refractive index, Luminous transmittance, Clarity and Haze and Photo elastic properties. Colour Measurements and Gloss.

Unit - 2 **08**

Chemical Properties

Knowledge of testing of Chemical Properties. Study of Immersion test, Stain Resistance of Plastics and Environmental Stress Cracking Resistance.

Flammability

Flammability testing. Study of Ignition Properties, Oxygen Index Test, and Flammability of Cellular Plastics, Smoke Density Test and UL94 Flammability Test.

Unit - 3 **07**

Weathering Properties

Tests conducted for Weathering of plastics. Study of environmental factors affecting plastics. Accelerated weathering tests, outdoor weathering of plastics and Resistance of plastics to biological systems.

Bio-degradability Testing

Understand of Bio-degradability Testing. various Test methods and standards for bio-degradable plastics. Criteria used in evaluation of bio-degradable plastics. Study of Description of current test methods.

Unit - 4 **07**

Testing of Textiles

Concepts of Testing of Textiles – Denier – Tex – Ends & Picks -Other tests viz. Breaking Strength, Tearing Strength, Bursting Strength, Pilling Propensity, Air Permeability, Abrasion Resistance.

Product Testing

Exposure to Product Testing of PVC & HDPE Pipes Water Tanks Containers. Polythene Films Woven Sacks.

References:

1. Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K. Nayak
2. Handbook of Plastics Testing Technology (Society of Plastics Engineers Monographs), by Vishu Shah, 2nd Revised edition Wiley–Blackwell 18 November 1998

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BVPPS502
PLASTICS RECYCLING AND WASTE MANAGEMENT

Course Objective:
Student capable to gain the knowledge on various sources of plastics waste generation and the segregation methods for recycling the plastics and recycling codes of commodity. To learn about primary recycling techniques with examples.

Course Outcomes:
- The students will have an impact of plastic waste on environment
- Student able to understand the technologies available for recycling and reusing of both commercial and engineering plastics
- Student understand the machineries for recycling of plastic waste and its functions
- The students have an ability to familiarize with various policies and legislations related to environment issues of plastics

Unit - 1 **06**
Understanding of Plastics Waste:
- Sources of waste collection, segregation, identification by simple methods
- Techniques employed for its separation.

Unit - 2 **06**
Knowledge of Plastics Waste Management:
- Techniques of recycling and its types.
- Use of plastics waste for energy recovery, road construction

Unit - 3 **06**
Knowledge of Machinery and Value addition:
- Process, Basic Mechanical recycling Plant.
- Additives for improving quality of recycled products

Unit - 4 **06**
Exposure to Environmental issues:
- Guidelines related with Plastics Waste
- The rules of Legislation in India for Plastics waste and its recycling

Unit - 5 **06**
Recycling of Textiles:
Methods, Concepts and Procedure for Recycling of Textiles.

References:

1. Technical Manual on Plastics Processing–CIPET
2. Plastic Waste Management Turning Challenges into Opportunities, Publisher: Bharti Publications
3. Environmental Engineering and Management, by Dr. Suresh K. Dhameja S K Kataria and Sons, 1 January 2010.

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BVPPS503
TECHNOLOGY OF THERMOPLASTIC POLYMERS

Course Outcomes:

- To study industrial manufacturing process advantages disadvantages, process parameters of the thermoplastics polymers and environmental concerns of their products
- To give understanding of properties like physical mechanical thermal rheological etc
- To make aware of practical applications of thermoplastics in real world and structure properties and relationship.
- To study basic processing methods related to of the thermoplastics polymers.
- To make aware of different grades of commodity and engineering plastics manufacturer suppliers of them in the market.

Unit - 1 **06**

- Industrial Manufacturing processes, properties and applications processing environmental
- concerns of various types of polymers polyolefin like LDPE HDPE etc

Unit - 2 **06**

- Polypropylene and copolymer of PP Plastomers
- Copolymer of polyolefin like EVA LLDPE EAA etc

Unit - 3 **06**

- Polystyrene, HIPS, SAN
- ABS,important copolymers of styrene maleic anhydride and styrene acrylics copolymers, toughening mechanism of impact modified plastics

Unit - 4 **06**

- Saturated Polyesters such as PET, PBT, PTT
- Polycarbonates, Polyacetals
- Polyamides- Nylon 6, Nylon 6,6, Nylon 11etc, aromatic polyamide such as Kevlar
- Acrylic polymers & copolymers, Polyacrylamide, PMMA, Polyacrylonitrile, etc
- Polyvinyl chloride & its copolymers Compounding of PVC

Unit - 5 **06**

- Cellulose esters and ethers such as Ethyl cellulose, CMC, CN, cellulose acetates, etc
- Thermoplastic PU, Poly vinyl acetate, Polyvinyl alcohol etc

References:

1. Plastics Materials, 7th Edition by John Brydson, Elsevier 1999.
2. Text book of polymer Science by Billmeyer, John Wiley and Sons 1984.
3. Principles of Polymer Science, by Bahadur and Sastry, Narosa Publishing House2002.
4. Polymer Science by Gowarikar, John Wiley and Sons 1986.
5. Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc1965.
6. Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc1988.
7. Handbook of Thermoplastics, Second Edition Olagoke Olabisi by CRC Press 2015.
8. Thermoplastic Materials by Ibeh, Christopher C, Taylor Francis Inc 2013.
9. Introduction to Polymer Science and Technology by H. S. Kaufman and J.J. Falcetta, Wiley – Interscience Publication, 1977.
10. Handbook of Polyethylene, A. J. Peacock, Marcel Dakker Inc, 2000.
11. PVC Technology, A.S. Athalye and Prakash Trivedi, Multi-Tech Publishing Co,1994.
12. Engineering Thermoplastics Polycarbonates Polyacetals Cellulose Esters, L. Bottenbruch, Hanser Publishers, 1996.
13. Polymer and Resins; Their Chemistry and Chemical Engg, Brage Golding, D. Van Nostrand Company Inc, 1959.
14. Structures of Cellulose, Atlla, American Chemical society, 2003.
15. Styrene Based Plastics and their Modifications, Ellis Harwood, 1991.

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BVPPS504
DESIGN AND FABRICATION OF MOLDS

Course Outcomes:

- Ability to understand the processing techniques
- Ability to design a mold for a product
- Ability to understand the importance of mold in product development.

Unit - 1 **06**

Compression moulds: Positive, semi-positive and flash mould with horizontal and vertical flash, arrangement of loading shoes, simple two plate and three plate moulds, split moulds.

Unit - 2 **06**

Transfer moulds: Principles of internal pot, auxiliary ram and separated pot mould, calculation of number of cavities.

Unit - 3 **06**

Injection moulds: Two plate and three plates types, injection, venting, runner and gets, calculation of number of cavities, hot runner mould

Unit - 4 **06**

- **Extrusion dies:** extrusion of simple shapes tubing, cable covering and sheeting dies.
- **Mould fabrication:** steels for molding tools and their treatment include processes used for mould fabrication, finishing processes.

Unit - 5 **06**

Heating system for plates and moulds, measurement and control of temperature of moulds and dies, simple blow mould Introduction to computer aided design and software design aspects for moulds and dies.

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BVPPS601
PLASTICS PRODUCT AND MOULD DESIGN

Course Objective:
The objective of this course is to provide students with the knowledge of designing plastic products and moulds/dies. The course also covers the principles and guidelines of product design and mould/ die design.

Course Outcomes:
Upon completion of the subject, the student will be able to:
- Familiarize with injection moulding machine specifications and mould design aspects.
- Familiarize with Blow & Extrusion mould/ die design aspects.
- Knowledge on compression mould and transfer mould design aspects.

Unit - 1 **08**
Introduction to Plastics Product design:
Knowledge of product design features and its application while designing for plastic parts.

Unit - 2 **08**
Design of Injection Moulds:
- To study injection moulding machine specification.
- General injection mould construction and its design features
- Exposure on different mould parts and its functions
- Study of 2-Plate, 3-Plate moulds, external undercut moulds, spilt moulds, cam track moulds
- Study of internal undercut, form pin, collapsible core, loose cores, threaded inserts, internal and external threads

Unit - 3 **06**
Design of Blow Mould & Extrusion Dies:
Describe the blow mould and extrusion die design & its considerations

Unit - 4 **06**
Design of Compression & Transfer moulds:
Understanding compression and transfer mould design and Its considerations.

References:

1. Paul F. Mastro “Plastics Product Design Engineering”, Wiley-Scrivener Publisher, First Edition, 2016.
2. Fundamentals of Plastic Mould Design, Sanjay K. Nayak, Pratap Chandra Padhi, Y. Hidayathullah Tata Mcgraw Hill Education Private Limited, 2012
3. Injection Mould Design by R G W Pye, Edition, 2000
4. Douglas M. Bryce, “Plastic Injection Molding: Mold Design and Construction Fundamentals”,Society of Manufacturing Engineers, 1998.
5. Handbook of Thermoplastics Injection Mould Design by P.S. Cracknell and R.W. Dyson | 23August 2014
6. Injection-mould Design Fundamentals by A.B. Glanvill and E.N. Denton | 1 January 1965
7. Understand the Plastics Product design aspects.

