

Polymer and Textile Engineering Department

Course Outline

1.00 MTH 101-UC: ELEMENTARY MATHEMATICS 1 (3,1,0)

Pre-requisite: Credit O.L. Math.

Number systems. Indices, surds, and Logarithms. Polynomials. Remainder and Factor theorems. Polynomial equations. Rational functions. Partial fractions. Fields Ordered fields. Inequalities Mathematical induction. Permutations and combinations. Binomial theorem, sequences and series. The quadratic equation and function. Relation between the roots and the coefficients. Complex numbers. Addition, subtraction, multiplication and division. Argand diagram DeMoiuers theorem, n-th roots of complex numbers.

Elementary set theory. Venn diagrams and applications. De-Morgans laws. Trigonometry. Elementary properties of basic trigonometric functions. Addition formulae and basic identities. Sine and cosine formulae. Half angle formulae. Area of Triangle. Solution of trigonometric equations. Inverse trigonometric functions. Functions, Concept and notation. Examples. Composition. Exponential and logarithmic functions. Graphs and properties. Limits and continuity. Techniques for finding limits. The derivative. Calculation from first principles. Techniques of differentiation. Chain rule. Higher order derivatives.

Extremum problems. Means value theorem. Applications. Indeterminate forms and Ls rule. Taylors and Maclaurins series. Curve sketching. Integration as the reverse of differentiation, as area, as limit of finite sums. Definite integrals. Properties of definite integrals. Applications.

2.00 CHM 101 UC: GENERAL CHEMISTRY (2,1,1)

Atomic structure and the periodic classification of the elements; ionic and covalent bonding including the effect of dipole interacting of physical properties. Redox reactions and the concept of Oxidation numbers; introduction of gas kinetics; introduction to nuclear chemistry. Solids and Lattice structure; acid-base reactions; general principles of extraction of metals.

3.00 PHY 101 UC: GENERAL PHYSICS (2,1,1)

Pre-requisites: Credit in O.L. physics and Maths and

concurrent registration in MTH 101. Two 1-hour lectures, one hour tutorial and three hours laboratory per week.

Mechanics: Space and time, unit and dimensions; vectors; kinematics, Newtons law; Galileon invariance, statics and dynamics of particles; universal gravitation; work and potential energy; conservation of energy and momentum; rigid bodies; fluid mechanics. Thermal physics; thermal properties including elementary thermodynamics and Kinetics Theory.

4.00 BIO 101 UC: BIOLOGY FOR PHYSICAL SCIENCES (2,1,1)

Scientific methods and the characteristics of living and non- living things. Cell and tissue biology. Elements of biological chemistry and cellular metabolism. Taxonomy of living things, heredity and evolution. Elements of ecology and types of habitats.

FRN 101 UC: FRENCH LANGUAGE I (1, 0, 0)

This course will introduce the students to the basics of French Language such as greeting in French, French alphabets, vowels, pronunciation and accents. The students will also learn the components of French grammar as the articles, verb, etc.

GST 103 UC: PHYLOSOPHY (1,1,0)

The nature and the scope of economics. The Nigerian political system: policy and means of production in Nigeria. The structure of the Nigerian economy aspects of economics and technological dualism; internal migration-rural to urban migration and the informal sector. The role of capital growth and development; public investment criteria; choice of technology. Human resources development in Nigeria labour utilization, education and manpower development and planning. Agriculture in the development process; land tenure and reform. Agricultural technology and green revolution and integrated rural development. Industrialisation: role and types of industry, choice of techniques, import substitution, and export expansion. The economic role of the government expenditure and taxation; the federal structure, fiscal federalism and revenue allocation; to financial system. Problems of development planning and plan implementation in the federal system of Government. Prospects of the Nigerian economy.

IGB 101 UC: INTRODUCTION TO IGBO GRAMMAR, COMPOSITION AND

COMPREHENSION (1 0 0 1)

1. Nkenke nkowa banyere ndi Igbo, Nkowa Asusu, Uru asusu bara, Mmalite edemede asusu Igbo, Mkpārīta uka banyere ndi malitere odide na ogugu asus Igbo dika, Ida Ward, Olauda Equiano, Oldendorp, n'oge ochichindi beke. Ihe mere o jiri di mkpa na aga-akuzi asusu Igbo n'ulo akwukwo anyi ha.

2. MKPURUEDEMEDE IGBO (Otografi onwu)

Ndeputa na Nguputa mkpuru edemede Igbo na Usoro odide ya

Mkpuru edemede Igbo ndi ukwu, mkpuru edemede Igbo ndi ukwu, Udume Igbo: Ha di ole?, Kedu ndi bu udaaru?, kedu ndi bu udamfe?, Mgbochiume nge, Mgbochiume mkpi,

Myiriudaume M na N

3. NKEJIASUSU IGBO: Mkpōaha na omumaatu ya; Njuajuju; Nnochiahā; Onuougu; Ngwaa; Njiko; Mbuuzo; Nkowaaha; Nkwuwa; Ntimkpu.

