B.E./B.Arch./B.Text.E./B.Tech. **Prospectus No. 121712**
III & IV Semester

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

(Faculty of Engineering & Technology)

PROSPECTUS

Prescribed for
Four/Five Year Degree Courses
Bachelor of Engineering/Bachelor of Architecture/
Bachelor of Textile Engg./Bachelor of Technology
(Chemical Engg.)/(Chemical Tech.)

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1) **Production Engineering**
2) **Architecture**
3) **Textile Engineering**
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6) **Food, Pulp & Paper, Oil & Paint and Petrochemical Technology**
7) **Biomedical Engineering**

III & IV Semester Examinations, 2011-2012

Semester Pattern

(CREDIT GRADE SYSTEM)

2011
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PUBLISHED BY
Dineshkumar Joshi
Registrar
Sant Gadge Baba
Amravati University,
Amravati. 444 602

SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF ENGINEERING
PRODUCTION ENGINEERING
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 PE 01 / 3 CH 01 MATHEMATICS-III / APPLIED MATHEMATICS-III

1. Prerequisite of Subject
   Engineering mathematics I and
   Engineering mathematics II
2. Objectives of Applied mathematics III. On Completion of the students are expected.
   - To understand Fourier transform & Z-transform, Laplace transform & their application to engineering problems.
   - To know probability and probability distribution.
   - To understand Numerical analysis.
   - To know vector Clarks &their application.

SECTION-A

UNIT –I: Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7 Hrs.)

UNIT-II: Laplace transforms: Definition, standard forms, properties of Laplace transform, Inverse Laplace transform, Laplace convolution theorem, Laplace transforms and Unit step function, Solution of Linear differential equations. (7 Hrs.)

UNIT-III: Probability & Probability Distribution
Probability : definition, axioms of mathematical probability, complementation rule, Theorem of total probability, Theorem of compound probability, Independent Events, subjective probability, Baye's Theorem, Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (7 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :-
Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic conjugate functions, Milne's method, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem. (7Hrs.)

UNIT-V: Numerical Analysis:
Solution of algebric and transcendental equations by method & method of false position, Newton-Raphson method Solution of system of linear equations by Gauss Seidal method, Relaxation method. Solution of first order ordinary differential equations by modified Euler's, method Runge - Kutta method. (7Hrs.)

UNIT-VI: Vector Calculus :-
Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (7Hrs.)

OUTCOMES:

Students are expected to expertise in solving numerical methods, Laplace transform, Fourier Transform & Z-transform

Probability & Probability Distribution and statistics are very useful to them in future curriculum/student.

Complex functions and vector calculus are backbone of future academic curriculum and hence should be in tuch with contents in syllabus.

Design of syllabus is more than sufficient for academic curriculum of student.

Text Books:

1. Higher Engineering. Mathematics by B.S. Grewal, Khanna Publication.
2. A Text Book of Applied Mathematics, Volume-II by P. N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference books:

1. Numerical Analysis- S.S. Sastry.
2. Advancing Engg. Mathematics by E.K.Kreyzig.

3PE02 / 3ME02 STRENGTH OF MATERIALS / MECHANICS OF MATERIALS

SECTION-A

Unit-I

1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety.
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II

1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs.

Unit-III

1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin and thick cylinders and thin spherical shells subjected to internal pressures.

Unit –V :

1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.

2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams

Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books :

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi.

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : A Practical Approach, I ed, University Press, Hydrabad.

3PE03 FLUID POWER SYSTEMS

Lecture:03 Hrs/ w	Internal Assessments: 20
Tutorial:—	University Exam: 80
	Credits: 03

Course Objectives:

- To understand concept of fluid mechanics, fluid types, fluid flow.
- To understand different equipment for measurement of flow of fluid.
- To understand different Pumps, Valves and Hydraulic Machineries.

SECTION-A

UNIT- I : Introduction to study of fluid motion, different properties of fluid, fluid pressure and its measurement, hydrostatic on plane and curved surfaces. (6)

UNIT- II : Fundamentals of fluid flow, types of fluid flow, continuity equation, equation of motion and energy equation, forces acting on fluid in motion, Euler's equation and Bernoulli's

equation, flow through pipes and its losses, losses in fittings (8)

UNIT- III : Application of Bernoulli's equation to venture meter, nozzle meter etc. pitot tube theory and application. Introduction to laminar and turbulent flow, Reynolds number and its significance, Flow through notches and orifice and flow measuring devices. (8)

SECTION-B

UNIT- IV : Pumps: Basic theory, working Principle and characteristics of variable capacity and fixed capacity type pumps, gear, vane, piston, rotary and axial piston pumps, Reciprocating pumps. (7)

UNIT- V : Valves: Check Valve, Operation and Selection, pressure relief valve principal types, speed and pressure valves, Differential pressure control valves, simple hydraulic circuit using these components.
(8)

UNIT- VI : Hydraulic systems:

1. Function and application of Hydraulic accumulation, differential hydraulic accumulator, intensifier, ram, lift riveter and crane.
2. Hydro Kinetic system such as fluid coupling and torque convertors.
3. Fluid, drives for machine tools such as lathe, drilling machine and shaper. (8)

TEXT BOOKS:

1. A TEXTBOOK OF FLUID MECHANICS AND HYDRAULIC MACHINES By: Dr. R. K. Bansal, 19(2010), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131808153.
2. INTRODUCTION TO FLUID MECHANICS (SI EDITION) ,Edward J. Shaughnessy,Jr, Ira M. Katz, and James P. Schaffer , 2005, Oxford University Press ,ISBN: 9780195677836.
3. INTRODUCTION TO FLUID MECHANICS AND FLUID MACHINES, By: S Som,G Biswas, Edition: 2 (2007), Tata McGraw-Hill Education, ISBN: 9780070667624.

REFERENCE BOOKS:

1. FLUID MECHANICS AND HYDRAULIC MACHINES, By: S. C. Gupta ,2006 Pearson Education, DELHI, INDIA, ISBN: 9788177583649.

2. HYDRAULIC FLUID MECHANICS AND FLUID MACHINES , By: S. Ramamrutham , Dhanpat Rai Publishing Company (P) Ltd, 1980, Dhanpat Rai Publishing Co. (P) Ltd, ISBN: 8187433841
3. ENGINEERING FLUID MECHANICS, By: Balachandran, P., PHI Learning Private Limited, Delhi. ISBN: 9788120340725
4. FLUID MECHANICS AND HYDRAULIC MACHINES, By: S.S. Rattan, Khanna Books Publishing Co (P) Ltd, New Delhi. ISBN: 9788187522461
5. Fluid Mechanics & Hydraulic Machines, By R.K.Rajput, 04 (2002), S.Chand & Company Limited, New Delhi, ISBN: 8121916666.