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BVPPS602
ADVANCED PLASTICS PROCESSING TECHNIQUES

Course Objective:
To introduce the Advancements to the Conventional Plastics Processing Techniques

Course Outcomes:
- Operate specialized injection moulding machine for given application.
- Set the processing parameters for advanced injection moulding machines.
- Manufacture a plastic product with advanced blow moulding process.
- Operate advanced extrusion process for manufacturing plastic products

Unit 1 **08**
Specialized Injection Moulding Processes
- Co-Injection Moulding –
- Two Colour Injection Moulding
- Gas Assisted injection Moulding
- Water Assisted injection Moulding
- Reaction Injection Moulding
- Liquid Injection Moulding
- Lost Core Moulding
- Structural Foam Moulding Low Pressure foam, High pressure foam
- Thin walled injection moulding
- Injection moulding machines for Thermosets.

Unit - 2 **08**
Advanced Injection Moulding Machines and Auxiliary Equipments:
- Microinjection moulding machines
- Tie bar less Injection Moulding
- All Electric Injection Moulding Machines
- Auxiliary Equipment- Automated Conveyor system, Automatic Material loading, High Speed Side or Top Entry Robotics

Unit - 3 **07**
Advanced Blow Moulding Processes:
- Extrusion Stretch Blow Moulding
- Injection Stretch Blow Moulding
- Forced Extrusion Blow Moulding
- Accumulator Blow Moulding
- Multi-layer Blow Moulding.

Unit - 4 **07**

Advanced Extrusion Processes:

- Construction and working of extrusion for coextruded products and die.
- Construction and working of extrusion for Ribbed pipes
- Construction and working of extrusion for corrugated pipes
- Construction and working of extrusion for Profiles

References:

1. Plastics Engineering Handbook Of The Society Of The Plastics Industry, M. Berins 5th ed. 1994, Springer 31 August 1991
2. Plastics: Materials and Processing by A. Brent Strong (3rd Edition), 3rd Edition, Pearson 6 June 2000
3. Handbook of Plastic Processes, Charles A. Harper, 1st edition Publisher Wiley-Interscience 22 August 2006
4. Extrusion: The Definitive Processing Guide and Handbook (Plastics Design Library), by Harold F. Giles Jr (Author), John R. Wagner, Jr. (Author) 1st edition William Andrew 31 December 2004
5. Blow Molding Handbook: Technology, Performance, Markets, Economics: The Complete Blow Molding Operation (Hanser Publishers), by A. Rosato C. Dominick V. Alberghini (Author) Oxford University Press 1 January 1989

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BVPPS603
TECHNOLOGY OF THERMOSET POLYMERS

Course Outcomes:

- Ability to understand basic concepts of resins
- Student should able to understand curing systems of Various resins
- Student should able to understand structure properties and relationships of resins
- Ability to understands about raw materials used in industry
- Ability to understand modification chemistry of Resin

Unit - 1 **06**

Alkyd resins Basic components like polyfunctional alcohols, poly-basic acids, vegetable oils/fatty acids. Different types of drying oils: drying, semi-drying and nondrying with examples. Influence of all these components in the synthesis and properties of the final alkyds obtained. Modification of alkyds: modifications with rosin, maleic anhydride, acrylics, vinyls, imides, etc.

Unit - 2 **06**

Polyesters Resins – unsaturated polyesters resins: Raw material: poly-basic acids, polyfunctional glycols. Curing of resins through unsaturation of the resin/polymer backbone. Curing systems, catalysts and accelerators. Molding compositions, fibre and film forming compositions

Unit - 3 **06**

- Phenolics. Basic Components of the polymer. Different kinds of phenols to aldehyde on the nature and the property of the polymer. Theory of resinification and effect of pH on the reaction mechanism and the reaction product. Curing of Phenolics.
- Modification of Phenolics such as oil soluble and oil reactive. Phenolic moulding compounds ingredients, compounding and applications
- Polyurethanes – Theromoplastic and Thermoset: Basic components diisocyanates and diols, different diisocyanates and diols used Reactions of isocyanates with various other functional groups synthesis of polymers polyurethane foams, polyester and polyether foams.

Unit - 4 **06**

- Processes like one-shot process, Polyether pre-polymers, Quasi-pre-polymer polyether foams, etc. Flexible foams Polyurethanes in Coatings Polyisocyanates IPN using polyurethanes-acrylic blends.
- Silicones Theromoplastic and Thermoset; Preparation of intermediates, Grignard's method, directs method, olefin addition method, sodium condensation method, rearrangement of organochlorosilanes.
- Nature and effect of Si-H, Si_O, Si-Si, and Si-C bond. Silicone fluids, resins, elastomers.