4. AKARAEDEMEDE: Nkowa ihe bu akra edemede nakwa uru ha bara n'edemede Igbo. Kpom – (.) na ebe ndi a na-etinye ha; Rikom – (,); Rikomelu – ("); Kpom kpom (:); Akaraajuju (?); Akaramkpu (!); Akarankpuchi/Akarangudo ();

Akarauhie (-); Akarangwu (" ").

5. NKEBIOKWU IGBO: Gini bu nkebiokwu? Nkebiokwu di iche iche; Omumaatu nkebiokwu di iche iche.

6. NKEBIAHIRI IGBO: Nkowa ihe bu nkebiahiriokwu; Nkebiahiriokwu di iche iche; Omumaatu nkebiahiriokwu di iche iche;

7. AHIRIOKWU IGBO: Nkowa ihe bu ahiriokwu na odidi ha; Ahirimfe; Ahirinha; Ahiriukwu; Ahirimgbagwo.
8. UDI AHIRIOKWU DI ICHE ICHE: Ahirincho; Ahirinkwusa; Ahirinitmiwu.
9. ASUSU IGBO DIKA, ASUSU SVO: Omumaatu ahiriokwu ndi na-egosiputa aha, ngwaa na nnara.
10. NKEJIOKWU IGBO: Gini bu nkeji okwu?, Kedu uzo e si emebe nkejiokwu?, Udi nkejiokwu ole e nwere.
11. NDAKORITA UDAUME: Gini bu ndakorita udaume?, Ndakorita udamfe; Ndakorita udaaru.
12. UDAOLU: Nkowa ihe udaolu putara; Akara uda elu; Akara udansuda; Omumaatu ha di iche iche; Itinye akara udaolu n'okwu.
13. NTUGHARI: Ihe ntughari putara; Ihe eji eme ntughari; Ihe ndi a ga-agbado ukwu n'ime ntughari; Ntughari ihe ogugu ndi a hoputara.
14. EDEMEDE: (KOMPOZISHON) Gini bu edemede?; Ihe ndi di mkpa maka edemede; Udi edemede di iche iche; Ide edemede n'onwe ya;
15. EDEMLETA: Nkowa ihe bu ide leta; Udi leta di iche iche; Nhazi edemede; ASUSU edemede.
16. ATUMATU OKWU: Nkowa ihe bu atumatuokwu; Mburu; Myiri; Mmemmadu; Nsinuuda; Ahauda; Nzaraonwe;

17. AGHOTA AZAA (AGUOAZAA): Nkowa ihu bu agbotaazaa; Ihe ndi a na-elekwasị anya n'ime aghota azaa; Uru aghotaazaa bara; Iweputa agumagu maka aghotaazaa.
18. NCHIKOTA: Gini bu nchikota?; Kedu ihe ndi a na-agbado ukwu n'ime nchikota; Uru nchikota bara; Ichikota agumagu e weputara.
19. EKWUMEKWU N'ASUSU IGBO: Ihe bu ekwumekwu n'igbo; Ihe ndi a na-elekwasị anya n'ikwu ekwumekwu; Uru ekwumekwu bara; Mkpaitauka na klaasi.
20. IKWU OKWU N'OHA: Uzo e nwere ike isi were asusu igbo gwa oha mmadu okwu.; Usoro ndi ekwesiri igbaso maka okwu oha.; Ekele, Isiokwu, ihe ndi mejuputara okwu, nchikota na mmechi.
21. NSUPE N'IGBO: Nsupe okwu n'igbo.; Iwu nsupe di iche iche.; Oru ndi "Na", "Ga", na "Ka", na aru n'asusu Igbo.
22. NJEM NLEGHARI ANYA /IGBA NKIRI: Ndi nkuzi ga-akporo umuaka gaa ebe ndi a hooro, bu ebe ha ga-eji anya ha hu ihe ndi metutara asusu na Omenaala Igbo, Iji nyere ha aka ghotu nke oma, ma chekwaa kwa ihe ndi a kuziri ha n'ime klaasi.

GST 201 UC: NIGERIA AND AFRICAN CULTURAL

DEVELOPMENT SCIENCE 11 (1,0,0)

Concept and meaning of development; traditional Africa

its geographical and ethno-graphical review, view, its family structure, kingship system etc socio-economic pre-occupation, political system art and music, modes of communication; Africa and processes of modernization education, writing and the press, urbanization and social change, modern trends in art and aesthetic, nationalism and cultural revival, mass media and national development.