3PE04 THERMAL POWER ENGINEERING

Lecture: 03 Hrs/ w	Internal Assessments: 20
Tutorial: 01 Hr/ w	University Exam: 80
	Credits: 04

Course Objectives:

- To understand the fundamentals of various thermodynamic devices
- To analyze the performance and understand the applications of thermodynamic systems
- To understand applications and working of Boilers and Steam Engines, IC engines , Air compressors, Steam Turbine, Gas Turbine and Heat Transfer.

SECTION-A

UNIT- I : **Basic Concepts** - Thermodynamic systems, control volume, properties and state of a system. Point and path function, processes and cycles, difference between work and heat, Ideal gases and vapours, ideal gases, as laws, equation of state, gas constant. Universal gas constant.
(6)

UNIT- II : **Lows of thermodynamics :** Low of conservation of mass & energy, lows of thermodynamics, work done, change in internal energy & Heat transfer during non-flow Processes. Introduction to entropy.
(8)

UNIT-III: **Properties of steam :** Triple point, critical point, sensible heat, latent heat, superheat & total heat of steam. Sp. Volume, internal

energy, external work of evaporation , dryness fraction & its determination, entropy of steam.

Boilers: Classifications, Steam Generation, Mountings & accessories, Applications Babcock _ Wilcox & Lancashire Boiler. (8)

SECTION-B

UNIT- IV: Otto, Diesel Cycles : IC Engines , Classification - two stroke, four stroke petrol and diesel engines, Ignition system, cooling system, fuel injection system, Governing of IC Engines, calculation of Power developed and efficiency.

Air Compressors: Reciprocating and rotary compressors, working principles and applications, calculations of efficiency and work done for single stage reciprocatory compressors. (8)

UNIT- V : Carnot cycle, Rankine & Modified Rankine Cycle ,Steam Turbine , Flow of steam through nozzles, critical pressure ratio, maximum discharge, throat and exit areas; classification of steam turbines, velocity diagram, calculation of work done, power development, axial thrust & efficiency, Compounding and governing of steam turbines.

Gas Turbine: Introduction, Classification, such as open and close cycle turbines. Braylon Cycle, methods to improve efficiency.

(8)

UNIT-VI : Heat Transfer : Heat transmission by conduction, one dimensional heat conduction, convection heat transfer coefficient, resistance concept, electrical analogy, insulation, heat transfer convection, radioactive heat transfer , black and grey surface, dimensional analysis. (7)

TEXT BOOKS:

1. THERMAL ENGINEERING By: Mathur & Mehta, 03 (2010), M/s Jain Brothers, Karol Bagh, New Delhi - India, ISBN: 81-86321-86-1.
2. A TEXTBOOK OF ENGINEERING THERMODYNAMICS, , By: R. K. Rajput, 04 (2010), Laxmi Publications (P) Ltd.New Delhi, ISBN : 9788131800584
3. ENGINEERING THERMODYNAMICS: WORK AND HEAT TRANSFER, By: Gordon Rogers & Yon Mayhew , 4/e , Pearson Education, DELHI, INDIA, ISBN: 9788131702062.

REFERENCE BOOKS:

1. ENGINEERING THERMODYNAMICS, P. Chattopadhyay, 2010, Oxford University Press ,ISBN: 9780198060659.
2. HEAT AND THERMODYNAMICS (SIE), By: Mark Zemansky, Richard Dittman: 01 (2011), Tata McGraw-Hill Education, ISBN: 9780070700352.
3. BASIC & APPLIED THERMODYNAMICS, By: P. Nag (2009), Tata McGraw-Hill Education, New Delhi, ISBN: 9780070700352.
4. THERMODYNAMICS AND HEAT ENGINES (SI UNITS), By R. Yadav, Cental Publishing House, Allahabad. ISBN: 9788185444031.

3PE05 PRODUCTION TECHNOLOGY - I

Lecture: 04 Hrs/ w	Internal Assessments: 20
	University Exam: 80
	Credits: 04

Course Objective:

- To make the students understand the concepts & broad principles of contents of the course
- Sensitizes the students of the importance of course in real life environment
- To make the students understand the basic casting, foundry processes, recent trends and related operations used for manufacture of castings and technology with respect to manufacture, inspection and testing
- To familiarize with various welding processes and their applications

SECTION-A

UNIT- I : Introduction to pattern making: Pattern materials, pattern making, allowances, Types of patterns, General properties of molding sands, Mold hardness. Preparation of sand moulds of different types, Molding processes, core making.

Casting : Casting processes and their principle of operation and applications, Basic principle and Terminology of sand casting, Solidification of casting, Progressive and directional solidification gating system, types of gate , Risers design. (8)

UNIT- II: Melting & Pouring Of Metals: Melting furnaces pit, open hearth, gas fired cupola and electric hearth furnaces, cupola operation development in cupola melting

Electric Furnaces: Direct Arc, Indirect arc and electric induction furnace. Modernisation and Mechanisation of Foundries. (8)

UNIT- III: Special Casting Processes : Permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods.

Defects in castings: Origin and classification of defects, shaping faults, Inclusions and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors.

Inspection and Testing of Castings: Cleaning & finishing of castings, Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (9)

SECTION–B

UNIT- IV: Welding and Joining Processes: Requirements for welding, weldability. Classification of welding processes.

Arc Welding: Arc initiation, arc maintenance, and arc control, transfer of metal across the gap, Electrode efficiency, Types and purpose of Electrodes, I.S.F. for providing the shielding.

TIG & MIG Processes: TIG-Electrode polarity, loss and electrode contamination, shielding gases, MIG-Spray transfer and dip transfer processes

Gas Welding: Processes and equipment used, types of flame, gas welding technique adjustment of flame, oxy Acetylene welding, gas cutting - merits, limitations and applications. (9)

UNIT- V: Resistance Welding: Heat generation in resistance spot welding, operational characteristics of resistance welding processes such as projection welding, butt welding, percussion welding.

Friction Welding: Principle of operation of friction welding, forge welding, plasma arc, Thermit welding.

Brazing and Soldering: Braze welding and soldering processes types of flames, filler metals fluxes used merits, limitations and applications. Ultrasonic, Electroslag, Electron Beam, Laser welding. (9)

UNIT- VI: Welding Defects and Inspection: Welding defects, Testing and Inspection of welds.