Unit - 5 **06**

- Silicon resin compounding, Processing and applications. Silicone modified resins
- Thermosetting acrylics: Synthesis of acrylic polymers and co-polymers, different techniques.
- Structure property relationship application of thermosetting acrylics, like anaerobic adhesives, laminating resins, etc
- Miscellaneous thermosetting polymers

References:

1. Text book of Polymer Science by Billmeyer, John Wiley ans Sons 1984.
2. Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.
3. Alkyd Resin by Martins C. R, Reinhold Publishing corporations 1961.
4. Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990.
5. Polyester Resin by Lawrence J. R, Reinhold Publishing corporations 1960.
6. Polymer and Resins; Their Chemistry and Chemical Engg, Brage Golding, D.Van Nostrand Company Inc, 1959.
7. Phenolic Resin chemistry by Megson, N.J.L, Butterworths scientific publication 1958.
8. Phenolic Resin by Whitehouse A.A.K, 2nd edition 1967.
9. Phenolic Resins by A. Knop and L. A. Pilato, Springer verlag 1985.
10. Polyurethane & synthetic resin by Robinson, R.S and Weeks, C.A.
11. Polyurethane Technology by Bruins P. f, Interscience publishers 1969.
12. Acrylic & other synthetic resins by S. D Tylmen and F. A. Peyton, J. B. Lippincott Co. 1946.
13. Silicones by R. N. Meals and F. M. Lewis, Reinhold Publishing corporations 1959.
14. Silicones by Ranney, M. W, Noyes Data co. 1977.
15. Silicones and their uses by McGregor R. B, McGraw hill book co. 1954.
16. Chemistry and Technology of Epoxy Resins by Eliss Brayn, Springer Nethelands,1993

KALINGA UNIVERSITY
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BVPPS604
MOULD MANUFACTURING

Course Objective:
The objective of this course is to provide students with the knowledge of mould manufacturing technology. The course covers the basic principles of mould/die materials selection, machining methods, assembly, proving, inspection, and maintenance of moulds/dies. The course also introduces the latest trends and developments in mould manufacturing technology, such as additive manufacturing, smart moulds, and micro-moulds.

Course Outcomes:
By the end of this course, students will be able to:
- Identify mould/die components and justify the selection of materials.
- Plan mould/die manufacturing using traditional and non-traditional machining techniques.
- Identify the finishing requirements of mould/die components and plan for the systematic assembly of mould.
- Plan mould/die maintenance and repair activities.

Unit - 1 **06**
Mould Materials:
- Properties, selection criteria and performance characteristics, ferrous, non-ferrous and non-metallic materials used for mould manufacturing, commonly used mould materials, material processing and treatment methods.
- Materials for prototype moulds.

Unit - 2 **06**
Mould Manufacturing Methods:
- Procedure for manufacturing of moulds, mould manufacturing checklist, process planning, use of shaper, lathe, milling, drilling, grinding and pantograph machines for machining of mould parts, advantages and disadvantages of using conventional machines for mould manufacturing.
- Use of CNC Lathe and CNC Milling machines for mould manufacturing, advantages and disadvantages.

Unit - 3 **06**
Nontraditional Machining for Mould Manufacturing:
- Process, applications and advantages of Electrical Discharge Machining, Chemical Machining, Photochemical Machining, Electrochemical Machining, Laser Beam Machining and Ultrasonic Machining in mould manufacturing.
- EDM Electrodes - materials, design and manufacturing.
- Additive manufacturing techniques for mould manufacturing; prototype mould manufacturing.
- Introduction to micro-moulds and smart moulds.

Unit - 4 **06**

Mould Polishing, Assembly and Inspection:

- Basics of polishing technology, polishability of mould materials, methods of polishing, types of polishing tools, ultrasonic polishing.
- Surface graining and texturing.
- Check list for mould systematic assembly, Fitting and assembly of various mould elements - core insert, cavity insert, sprue bush, ejection system, blue matching and die spotting, venting, final inspection, fitting of locating ring and carrier bar, mould trial checklist and mould proving.
- Checklist for mould inspection, Introduction to mould inspection.

Unit - 5 **06**

Mould Maintenance and Repair Methods:

- Causes and prevention of mould defects and failures.
- Common mould problems such as wear, corrosion, cracking, warping, etc.
- Mould cleaning, lubrication and storing methods.
- Mould repair and modification techniques.
- Welding techniques and considerations for mould repairing.
- Electro deposition in damaged mould surfaces, Protective Coating.

References:

1. Gunter Mennig and Klaus Stoeckhert,“Mold-Making Handbook”,Third Edition, Hanser Publications, 2013.
2. Georg Menges, Walter Michaeliand Paul Mohren, “How to Make Injection Molds”, Third Edition, Hanser Publications, 2001.
3. S K Hajra Choudhury and Nirjhar Roy, “Elements of Workshop Technology Vol. II: Machine Tools”, Fifteenth Edition Revised, Media Promoters and Publishers Pvt. Limited, 2016.
4. Dangel R., “Injection Molds for Beginners”, Second Edition, Hanser Publications, 2020.
5. Harry Pruner and Wolfgang Nesch, “Understanding Injection Molds”, Second Edition, Hanser Publications, 2020.

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