CSC 201- UC: COMPUTERS AND APPLICATION 1 (2,1,1,)

Pre-requisites: MTH 101 and MTH 102

Introduction to digital computer, their use and modern programming techniques; Brief history of computers, generation of computers, structure of a general-purpose computer. General problem solving, systematic development of algorithms, flow diagrams, meaning of logical processes analysis of computational problems coding of programs, verification and validation of programs. Practical experience operating computers, and peripheral equipment. Extensive practice with one or more high level language. Emphasis on technical applications. Elementary numerical algorithms.

MTH 203 UC: ELEMENTARY DIFFERENTIAL EQUATIONS (2,1,0)

Pre-requisites: MTH 101 and MTH 102

Derivation of equations from physics, chemistry, biology, geometry etc. First order equations. Applications of first order equations. Second order linear equations. Fundamental solutions. Linear dependence and independence. Wronskian properties of solutions of linear equations. Methods of undetermined coefficients and variation of parameters. Application of second order linear equations. General theory of n-th order linear equations. Laplace transform. Convolution. Solution of initial-value problems by Laplace transform method. Difference equations.

MTH 211- UC INTRODUCTION TO STATISTICS AND

PROBABILITY (2,1,0) Pre-requisites: MTH 101 and MTH 102

Frequency distribution measures of location and dispersion in simple and grouped data. Laws of probability. The Binomial, poisson and normal distributions. Estimation and tests of hypothesis. Analysis of variance and covariance, simple regression and correlation, contingency tables and χ^2 applications.

ENG 101- SC: WORKSHOP PRACTICE (0,0,1)

General: Use of Engineering measuring instruments: calipers, e.g. Vernier Calipers; Gauges, e.g. Micrometer; screw gauge and other devices. Introduction to hand tools to hand tools, proficiency in the use of wood planners, Hand sawsanders and pattern making.

SHEET METAL WORK: production of sheet metal products- layout, cutting, shaping, simple bend theory etc.

Introduction to joining techniques:- Soldering, brazing, fusion welding, fastening, and assembly. Basic woodworking principles and tools finishing and evaluation of finished products.

ENG 103 SC: ENGINEERING DRAWING 1 (0,0,1UNIT)

Introduction to Engineering Tools. Planning and layout of Engineering Drawing. Engineering Drawing Concept. Introduction to Dimensioning types; Dimensioning of circles, holes radii, tolerancing. Descriptive Geometry. Freehand sketching.

Introduction to Drawing/Drafting Software and CAD basic tools Orthographic multi view projection. Construction of plane shapes using CAD Construction techniques. Presentation of data and results. Using charts, graphs etc by basic tools Computer software. Further dimensioning addition of dimensions to drawings using CAD.

ENG 201- UC: ENGINEERING WORKSHOP PRACTICE 11 (1,0,1)

Pre-requisites: ENG 101, ENG 102

Introduction to Manufacturing Technology. Safety in the Engineering workshop, Safety on the job, House keeping, and fire prevention.

Manufacturing Processes: for Computer Numerical Control (CNC) Machining of cast and welded components, Manufacturing Procedures for various workpieces Manufacturing and Machining Sequence of Operations for various welded workpiece.

Measurement: Reading measuring instruments used in the Foundry and welding workshop. Types of measuring instruments available in the Engineering Workshop for welding and Foundry products and workpieces. Measuring and marking out instruments.

Basic Foundry Technology: Foundry machinery and Equipment used in the Foundry Workshop. Basic steps in making castings, Sand testing, mixing of sands, preparation of moulds.

Patterns: Pattern making - solid, split, sweep pattern; hoisting gates and risers. Melting and pouring of metals, solidification, casting of simple shapes using sand moulds, permanent moulds and expendable polystyrene. casting defects. Molding processes and materials, Green sand, Dry sand Moulds, Core moulding, Carbon dioxide process moulds, floor and pit moulding, shell moulding,

Plaster moulds, Design and cost feature of basic casting methods, permanent mould casting methods, moulding equipment and mechanization, mechanization of sand preparation, sand preparation and handling moulding sand binders: Core sand core binders, organic binders, coal tar pitch and petroleum pitch, core making methods, core ovens, etc.

Casting Alloys: Ferrous and Non-ferrous alloys, melting and heating treatment furnaces, cleaning and inspection, removal of gates, risers and finishing castings, casting industry, How to progress in the casting industry for all related professionals: Engineers, Technologist Technician, craftsman, Pattern maker, Process operator, Core maker, Fork lift Truck Driver, etc.

Welding Technology: Techniques used in Gas welding and brazing, gas welding, Tungsten Inert Gas welding TIG processes, Plasma arc welding, Types of flames in gas welding: Welding techniques for welding a BUTT joint, gas welding equipment, oxy-acetylated welding equipment, symbols of welding and their applications.