Methods of Surface Improvements: Electroplating, electroforming, and iodising, metal spraying, Inhibitors, Cathodic and anodic protection, Coatings etc. Introduction to surface modification techniques such as Electro deposition, Diffusion coatings, Vapor deposition Thermal Spray Coatings, Ion implantation shot peening, polishing, mechanical cleaning. etc. (7)

TEXT BOOKS:

1. MANUFACTURING TECHNOLOGY : FOUNDRY, FORMING AND WELDING, By: P. N. Rao, 2008, Tata McGraw-Hill Education, ISBN: 9780070087989.
2. MANUFACTURING TECHNOLOGY, By: D. K. Singh , 2/e (2006) Pearson Education, DELHI, INDIA, ISBN: 9788131722275.
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY By: Dr. P C Sharma, 2 (2008), S.Chand & Company Limited, New Delhi, ISBN : 8121928214

REFERENCE BOOKS:

1. INTRODUCTION TO BASIC MANUFACTURING PROCESS & WORKSHOP TECHNOLOGY, By: Singh, Rajender, 2/e (2010), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788122430707.
2. WORKSHOP TECHNOLOGY (MANUFACTURING PROCESS), By: S. K. Garg, 3/e (2009), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131806975 .
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY (MANUFACTURING PROCESSES), By: R. K. Rajput, 1/e (2007), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131802441 .

3PE06 / 3ME06 STRENGTH OF MATERIALS-LAB. / MECHANICS OF MATERIAL-LAB.

Practical:02 Hrs/ w	Practical Term Work: 25
	Credit: 01

Practicals:

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.

5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PE07 FLUID POWER SYSTEMS – Lab.

Practical: 02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credit:	01

TERM WORK:

At least ten experiments based on above syllabus as given below:

1. Pressure measurements by manometers.
2. Coefficients of discharge for Venturimeter.
3. Verification of Bernouli's equation.
4. Forces of impact of jet.
5. To find Reynolds number of a flow and its critical velocity.
6. To find Cc, Cv and D Cd for flow through orifice.
7. To find coefficient of discharge of a given notch.
8. Frictional losses through pipe and fittings.
9. Trial on reciprocating pump.
10. Trial on Centrifugal pump.
11. Trial /Study of Gear pump.
12. Study on Vane pump.
13. Study of piston pump.
14. Trial/Study of Hydraulic Ram.
15. Study of Valves.
16. Study of various Hydraulic Circuits.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

REFERENCE BOOKS:

1. FLUID MECHANICS WITH LABORATORY MANUAL, By: Majumdar, Bireswar, P., PHI Learning Private Limited, Delhi. ISBN: 9788120340343.
2. EXPERIMENTS IN FLUID MECHANICS, By: SINGH, SARBJIT, P., PHI Learning Private Limited, Delhi. ISBN: 9788120337626.

3. FLUID MECHANICS AND HYDRAULIC MACHINES A LAB MANUAL, By T. S. Desmukh, 2009, Laxmi Publications(P) Ltd.New Delhi, ISBN : 9789380386072.

3PE08 THERMAL POWER ENGINEERING – LAB.

Practical:02 Hrs/ w	Practical Term Work:	25
	Credit:	01

TERMWORK:

At least ten experiments based on above syllabus as given below:

1. Study of Water Tube Boiler.
2. Study of Fire tube boiler *(any two types)*.
3. Study of steam turbine.
4. Study of two stroke and four stroke I.C. Engines.
5. Study of I.C. Engines Components.
6. Study and trial on a reciprocating air compressor.
7. Study of a rotary air compressor.
8. Determination of Dryness Fraction of steam.
9. Study of Thermodynamic cycles.
10. Study of Gas turbine.
11. Study of Heat conduction to composite wall.
12. Study of Stefan's Boltzmann Constant.
13. Study and Trial of a domestic refrigerator.
14. Study of Simple Steam power plant.
15. Study of parallel flow & counter flow heat convection.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PE09 PRODUCTION TECHNOLOGY – I – LAB.

Practical:02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credits:	01

PRACTICE:-

1. **FOUNDARY :-** Sand preparation and practice in moulding of various types of patterns. Moulding 2 jobs, pattern making 2 jobs.
2. **JOINING PROCESSES:-** 2 composite jobs involving electric welding, gas welding and gas cutting.

   A journal should be prepared and submitted on above term work. The practical examination shall consist of a job preparation and college

assessment should be based upon the jobs, termwork and viva examination.

REFERENCE BOOKS:

1. WORKSHOP PRACTICE, By: R. K. Rajput, 1/e (2011), Laxmi Publications(P) Ltd. New Delhi, ISBN: 9789380856650.
2. WORKSHOP PRACTICE, By H.S. Bawa, (2009), Tata McGraw-Hill Education, New Delhi, ISBN: 9780070671195.
3. Production Technology By: R.K.Jain.
4. Workshop Technology I & II By: Raghuwanshi.
5. Workshop Technology By: Hajra Chaudhary.

3PE10 PRODUCTION AND MACHINE DRAWING – LAB.

Theory: 01 Hrs/ w	Practical Term Work:	75
Practical: 02 Hrs/ w	Practical / Oral Exam:	25
	Credits:	03

Course Objective:

- Understanding, preparation and reading of 2D drawings of various machine parts and
- Assemblies used in industry and basics of computer aided drafting practices.
- Basics of computer aided drafting.

UNIT I: **Sectional Views:** Conversion of pictorial view into sectional orthographic projections, sectional views with different types of sections, missing views.

UNIT II: **Development of Surfaces:** Development of surface of Cubes, Prisms, Cylinders, Pyramids and Cones.

UNIT III: **Intersection of Surfaces:** Interpenetration of solids, prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism.

UNIT IV: **Preparation of Sketches:**

1. Latest ISI conventions covering the standard practice in Machine Drawing.

2. Conventions for various components like bearing, gears, springs, key and key ways, threads, tap holes and materials.

3. Symbolic representations for working drawing for welded joints.

4. Use of specifications for limits, fits and tolerances.

5. Conventions used for surface roughness i.e. machining symbols, M/c allowance symbols etc.

6. Rivets & Riveted joints.

7. Keys, Cotters and cotter joints, knuckle joints and couplings.

8. Bearing and bearing mountings.

9. Engine & machine tool components.

UNIT V: **Detail And Assembly Drawing :** Preparation of detail and assembly drawing of simple machine assemblies, like pedastal bearing, plummer block, simple eccentric, stuffing box, cross head, connecting rod, tail stock, tool post, C-clamp, screw jack, crane hook, etc.

UNIT VI: **Basics of Computer Aided Drafting :** Basics of computer aided drafting commands such as line, circle, rectangle, ellipse, arc, spline ,hatching ,etc. Editing commands, Basic Dimensioning, Creating 2-D simple machine parts and assembly.

TERM WORK:-

A. Drawing Sheets:

1. Sectional views of some objects.
2. Missing views.
3. Development of surfaces
4. Intersection of solids.
5. Preparation of production Drawings of assembly of different machine elements from details.
6. Preparation of production Drawings of details of different machine elements from assembly.

B. Sketch Book: Preparation of sketches mentioned in UNIT IV

C. Computer Print: At least four computer outputs using graphic packages for the engineering applications such as -

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) –
2. Creation of simple figures like polygon and general multi-line figures.
3. Drawing of a Title Block with necessary text and projection symbol.
4. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
5. 2D Profile of standard machine parts such as Keys, Cotters and cotter joints, knuckle joints and couplings, etc.
6. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc,

7. Drawing front view, top view and side view of objects from the given pictorial views
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc, and dimensioning.
9. 2D - Isometric drawing of simple m/c components.

PRACTICAL EXAMINATION:-

External viva voce will be conducted based on term work and above syllabus.

TEXT BOOK:-

1. **Production Drawing,** Narayana K. L., Kannaiah P., Venkatata Readdy K., , 2nd Edition, New age international Publishers, Delhi, 2008, ISBN 978-81-224-2288-7.
2. **Machine Drawing,** Ajeet Singh, DEC-07, TMH, NEW DELHI, ISBN: 9780070659926
3. **Machine Drawing,** Bhat N. D., Panchal , , Charotar Pub. House, ANAND
4. **Engineering Drawing,** Bhat N. D., Panchal , Charotar Pub. House, ANAND

REFERENCE BOOKS:

1. TEXT BOOK OF MACHINE DRAWING (With Computer Graphics) (First Angle Projection) Lakshminarayanan & Mathur 13th Ed., Rep. 2010 , M/s Jain Brothers, New Delhi, ISBN: 81-86321-33-0
2. ENGINEERING GRAPHICS (Including AutoCAD)(First Angle Projection) Lakshminarayanan & Vaishwanar 16th Ed., 2009, M/s Jain Brothers, New Delhi, ISBN: 81-86321-69-1
3. A Text book of Machine Drawing, Gill P. S. Revised Edition K. Kataria and Sons,New Delhi, 2008, ISBN 81-85749-79-5.
4. Machine Drawing by N. Sidheswar, Shastri, Kanaiah, TMH
5. Machine Drawing by R.K.Dhavan, G.R. Nagpal, S. Chand & Co.
6. Graphic Science & Design by French, Vierck & Foster McGraw Hill

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SEMESTER : FOURTH

4PE01/4ME01 BASIC ELECTRICAL DRIVES & CONTROL

Lecture: 03 Hrs/ w	Internal Assessments: 20
Tutorial: 01 Hr/w	University Exam: 80
	Credits: 04

Section-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors.

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor.

Section-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper.

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators.

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening & Dielectric heating.

Books Recommended

Text Books:-

1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :

1. Drives and Control - N. Dutta
2. Mechatronics - W.Bolton, Addison Wesley, Longman Ltd., 1997.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons, 2006

4PE02 MATERIAL TECHNOLOGY

Lecture:03 Hrs/ w	Internal Assessments:	20
	University Exam:	80
	Credits:	03

Course Objectives:

To make the students understand the concepts & broad principles of contents of the course

Aim is to provide insight of the subject , sensitizes the students of the importance of course in real life environment

SECTION - A

UNIT - I : **Introduction to metallurgy:** Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy. Classification of materials & their application Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation lever rule for phase mixtures.

Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification Introduction to processes for chemical analysis of metals: spectrometry, gravitometry. (07)

UNIT - II : Study of binary equilibrium diagram and invariant reactions Construction and study of Iron-carbon Equilibrium Diagram Critical temperatures Microstructure of slowly cooled steel Estimation of carbon from microstructure, structure property relation. Introduction to composite materials, advantage and applications. (07)

UNIT- III : **Alloy Steels**: Classification and application of plain carbon steel Effect of grain size and impurities on properties of plain carbon steel Purpose of alloying, classification of alloying elements and their effect on steels, effect on transformation in steel, Low alloy engineering steels and High speed steels, their heat treatments and applications. Ferritic, Austenitic and Martenstic stainless steels, their properties and applications, weld decay in stainless steel. (08)

SECTION-B

UNIT- IV : **Cast irons :** Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and usesof Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (07)

UNIT- V : **Principles of Heat Treatment**: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on ‘s’ Curve. Characteristics of pearlite, bainite and martenstics transformation during continuous cooling. Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability, Methods of surface hardening: Carborizing, Nitriding, Cyaniding, Flame and Induction Hardening. (08)

UNIT- VI : **Mechanical working of Metals**: - Hot and cold working, Relative advantages and dis-advantages, study of stressstrain curve, luders bands Work hardening, strain Ageing; Recovery, Recrystallisation and grain growth. Metallurgical factors affecting various working processes, preferred orientation, Deformation mechanisms-Slip, twining, critical resolved shear stress.

Powder Metallurgy: Manufacture of metal powders, Atomization, Milling, Reduction, Electrolysis, carbonyl. Process; Single die and double die compaction, sintering, stages of sintering. Manufacture of porous bearings a n d cemented carbide tip tools by P.M.techniques. Advantages, limitations and applications of powder metallurgy. (08)

TEXT BOOKS:

1. V.D. Kodgire: Material Science and Metallurgy for Engineers. Everest Publishing House, Pune.
2. Smith W.F.: Principles of Material Science and Engineering: McGraw Hill Book Co.

REFERENCE BOOKS:

1. Davis H. E., Troxell G.E. and Wiskocil C. T.: Testing of Engineering Materials. Mc Graw Hill Book Co.
2. Van Vlack L.H.: Elements of Material Science. Addison- Wesley Publishing Co.
3. Baldev Raj, T. Jayakumar and M. Thavsimuthu: Practical Non-Destructive Testing. Narosa Pub. House. Delhi.
4. Hull and T. W. Clyne: An introduction to Composite Materials: 2/e, Cambridge Solid State Science Series.
5. Structure and properties of materials II, Willey Eastern (P) Ltd.
6. Structure and properties engineering materials, by Murthy -Tata McGraw Hill 2003.
7. Donald R. Askland, P.P. Phule-Science and engineering of materials, Thomson Learning (2003)

4PE03 THEORY OF MACHINES

Lecture:04 Hrs/ w	Internal Assessments: 20
Tutorial:01 Hrs/ w	University Exam: 80
	Credits: 05

Course Objectives:

- To develop the ability to understand the concepts of mechanisms and the kinematic analysis of mechanisms.
- To make the students conversant with basic concepts and theory regarding friction, lubrication, belt, rope, chain
- drives, Gears and Gear Trains and vibrations.

SECTION-A

UNIT- I : **Mechanisms :** Introduction to study of mechanism & machines, Basic definitions, Kinematic pair and chains; Inversions of Four bar, slider crank and double slider mechanism. Common Mechanism : Straight line mechanism; Quick return Toggle mechanism; Steering mechanisms. Binary joints in chain, Kutzbatch's criterion, Grubler's criterion. (8)

UNIT- II : **Velocity and Acceleration Analysis:** Relative velocity and acceleration method; Instantaneous centre method; Analytical method for determination of velocity and acceperation in slider crank mechanism. Klein's costruction.

Cams: Types of Cams and followers ; Field of applilcation; Graphical layout of radial cams. (8)

UNIT- III : **Gears and Gear Trains :** Terminalogy for all types of gears; law of involute gearing; Interference and methods to reduce it, Gear trains, Velocity ratio.