Joining: Design of Welded joints, stress analysis, types of joints, e.g. T-joints, BUTT joint, corner joints (Cap Joints, etc), soldering, brazing, adhesive joints. Fusion welds e.g. manual metal arc, TIG, SAW, SPOT, etc. Edge preparation, surface cladding, etc. Strength and toughness of welded joints, Laser welding, radio frequency (RF) welding, Ultrasonic welding, resistance and solid state welding, Hot gas and extrusion welding, Microwave welding, Vibration welding, Hot plate welding, Friction stir welding of plastics, infrared heating, Braze welding, and use of information and communication technology (ICT) applications in Engineering workshop practice.

ENG 203- SC ENGINEERING DRAWING 111 (0,0,1)

Drawing conventions including weld vents, piping, referencing selection of tolerances based on design requirements. Gears, gear drives, and rolling bearings. Pipes/structural Drawing. Reading and interpreting complete drawing. Detailed use of CAD for Engineering Drawing, and introduction to Auto CAD.

ENG 207 SC INTRODUCTION TO ENGINEERING MATERIALS I (2,0,0)

Pre- requisite CHM 102, PHY 102

Review of atomic bonding, classification of Engineering Materials (metals, Ceramics, Polymers composites, Semi conductors) introduction to extractive metallurgy. Elements of crystallography Crystal structures: Lattice unit, planes and directions, miller indices, inter-planar spacing. Packing of spheres - simple cubic, body centered cubic, face-centered cubic, hexagonal close packed structures, atomic packing densities interstitial sites, sizes and their distribution, Lethal implantations vacancies, and other point defects, line and surface defects phase Equilibriums and alloy theory, solid solution. Introductory heat treatment of steels.

ENG 209 SC: ENGINEERING THERMODYNAMICS (2,1,0)

FUNDAMENTAL CONCEPTS: History of Thermodynamics, Dimensions, Units system, state, property, process heat, work, pressure, temperature, Zeroth law.

First Law of Thermodynamics: Conservation of energy (Joules experiment) first law, energy Non flow processes, enthalpy, steady flow processes.

Properties of pure substances pure substances, P,V,T relations and diagrams CP, CV, ideal gas. Thermodynamic charts and tables

A Second Law of Thermodynamics and boat engine cycles cannot

heat engine and cycle. The second law and its corollaries. Entropy: Reversible and irreversible processes. Classics inequality, entropy, and irreversibility.

Heat engine and heat pump calculations. Applications of 2nd law to non-flow and steady flow processes. Available and unavailable energy, availability Gibbs equations.

ENG 213 SC: ENGINEERING MECHANICS (1, 0, 1UNITS)

Pre-requisites: MTH 101, MTH 102, PHY 101

Basic concepts In Statics: Statics of particles and rigid bodies in plane: analysis of forces: distributed forces, vectors, flexible cables, friction static and dynamic.

Equilibrium of a particle and equilibrium rigid body, Areas, centroids, masses, centers of gravity, analysis of structures; internal forces, Newtons, third law, shearing force moments, trusses and frames. The basics of free body diagrams. General mathematics principles. Moments of inertia of an area. Computer application and stimulation in statics.

ENG 217 ENGINEER SOCIETY (1,0,0)

Science Technology and Engineering: Definitions, Historical Development of Engineering, Science and Technology. The Engineering Family: The Engineer; The Technologist, The Technician, the Artisans and Craftsmen. Role of the Engineer in the society: In Space travel missions, in Oil and Gas production operations, in politics, law, medicine, education, administration, management, food production, utilities, military service, and developing new technologies and products. Branches of Engineering: Agricultural Engineering, Aeronautical Engineering, and Civil Engineering, Mechanical Engineering, Materials and Metallurgical Engineering Electrical and Electronics Engineering, Petroleum Engineering, Gas Engineering and Chemical Engineering, etc. Professional Qualifications: Engineering Education qualifications, register able as a Professional Engineer with: Nigerian Society of Engineers (NSE), Council for the Regulation of Engineering in Nigeria (COREN), Africa Institute of Science and Technology (AIST NIGERIA). Etc. Other Countries have their own bodies.

Professional Practice: Professional Ethics and Conducts. Professional Registration procedures, and Engineering Professional responsibilities. Management skills, product management, developing intellectual property rights and business legal rights, handling human and energy resources, fossil, geothermal, nuclear, wind and solar.

Conversant with safety in Engineering Practices control of occurrences of accidents in production Industry (Oil, Steel, mining, etc). Rules and regulations guiding pollution of the environment. Capable of applying appropriate technologies, Information and Communication Technology (ICT) systems in Engineering practice. Financial Management knowledge requirement, human relations management essential in developing the Engineer to promote productivity in any enterprise.

ENS301- SC: INTRODUCTION TO ENTREPRENEURSHIP AND INNOVATION (1,0,1)

This course is an introductory course for studying Entrepreneurship for the first time. The design and flow of course are aimed at creating awareness and providing the knowledge and skills that are important in achieving success in human endeavours as a value addition to the students chosen field of specialization. This course outline is made up of (13) topics as follows:

1. Development Entrepreneurship/Intrapreneurship
2. The Nigerian Entrepreneurial Environment
3. Creativity and Intellectual rights
4. Technological Entrepreneurship
5. Innovation: Theories and Management
6. Family business and succession planning
7. Women Entrepreneurship
8. Social Entrepreneurship
9. Business opportunity set and Evaluation
10. Introduction to business Strategy
11. Introduction to Business Ethics and Corporate Governance
12. Relationship between scientific Research innovation and products
13. Product invention, timeliness and processes.

ENG 305 SC STRENGTH OF MATERIALS 1 (1.1.1)

Pre-requisite: ENG 226

Elementary concepts in two-dimensional theory of elasticity generalized Hooks law equation of equilibrium, strain-displacement and stress-strain relations.

Review of mechanical properties of materials. Axial load, shear torsion Combined loading. Thermal stresses and strains for axial loading. Shear and bending moments; diagrams. Elementary beam theory, stress and strain transformation principal stresses

and plus circle Deflection of beams and shafts: by double integration, Macaulays (Singularity function) and moments area theorem methods. Buckling of Columns. simple bending theory, shear and moment Torsion combined torsion and bending, Stresses; transformation of buckling of columns.

LABORATORY

Mechanical testing of members under axial bending and torsional loads. Deformation and characteristic stress-strain curves: strength, ductility, brittleness, loading and unloading of materials.

ENG 305 SC: STRENGTH OF MATERIALS 11 (2,1,0 UNITS)

Pre-requisite: ENG 226

General state of stress and strain at a point. Bending of beams with un-symmetrical sections, skew bending, bending of curved bars, thin plates, beams on elastic foundations, Torsion of thin walled sections. Statically indeterminate systems and stability analysis. Introduction to plastic behaviour of materials, elastic, perfectly plastic and strain hardening materials linear viscoelastic materials, theories of failure. Problems in stress shrinking fit concentrated forces, contact stresses.

ENG 307 SC ENGINEERING MATHEMATICS 1 (2,,1,0 UNITS)

Pre-requisite: MTH 203, ENG 226

Review of ordinary different equations: bassel, Lagrange partial different equations: Engineering applications, Laplace transformations and other transform methods. Series solutions and special functions: such as Gamma functions, Beta, Gauss functions, and Fouriers series.

ENG 311 SC MACHINCES DESIGN 1 (1,1,0 UNITS)

Pre-requisite: ENG 226

The design process from the recognition of need to prototype development. Principles of reliability and economics in design for production. Strength wear and materials consideration. Fits, limits and tolerance specifications. Brief review of force systems and stresses usually encountered in design. Design of riveted joints, screw fastening, springs, welded construction and cast structures. Identification of standard machine components. Design methodologies conception and final design methods. Computer Aided. Design (CAD) application.

ENG 315 SC: PRINCIPLES OF ENGINEERING SURVEYING (1,0,1)

Introduction to branches of surveying. Basic surveying concepts and instrumentation, measurement of distances and angles, measurement errors, electronic distance measurement. Co-ordinate systems/bearings. Global positioning system (GPS). Traversing and Computation. Adjustment of traverse leveling operations, use of leveling and plotting of leveling profiles, contouring, plane table surveying. Calculation of Areas and volumes s rule, Trapezoidal rule, Calculation of areas from bearing. Introduction to the National grid.

LABORATORY

Adjustment of theodolites and levels. Use of GPS and Electronic distance measuring instruments, Traverse leveling computations of distances and plotting. GIS (Geographic Information Systems and other Computer application in Engineering Surveying).

ENG 317 S.C. ENGINEERING WRITING AND PRESENTATION (1,1,0)

Methods and formations involved in and presentation of technical reports. Current technical reports. Current techniques in engineering paper presentation. Communication schemes. Referencing and types of referencing e.g. Harvard and Vancouver methods). Use of internal research Methods. Technical presentation (Writing and data collection, organization and presentation). Oral presentation of technical ideas. Use of audio-visual presentation aids. (Multi-media, Computer Hardware and software applications) etc. use of modern software in presentation, example Microsoft power point, Coral Draw, Microsoft word and others.

ENG 411 S.C DIGITAL SYSTEMS AND APPLICATIONS (1,0,1)

Introduction to combinational logic circuits and logic gates. Minimization of hardware using minierms and maxiterm expansions use of K-maps. Sequential logic circuits: flips flops, digital counters, shift registers, adders, decoders, multiplexes. Introduction to microprocessor internal architecture of a basic microcomputer. Microprocessor fetch-decode-execute cycle. Input/output techniques, memory mapping 1/0 mapped ports, 1/0 control. Microprocessor programming Text and faultfinding devices for digital systems.