Friction and Lubrication : Friction in pivot and collars Types of friction, laws of friction, limiting angle of friction, inclined plane theory, efficiency of inclined plane. (9)

SECTION-B

UNIT- IV : **Belt Drives:** Types of Belts, angular velocity ratio, effect of belt thickness, effect of slip, length of belt, angle of contact, angle of lap, law of belting, crowning of pulley, limiting tension ratio, power transmission, centrifugal tension in the belt and its effect on power transmission, initial tension and its effect on power transmission. Creep of belt (Numerical treatment expected)

Brakes: Types of brakes, Force analysis of brakes, external and internal expanding shoe brakes block brakes, band brakes, block and band brakes, Breaking torque. (Numerical treatment expected)

Dynamometer: Different types of Absorption and transmission dynamometers. (9)

UNIT- V : **Dynamic Force Analysis** :- Inertia forces; D'Alemberts principle; Dynamic force analysis of slider crank mechanism; Shaking forces, TQ diagram; Flywheel reqirement.

Governors: Types of governors, centrifugal, watt, porter, Proell, Hartnell governors, sensitivity of governor, effort of a governor, controlling force.

Flywheel: turning moment of flywheel, coefficient of fluctuation of energy , energy stored in flywheel, flywheel in punching press. (9)

UNIT- VI : **Vibration Analysis:** Introduction to longitudinal, Transverse and torsional vibrations; free and forced vibrations with and without damping; critical speed.

Balancing: Static and dynamic unbalance; Balancing of several rotating masses in single and multi transverse planes. (7)

TEXT BOOKS:

1. A TEXTBOOK OF THEORY OF MACHINES (IN S.I. UNITS), By: Dr. J. S. Brar ,Dr. R. K. Bansal, 5/e (2011), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131808054
2. THEORY OF MACHINES AND MECHANISMS, By: John J. Uicker, Gordon R. Pennock, The late Joseph E. Shigley ,3/e (2009), Oxford University Press, DELHI, INDIA, ISBN: 9780198062325.
3. THEORY OF MACHINES, By: S Rattan, Edition: (2009), Tata McGraw-Hill Education, ISBN: 9780070144774.

REFERENCE BOOKS:

1. THEORY OF MECHANISMS AND MACHINES, By: Purohit, Kamlesh, Sharma, C. S., PHI Learning Private Limited, Delhi. 9788120329010.
2 A Textbook of Theory of Machine, By R.S.Khurmi, 14/e, S.Chand & Company Limited, New Delhi, ISBN: 812192524X.
3 KINEMATICS & DYNAMICS OF MACHINERY, By: Robert Norton, Edition: (2009), Tata McGraw-Hill Education, ISBN: 9780070144804.

4PE04 PRODUCTION TECHNOLOGY - II

Lecture: 04 Hrs/ w

Internal Assessments: 20
University Exam: 80
Credits: 04

Course Objectives:

- To study the various conventional and basic Machine Tools and manufacturing processes carried out on these machines for different applications.
- To study the various advanced Machine Tools, as well as Non-Conventional Machine Tools and manufacturing processes carried out on these machines for different applications.

SECTION-A

UNIT- I : Introduction to theory of Metal cutting, Tool material, Tool Geometry, Machinability, Cutting fluid, Machine Tool classification.

Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanisum, bar feeding mechanism, introduction to Automatic screw machines & Single spindle and multi-spindle automat. (8)

UNIT- II : Drilling Machine: general purpose, Mass production and special purpose drilling M/cs.

Boring Machine: Horizontal, Vertical and jig Boring M/c.

Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.

Processing of plastics by compression, Transfer, Injection, Extrusion. Blow-moulding, Rotational moulding and calendering. (9)

UNIT- III : Milling Machines: Types, Types of Milling Cutters, Dividing head, Compound and differential indexing.

Gear producing Machines.

Study of various part & Operation of Shaper, Planer, slitter and power hack saw. (8)

SECTION-B

UNIT- IV : Unconventional Machining Processes:-

Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters ; Abrasive and water abrasive jet machining :- Mechanism of metal removal parameters involved.

Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

Electro Chemical Machining- Classification, fundamentals: Electro mechanical milling.

Electric discharge Machining - Types dis-sie-onking, wire EDM, Mechanism of material removal, process parameters, advantages and applications. (9)

UNIT- V : Surface finishing processes and coating: Super finishing processes, honing, lapping, buffing, polishing, tumbling, electroplating, galvanizing, metal spraying, and burnishing. Hot dipping, Study of process parameters of above processes.

Automats: Major classification, horizontal and vertical, single spindle and multi-spindle, bar type and chuck type, screw type and Swiss type, tool and tool holders, typical tooling set-up for simple work pieces, special attachments, threading attachments, high speed drilling attachments, chutes, magazines, and hoppers for feeding (9)

UNIT- VI : Micromachining: Fundamentals of micro fabrication. Tool material interaction during micromachining Mechanical Micromachining; Micro-drilling, micro-milling, micro-turning processes. Thermal Micromachining processes; micro-EDM, micro wire EDM, micro-ECM, LASER based micromachining, LIGA. Micro-electro-mechanical Systems (MEMS). Measurement techniques in micro engineering. (7)

TEXT BOOKS:

1. MANUFACTURING TECHNOLOGY : METAL CUTTING & MACHINE TOOLS By: P N Rao, (2008), Tata McGraw-Hill Education, ISBN: 9780070087699.
2. A TEXTBOOK OF MANUFACTURING TECHNOLOGY (MANUFACTURING PROCESSES) , R. K. Rajput , 1/e (2007), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131802441.
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY By: Dr. P C Sharma, 2 (2008), S.Chand & Company Limited, New Delhi, ISBN : 8121928214

REFERENCE BOOKS:

1. MANUFACTURING ENGINEERING HANDBOOK, By: Hwaiyu Geng, Edition: (2004), Tata McGraw-Hill Education, ISBN: 9780071398251.
2. MICROMANUFACTURING AND NANOTECHNOLOGY, By: Mahalik, N.P. , 1/e, (2007), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788181285058
3. PRODUCTION TECHNOLOGY, By :Hindustan Machine Tools, (2004), Tata McGraw-Hill Education, ISBN: 9780070964433.
4. MODERN MACHINING PROCESSES, By : P Pandey, H Shan, (1980), Tata McGraw-Hill Education, ISBN: 9780070965539.
5. Fundamentals of Metal Cutting and Machine Tools, By: Juneja, B.L. , 2/e, (2010), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788122414677

4PE05 MEASUREMENT SYSTEMS

Lecture: 04 Hrs/ w	Internal Assessments:	20
	University Exam:	80
	Credits:	04

Course Objectives:

- Know fundamentals of mechanical measurement systems, Applications of measurement systems as per Industrial requirements.
- Suggest suitable sensor for given applications, Procure and install the sensor

SECTION - A

UNIT- I : **Generalised measurement system:** significance of measurement, generalised systems, application of measuring instruments, types of measuring instruments.