Microprocessor and microcomputer Application examples-weighing scales, central heating system, ware form-synthesis. Digital interfacing techniques for engineering applications. Such as control of CNC lathe and Milling machines.

DEPARTMENTAL COURSES CONTENTS

PTE 301 POLYMER CHEMISTRY(2,0,0)

Initiation mechanisms (free radical, cationic, anionic stereo-specific) in the polymerization reactions through functional groups and multiple bonds, (vinyl and diene); ring opening, polymer modification, living polymers; Distribution between chain and step growth kinetics, Kinetics of vinyl polymerization and polycondensation. Methods of determination deviation of equipments, parameters of polymerization. Auto-acceleration, chain transfer, inhibitors, retarders. Raw materials, polymerization techniques and properties of polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyvinyl acetate, polyvinyl alcohol, polymethyl methacrylate, polyamides, polyethers, polyurethanes and inorganic polymers. Polymer characterization: essential characteristics of fibre forming polymers.

PTE 303 POLYMER PHYSICS (2,0,0)

Pre-requisite: PTE 202

Polymer chain structure; isomerism and regularity geometrical, optical and substitution isomerism; branching in polyethylene, PVC and polyvinyl acetate. Physical techniques to study polymer structures in solution, in the amorphous and crystalline states (Vibrational, UV, IR, NMR, and Roman spectroscopy; X-ray and neutron scattering, DFA, TGA). Molecular weights types and methods of determining molecular weight distributions and polydispersity index. Co-polymerization types monomer reactivity ratios, kinetics, and instantaneous composition of feed.

PTE 307 YARN MANUFACTURE (1,0,1)

Pre-requisite: PTE 202

Principles of Opening and cleaning. Blending, detailed study of blow room machinery for different varieties and grades of cotton; recent developments. Principles of carding systems, principles of roller drafting, detailed study of drawing frame mechanisms. Drafting systems; recent developments. Objectives of combing, comber lap preparation; working principles of drafting twisting and winding, recent development. Detailed study of ring frame mechanisms; recent developments in design and operations, various systems of doubling production of folded yarns; fancy yarns, sewing thread manufacture, Reeling paste spinning.

PTE 401 POLYMER PROCESSING ENGINEERING TECHNOLOGY 11 (2,0,1):

Pre-requisite: PTE 310

Introduction to mathematical modeling and mechanical analysis of pressures; objectives, capillary/rheometry-shear viscosity, its representation and measurement as a function of shear rate, pressure and temperature; elasticity, extensional viscosity extrudate swell, entry losses, flow in tubes and channels, flow in dies.

Foam production: Methods of foaming and foam moulding processes, characterization of foams, cutting, shaping and bonding of plastics, cementing, welding, heat sealing, machining decorating and finishing, painting, coating, colouring, texturing and design. Polymers for making forms PVC, polyurethane and Elastomers. Melt viscometry. Factors affecting viscosities of

polymer melts.

PTE 403 QUALITY CONTROL IN POLYMER AND TEXTILE INDUSTRY (2,0,1)

Pre-requisite: PTE 322

Definition of quality control, quality control, organizations and functions, significance and importance of testing polymers, fibres, yarns, fabrics, dyestuffs, chemicals and auxiliaries; importance of keeping standards and factors responsible for deviation from standards. Quality control in polymer processing, yarn manufacture; control of counts, yarn strength and evenness. Statistical interpretation of data. Measurement and control of quality in winding, warping sizing, drawing-in and weaving. Wash, stain and light fastness of finished goods.

PTE 405 ENGINEERING PROPERTIES OF BULK POLYMER (2,0,0)

Pre-requisite: PTE 303

Phase states and phase transitions 1st and 2nd order transitions, concept of T_g ; Crystal structures of theoretical calculations of T_g ; Crystal structures of polymers, single crystals, melt crystals, mechanism and kinetics of polymer crystallization. Thermodynamics of melting and crystallization of polymers. Degree of crystallinity and methods of determination. Orientation and drawing. Structural determinants of mechanical properties, melting points plasticization, reinforcements, cross-linking, copolymerization, and melt viscosity. Property requirements and utilization. Effect of chemical structure on crystallinity, viscous flow, rubber elasticity and viscoelasticity.

PTE 407 NON-WOVEN TECHNOLOGY (2,0,0)

Pre- requisite: PTE 307/PTE 308

Classification definitions, and uses, economics of non- woven fabrics; preparation of webs and sheets opening, binding and mixing equipment; formation of parallel-laid, cross-laid and random-laid webs; equipment, limitations, speed, weight limits and web control; specifications of typical machines and webs produced, methods of producing continuous filament webs; spun-bonding, methods of yarn-sheet preparation. Composite properties in relation to process variables.