General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interfering and modifying inputs. (7)

UNIT- II : **General performance characteristics:** Static characteristics, different types of errors, combination of component errors in overall systems.

Dynamic characteristics: general mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. (9)

UNIT- III : **Strain measurement:-** types of strain gauges, strain gauge circuits, calibration, temperature compensation, use of strain gauges on rotating shafts, selection and installaiton of strain gauges.

Pressure measurements:- basic methods of pressure measurement, manometers, transducers-elastic, gravitational, elastic : draph, strain gauge pressure cell, high pressure measurement Bridgeman type, low pressure measurement - Mcleod, Krudsen, ionisation, thermal conductivity gauges. (9)

SECTION - B

UNIT- IV : **Force measurement:** various mechanical, hydraulic, pneumatic and electrical methods.

Torque and power measurements: various mechanical, hydraulic & electric methods.

Flow measurements: construction- Venturi, Orifice, Dall tube, rotameter, pressure probes- Pitot static tube, yaw tube

anemometer, positive displacement flow meters, turbine meter, electro-magnetic flow meter. (9)

UNIT- V: **Temperature measurements:-** standards, various temperature measuring devices, bimetallic strip, liquid in glass thermometer, pressure thermometers, thermo couples, electrical resistance thermometers, thermistors, radiation thermometors.

Liquid level measurements: various methods such assingle flot, displacement or force transducers, pressure sensitivity, bubbler or page system, capacitance variation type (for both conducting and non conducting type liquids) resistance variation type, radioisotope. (8)

UNIT- VI: **Speed measurements:** various mechanical type techometers, electrical types tachometers, stroboscope etc.

Vibration measurements: seismic, strain gauge and peizoelectic accelerometers.

Displacement measurements: linear and angular displacement measurements, LVDT, LDR, capacitive & inductive pick ups.(8)

Text Books :

1. Rangan , Sharma,'Instrumentation Devices and Systems', Mani-Tata McGrawhill- Second Edition.
2. Nakra,Chaudhary,' Instrumentation Measurement and Analysis', Tata McGrawhill-21st Reprint.
3. Principles of Industrial Instrumentation- D. Patranabis-Tata McGrawhill-7th Reprint,1986
4. Electrical and Electronic Measurements and Instrumentation- A. K. Sawhney- Dhanpat Rai and Sons , Delhi-2002print
5. Mechanical and Industrial Measurement- R.K.Jain- Khanna Publications-9th print

Reference Books :

1. Andrew, Williams,' Applied Instrumentation in Process Industries (Vol. I)'-Gulf Publications Company- Second Edition
2. B. G. Liptak- Butterworth Heinemann, 'Process Measurement and Analysis' Third Edition
3. Jone's Instrument Technology (Vol. 1 and Vol. 2)- B. E. Noltingk EL / BS- Fourth Edition
4. E. O. Doebelin, 'Measurement System Application and Design- McGrawhill International- Fourth Edition.

4PE06 / 4ME06 BASIC ELECTRICAL DRIVES & CONTROL-LAB.

Practical:02 Hrs/ w — Practical Term Work: 25
Credit: 01

List of Experiments

Any eight practicals from the following list:

1. To study the Specification of Various Electrical Machines. 2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

4PE07 MATERIAL TECHNOLOGY – LAB.

Practical:02 Hrs/ w — Practical Term Work: 25
Credit: 01

Course Objectives:

- To develop skills in the subject and Verify the principles of the course
- Application of the theory and Understanding of fundamentals of the subject

TERMWORK:

Practical Minimum 10 out of following:

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalised plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of Brasses.
8. Study of micro structures of Bronzes.
9. Study of micro structures of White metal bearing alloys and alloys.

10. Study of micro structures of hardened and tempered steels.
11. To study F.e.(Equilibrium diagram & Allotropie forms of fe)
12. To study different Heat Treatment Process for steel.
13. To study different surface Haldening processes for steels.
14. To study effect of alloying elements on the properties of steels.
15. To measure variation in hardness by hardness tester (Jominy end quench test apparatus)
16. Study of hardness tester and conversion of Hardness number
17. Industrial visit to study heat treatment plant.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

Text Books:

1. Electrical machinery and transformer by Irvin Kosow, Prentice Hall
2. Thomas L Floyd Electronics Devices, 5th Edition Pearson, India, 1999.

Reference Books:

1. Electronic Devices & Circuit Theory : Boylestad & Nashelsky,PHI Publishing
2. Electric Machines and Transformers :Anderson Leonard D. &Jack McNeil
3. OP- Amplifier : Gayakwad,Pearson Publications Edition,2009
4. Microprocessor :Gaonkar,Fifth Edition,Penram International Publishing
5. Digital Principle and Applications: Malvino & Leach,Fifth Edition,Medium Publishing
6. Computer Based Industrial Control By Krishna Kant PHI-Mechatronics – by Bolten.
7. Allen Mottershed, Electronics Devices and circuits, Twentieth Indian edition, New Delhi ,1998.
8. Digital Principles and Application By Albert Paul Malvino, Donald P Leach
9. Electrical machinery S.K. Bhattacharya, T.T.T.I. Chandigarh
10. Electrical machines & Power system vol 1. Syed A. Asar , McGraw hill
11. Fractional and sub fractional horse power electrical motors. C.E. Veinou and J.E. Martits , McGraw hill
12. Electrical engineering handbook Siemens, Wiley eastern
13. Process Instrumentation Hand Book. By Cinsidine MGH

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course

4PE08 THEORY OF MACHINES – Lab.

Practical: 02 Hrs/ w

Practical Term Work: 25
Practical / Oral Exam: 25
Credit: 01

Objectives:

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course.

TERMWORK:

Practical Minimum 10 out of following:

1. Study of inversions of four bar mechanism.
2. Study of inversions of slider crank mechanism.
3. Study of inversions of double slider mechanism.
4. Velocity analysis of mechanisms.
5. Graphical layout of radial cam.
6. Acceleration analysis of mechanisms.
7. Determination of velocity ratio in gear trains.
8. Graphical layout of involutes Gear profile.
9. Study of various brakes..
10. Study of various clutches.
11. Static and dynamic balancing of rotating masses.
12. Determination of inertia force of connecting rod by graphical method.
13. Study of different types of gearboxes.
14. An experiment for finding radius of gyration of a flywheel by triflers' suspension method.
15. An experiment for finding radius of gyration of a flat bar using theory of compound pendulum.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

4PE09 PRODUCTION TECHNOLOGY - II – Lab.

Practical:02 Hrs/ w

Practical Term Work: 25
Practical / Oral Exam: 25
Credit: 01

Objectives:

- To give students 'hands on experience' of craftsmanship ,machining, maintenance and assembly.

- To make students familiar with different Work Trades.
- To develop quality & safety consciousness amongst the students.
- To develop respect towards labour work amongst the student.

Comments : Students should wear safety apron and safety shoes during the practical.

PRACTICALS:-

Introduction of machining operations related to Lathe, Shaper, Slotter, Drilling & Grinding Machine.

Machine shop practice:

1. One job on lathe covering taper turning and threading.
2. One job on shaping covering plane and inclined surfaces.
3. One job on milling machine.

   The above jobs should include drilling, grinding, tapping etc.

Demonstrations:

1. Demonstration of plastic moulding machine.
2. Machine part assembly: Demonstration and exercise on assembly of machine parts in a group of students.
3. Machine maintenance: Introduction of Preventive and breakdown maintenance, demonstration and exercise on inspection of a machine, minor repairs and lubrication.

Term work should be submitted in the form of journal including

1. Study of single point tool geometry
2. Study of important accessories of machine tools.
3. Study of cutting fluids

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by external and internal examiner.

4PE10 MEASUREMENT SYSTEMS – Lab.

Practical: 02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credit:	01

TERMWORK:

Practical Minimum 08 out of following:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-up transducers.
4. Performance of capacitance transducer as a angular displacement measuring device.

5. Performance of inductive transducers.
6. Flow measurement.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement.
11. Liquid level measurement.
12. Temperature measurement.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS
PRESCRIBED FOR
FIVE YEAR DEGREE COURSE IN
BACHELOR OF ARCHITECTURE
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER: THIRD

03AR01 APPLIED MATERIALS

Objective : To expose the students to the various types of building finishing materials.

Unit I : Different types of furnishing and finishing materials for Interior and Exterior surfaces. Special finishes like aluminum based materials , anti-corrosive and water bound paints .

Unit II: Paving and Cladding materials-natural and artificial , its types.

Unit III: Polymers and polymer based materials for walls , pipes, sanitary ware, glues and mastic. Polycarbonate and acrylic materials , its properties.

Unit IV: Manufactured timber based materials for interior such as plywood's, veneers , mica, laminates,etc. Types of materials useful for false ceiling , its properties.

Unit V: Material useful for different types of partitions. Alluminium, plastic, glass and different alloy and its application in the building industry.

Unit VI : Acoustical materials , metals used for steel cables, structural glazing and curtain walling. Sessional work: Test, assignment and Material survey report.

References :

1. S.C. Rangwala, Engineering Materials, Charotar publishing House, Anand, 1997.
2. R.K.Rajput , Engineering Materials.
3. Don. A. Watson, Construction Materials and processes, Mc Graw Hill Co. 1972.

03AR02 BUILDING MATERIALS & CONSTRUCTION- III

Objective : The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization .

Unit I : An introduction to timber floors and its specific application to various activities. Detail study of single joist, double joist and triple joist timber floors.

Unit II : Application of false ceiling materials such as asbestos sheets, soft boards, acoustic boards, plaster of paris etc; on timber, steel or aluminium framework.

Unit III : Cement and its varieties, composition, properties and uses; brief study on manufacture of Portland cement; test for cement; mortars for various work.

Unit IV : Concrete, its ingredients, manufacture & properties, ingredients suitability requirements for aggregates, grading of aggregates, role of water, reinforcement, admixtures in concrete, properties of concrete. Manufacturing of concrete and concreting , grades of concrete, mixing of proportions, placing, compactions, transporting, curing, testing of concrete, joints in concrete and concrete finishes.

Unit V : Introduction and purpose of foundation. Brief introduction to types of shallow and deep foundation. Detail study of masonary foundation & R.C.C. footing foundations and its types.

Unit VI : Formwork and its importance to R.C.C. building elements such as column footing, columns, beams, arches, slabs. Comparative analysis of timber & steel formwork.

Sessional work: Assignments, test,site visit and drawing on the above topics.

References:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997
2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

03AR03 HISTORY OF ARCHITECTURE – II

Objective : History of Architecture exposes the student to evolution of different architectural solutions through historical periods to understand the building materials, construction techniques, planning and designing features.

Unit I : Egyptian and Mesopotamian Architecture and its impact on social, economical and geographical conditions.

Unit II : Introduction to the western civilization and study of Greek civilization and its impact on Architectural development.

Unit III : Introduction to the Roman Architectural development and study of public buildings and spaces.

Unit VI : Brief study of Romansque, Gothic, Byzantine and renaissance architecture.

Unit V : Introduction to Islamic architecture. Evolution of building types in terms of forms and functions.

Unit VI : The architectural development of the mosque, the tomb, minaret, the madarasa etc; method of construction and building elements.

Sessional work; Assignments and drawing on the above topics.

References:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.
2. Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983
3. Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981
4. Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

03AR04 APPLIED CLIMATOLOGY- I

Objective: The prime objective of this course is to understand global environmental factors and climatic zones to be utilized for designing the spaces.

Unit I: Introduction to solar system and Earth – Sun relationship and its impact on earth surfaces.

Unit II: Thermal balance of Earth, global trade wind pattern, coriolisis effect and tropical zones on earth surfaces.

Unit III: Human comfort through body metabolism, heat gain and heat loss, thermal balance of body, clothing pattern its effect on body.

Unit IV: Climatic factors that influence climatic elements; study of climatic factors such as Altitude, longitude, latitude, seasons,

water bodies, vegetation, rainfall, topography, urbanscape, sky conditions, global trade wind pattern, soil conditions etc; its impact on basic climatic elements.

Unit V: Climatic elements and data collection equipments. Air temperature, inversion of temperature, thermal diffusivity, thermal conductivity, effective temperature. humidity its types, solar radiation and its effects on building surfaces, wind – study of diurnal and seasonal variations, wind eddies, stack effect, Precipitation- rain, water vapour, fog and snow. Measurement and graphical presentation of climatic data. Use of bioclimatic and psychometrics chart.

Unit VI: Tropical climates and its types with characteristics.

Sessional work; Assignments and test on the above topics.

References:

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London-1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982
4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment; UNSW –press-2007.

03AR05 ARCHITECTURAL STRUCTURE-II

Objective: To understand loading, structural elements and to analyse them.

Unit I: Strain energy in tension, compression and shear; tention member under impact load.

Unit II: Theory of simple bending in beams. Distribution of shearing and bending stress on horizontal section.

Unit III: Column and struts, Euler's theory of long column, Rankin theory.

Unit IV: Foundation design soil aspects.

a) Importance of the subject. b) Types of soil and their properties. c) Method of compaction and consolidation. d) Void ratio porosity, bulk density, moisture content, degree of saturation, liquid limit, plastic limit. e)Test for assessing load

bearing capacity of soil. f) soil properties and characteristics relevant to the design of foundation. g) criteria for selection of foundation type for different soil condition. e) effect of water level, settlement of soil.