PTE 409 KNITTING TECHNOLOGY (2,1,0)

Weft knitting: definition, characteristics of weft knitted fabrics; machines used for knitting; straight-bar, flat bar, v-bar, single cylinder, cylinder and dial; stitches e.g. plain jersey, rib puri interlock and their decorations.

PTE 411: Polymer Rheology (2, 0, 1)

Review of laminar and turbulent flow, steady flow, Reynolds number. Newtonian flow, fluid flow along a channel of uniform circular cross-section, fluid flow between parallel plates, equation of capillary viscometer, solution viscosity, cone and plate rotational viscometer, bob and cup viscometer, falling ball, sliding plate and vibrating reed viscometer, melt index, ubbehohde and Ostwald capillary viscometers. Non-Newtonian fluid flow through uniform circular cross-section and parallel plates, pseudo plasticity, dilatancy, thixotropy, rheopectic and bingham bodies, creep deformation and stress relaxation, rheological systems and properties. Deformation of polymer solids, Maxwell and Voight models, 3-parameter model.

PTE 413 PVC TECHNOLOGY (2,1,0)

Historical account of PVC

Manufacturing of Vinyl Chloride Monomer through acetylene, ethylene and oxychlorination. Types of PVC: Suspension grades, emulsion (E or P) grades. Polymerization techniques. Properties and uses of PVC cable insulation

chemical plant, leather clothes, packages, toys; Co-polymers of PVC and their uses structure of PVC; particle size distribution. Stabilization and additives (blowing agents substrates, fillers, plasticizers). Fikentschner K values and uses.

Plastisol technology for leather cloth calendaring, formation, mixing, coating (knife and reverse roll), curing, chemical embossing.

Processes:-

Blow moulding for making PVC bottles.

Thermoforming to make thin wall containers e.g. cups; large scale mouldings e.g. boats, garage doors, domestic baths; skin and blister packaging of household goods e.g. nails, screws, disposable razors,

Slush, moulding for play balls, soft toys, dolls (head, bodies and limbs)

Compression moulding,

- Injection moulding for shoe soles.

PTE 501: POLYMER SCIENCE II (2, 0, 1)

Pre-requisite: PTE301/PTE405

(polymer stereochemistry and co-ordination polymerization). Fine structure of cotton and rayons, theories of fibre structure, moisture sorption by films and fibres; heat of sorption and melting. Mechanism of setting of fibres. Diffusion of gases through films and relating to the diffusion coefficients with film structure. Diffusion of dyes into films (VLF) equation, high tenacity fibres- polyethylene fibres, polypropylene fibres, modacrylics, fluorine containing fibres, Nomex Kelvar.

PTE 503 POLYMER CHAIN PROPERTIES AND SOLUTION

Polymer chains freely jointed rotating, chains with restricted rotation. Conformations of dissolved polymer chains. Thermodynamics parameters for polymer solutions; types of solution, Flory-Huggins, Flory-Krigharm theories. Free volume concept. Thermodynamics of dissolution of flexible, rigid, gassy and crystalline polymers. Thermodynamics of swelling of cross-linked polymers. Thermodynamics quality, of solvents. Factory heat and free energy of mixing. Criteria of solubility, solubility parameters, phase separation, UCST and LOST. Polymer fractionation. Hydrodynamics of polymer solutions: phenomenological volume effects; concentration dependence. Osmometry, end-group analysis and light scattering.

PTE 507 ENGINEERING TECHNOLOGY OF ELASTOMER (2, 0,1)

Pre- requisite: PTE 301, 323 AND 401

Survey of world production and consumption of elastomers. Kinetic theory of rubber elasticity; thermodynamics, network structure and elasticity; stress-strain behaviour. Compounding and formulation principles of mixing and internal mixings, dry (compression, transfer, injection) and extrusion. Heat transfer and vulcanization methods. Materials behaviour and testing. Safety in rubber industry. Plant layout and operations method.

PTE 509 COMPLEX TEXTILES AND DESIGN (2,0,1)

Pre- requisite: PTE 305

Preparation of dobby and coloured design, construction of backed, double and treble cloth. Initiation to Jacquard designs, Warp and pile fabrics including terrypile structure. Ganze and lano fabrics construction of toilet and other quilting fabrics tapestry, muslin, lappet and swivel weaves, narrow fabrics. Introduction to carpet wearing and fabrics industrial purposes.

PTE 513 SEMINAR (0,1,0)

All students will be required to participate in weekly seminars to be given in turns by members of the class selected advance topics on one area of polymer and fibre science and technology will be assigned to each student who has to prepare a review paper a review paper followed by oral presentation and discussion.

PTE 531 – POLYMER COMPOSITES AND BLENDS

Basic definitions and concepts of polymer composites, matrix and reinforcements/fillers, Polymer blends, Compatibility, Types of polymer composites and blends, mechanical polyblends, chemical polyblends and mechano-chemical polyblends, solution-cast polyblends, latex polyblends, Tg of polyblends.

Micro and nanocomposite Technology, Clays, Nanofillers and Nanofibres, Fibre Reinforced Composites (FRC's), Comparative analysis of polymer composite properties, polymer – filler compatibility, impregnation, structure property relationship of micro and nanofillers, Manufacturing techniques for polymer composites, batch and continuous manufacturing techniques; hand lay – up, spraying, casting, extrusion, injection moulding, compression and thermoforming, tooling and mould making, measuring of filler particle size, measurement of filler properties, Interpenetrating Polymer Networks (IPN), Composites formulation, Mixture rule and directional properties, Design considerations, Mechanical properties of polymer composites, electrical and thermal properties, specific gravity determination, Techno commercial considerations for polymer composites and blends.

PTE 521 POLYMER PROCESSING ENGINEERING TECHNOLOGY III (2,0,1)

Pre- requisite: PTE 401

Basic principles underlying composite materials properties. Emphasis on design of composite systems to yield desired combinations of properties. Gears and transmission; spur gears, profile modifications; helical and worn gears; gear manufacture, gear trains. Introductions in design rotor dynamics, fundamentals of sound and associated vibration; random aspects of noise. Technology of different methods employed in forming thermoplastic and thermosetting materials with emphasis on

analysis of mechanism of machining of plastics; Forces, optimum tool geometry, surface finish, Grinding of plastics.

PTE 523 PULP AND PAPER TECHNOLOGY (2,0,1)

Introduction to wood-polymer principles; emphasis on chemical and physics chemical properties of wood based on its polymeric chemical structure. Wood and pulping chemistry, processes involved in paper manufacture, finishing and adhesive systems widely used in wood products manufacturing. Analysis and testing.

PTE 531 POLYMER REACTIONS AND DEGRADATION

Pre- requisite: PTE 301

Survey of polymer reactions: radical and cationic chain transfer reactions; radical and step-growth block copolymer formation; polyester and polysulphide interchange reactions; cross-linking of polymers; the ring closure reactions pendant functional groups in head to tail versus head head orientation. Agencies

degradation-energetic (thermal, mechanical, u.v., and high energy); and chemical (hydrolytic, oxidative). Ceiling temperatures. Thermal degradation of polymers, - photolysis, radiolysis of polyethylene, polystyrene and polymethyl methacrylate. Oxidative degradation. Auto oxidation. Oxidation of natural rubber and saturated polymers. Hydrolysis of cellulose, and cellulose derivatives and polyamides; Alcoholysis of polyesters. Inhibition of auto-oxidation. Thermal resistance. Degradation of print films, kinetic and mechanisms. Effects of solid structure. Cross-linking and weathering.

PTE 533 - CONDUCTING POLYMERS (2,1,0)

Pre- requisite: PTE 301/PTE 405

Historical development, conducting polymers in microelectronics, conducting polymers in the area of lithography, use for metallization, corrosion protection, electrostatic discharge (ESD) protective coatings for packages and housing of electronic components. Synthetic of conductive polymers, polyacetylene synthesis, mechanisms of conduction, poly (P Phenylene), polypyrrole, anodic polymerization of pyrrole, doping with I_2 , Br_2 and $FeCl_3$ in metal salt solutions of Ag^+ , Cu^{2+} , Polyaniline, reaction of aniline with ammonium persulphate in aqueous HCl. Poly(phenylene sulphide), poly (vinyl pyridine) sulphonated conducting polymers, properties of conducting polymers, molecular weights, electrical conductivities and carrier transport, Optical properties, conducting polymer solutions and composites, conductivity measurement and characterization, spectrometric titrations, UV visible spectrophotometer, FT IR, cyclic voltametry (i.e. electrochemical study of the electrode current as a functions of potential, potentiometric methods, NMR spectroscopy simplified conductivity meter, two point probe meter, applications of conducting polymers, polymeric solid batteries, polymer modified electrode, polymeric electrolytes, photonic applications of conducting

polymers, summary of groups of applications electrostatic materials, conducting adhesives, electromagnetic shielding, printed circuit boards, artificial nerves, antistatic clothing, piezo- ceramics, active electronics (i.e. diodes, transistors) and aircraft structures, EMI shields. Molecular electronics, electrical displays, chemical, electrical and thermal sensors, drug release systems, rechargeable batteries, optical computers, ion exchange membrane, electrochemical actuators, smart structures, switches and solar cells.