Unit V: Direct and bending stresses, eccentric loading on short column, middle third rule, chimneys.

Sessional work; Assignments and tutorials on the above topics.

References :

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.
2. S.Ramanmurtham, Strength of Materials – Dhanpatrai & Sons, Delhi 1990
3. W.A.Nash, Strength of Materials – Schaums Series – McGraw Hill Book Company, 1989
4. R.K.Bansal – engineering Mechanics and Strength of Materials – Lakshmi Publications, Delhi, 1990

03AR06 ARCHITECTURAL DESIGN STUDIO – III

Objective: The prime objective of this course is to introduce architectural design as a process and as a final product; to understand fundamentals of space, form and order through basic perception of architectural skills.

Basic contents:

1) Introduction to the design assignment, their aims and objectives, scope, special emphasis and limitation. Application of planning and design standards for the proposed design project.
2) Planning and design data collection, area analysis, study and evolution of plan forms for each activity, grouping of activities, case study analysis and its presentations.
3) Major design project shall include house design, clinic, elementary school, restaurant with respect to planning & design aspect.

Sessional work: One major design project and one time project with other task and assignments.

Suggested text books:

1. Ching, F.D.R. : Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals

Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.

4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., "Form defining strategis: experimental architectural design". Wasmuth, 2007.

03AR07 BUILDING MATERIALS & CONSTRUCTION STUDIO - III

Sessional work :

Assignments and drawing on the above topics given in the subject 03AR02 Building Materials & construction – III. Viva Voce by external examiner at the end of Semester.

03AR08 COMPUTER GRAPHICS STUDIO- I

Sessional work :

Assignments and 2D projects on the above topics given in the subject 01AR04 computer graphics- I in the soft and hard copies. Viva Voce by external examiner at the end of Semester.

03AR09 SURVEYING AND LEVELLING-LAB

Objective: To impart knowledge about the basic principles of geomatics engineering for mapping and other applications.

Unit I: Importance of geomatics engineering techniques to architecture, field surveying, photogrammetry, remote sensing, geographic information system and global positioning system.

Unit II: Types of maps, scales and uses, map sheet numbering, map projection, definition of surveying, principles, importance, classification, surveying equipment namely levels, compass, theodolites, tachometer, EDM, total stations and other instruments.

Unit III: Measurement of distance, angles, and directions; determination of elevation through spirit leveling, trigonometrically leveling, tachometric surveying and contouring.

Unit IV: Method of control establishment namely traversing, triangulation, plane table surveying and mapping. Introduction to GPS survey.

Sessional work :

Assignments, test and tutorials on the above topics.

Practicals:

a) Chain and compass surveying. b) Levelling c) Plain table surveying and preparation of map. d) Determination of height of a building.

Suggested books:

1) Schofield W., Engineering surveying., Butterworth-Heinemam.,2007.
2) Chandra. A.M., Surveying., New Age publisher-2000.

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SEMESTER: FOURTH

04AR01 ARCHITECTURAL DESIGN – IV

Objective: To expose the students to the designing of multifunctional community buildings with emphasis on building bye laws, impact of culture, traditions, material and techniques.

Basic contents:

1) Introduction to the designing of multifunctional community buildings on an intermediate scale.
2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.
3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.
4) Major design project may include design of library, club, gymnasium, low rise apartment, low cost housing element, office cum shop, etc.

Sessional work:

One major design project and one time project with other task and assignments.

Suggested text books:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals
   Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.
4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.

5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., “Form defining strategis: experimental architectural design”. Wasmuth, 2007.

04AR02 BUILDING MATERIALS & CONSTRUCTION- III

Objective: The course will enable the learning in progression, starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

Unit I: Ferrous metals, brief study of cast iron, wrought iron, pig iron and steel; its manufacturing process and properties. Anticorrosive measures for steel, market form of steel for building construction.

Unit II: Non ferrous metals and its various uses in building construction. Steel and aluminium sections for door design (sliding, revolving, openable, collapsible gates, rolling shutters) with fixtures and fittings.

Unit III: Metal casements useful for windows and ventilators.Types of metal casements windows with fixtures, fitting and method of fixing.

Unit IV: Metal casements useful for partitions , fixtures, fitting and method of fixing.

Unit V: Composition of Glass, brief study on manufacture, treatment, properties and uses of glass; special types of glass, sheet glass, safety glass, tinte coated glass, glass blocks, properties and application in the building industry and current developments.

Unit VI: Plastics: Thermoplastic and thermosets properties and architectural uses of plastics, structural plastics, reinforced plastics and decorative laminates, plastic coatings, adhesives and sealants. Primary plastic products for walls, roof, and partitions. Secondary building products for rooms, windows, rooflight,domes,gutters, handrails,etc;

NOTE: Sessionals will be in the form of reports, drawings, and models. Construction site visits are essential for practical exposure.

Sessional work;Assignments and drawing on the above topics.Viva Voce by external examiner at the end of Semester.

References:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997

2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

04AR03 HISTOTY OF ARCHITECTURE-III

Objective : History of Architecture exposes the student to evolution of different architectural solutions through historical periods to understand the building materials, construction techniques, planning and designing features.

UNIT-I : Delhi OR Imperial Style. Development of Architectural Style during the Rule of the slave, Khalji, Tuglag, Sayyid & Lodhi Dynastles- important examples for each period.

UNIT-II : Provincial Style: Development of the Provincial Style of different regions- Punjab, Jaipur, Bengal, Gujrat, Malwa, The deccan (bijapur, Golconda, bidar and Gulbarga) – Important Examples for each style with building construction techniques and design elements.

UNIT-III : Mughal Style : Development of the Mughal Style under the different rulers – Humayun, Akbar, Jahangir & Shahjahan- Important Examples for each style with building construction techniques and design elements.

UNIT-IV : Industrial Revolution and it's effect on modern contemporary Architecture. Study of various school of thoughts in Architecture.

UNIT-V : Western Poineer Architects, their philosophy and work : namely Le-Carbourier, Walter Gropuies, F. L. Wright, I.M.Pei, etc.

UNIT-VI : Indian Contemporary Architects and their work, namely- Chales Corea, B.V. Doshi, Raj Rewal, Anant Raje, U.C. Jain, etc.

Sessional work : Assignments and drawing on the above topics.

References:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.
2. Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983
3. Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981
3. Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

04AR04 APPLIED CLIMATOLOGY- II

Objective: The course aims to understand the various features to be considered for planning and designing of climate responsive built and un-built spaces.

UNIT-I : Introduction of planning, designing, materials and techniques considered in traditional structures with respect to climate to achieve comfortable living conditions.

UNIT-II : Impact of Micro and Macro climatic conditions on built and un-built spaces.

UNIT-III : Thermal properties of traditional and modern building materials and its comparative analysis. Appropriate planning and construction techniques to achieve comfort level in indoor and outdoor spaces.

UNIT-IV: Solar chart and its use, shadow angles, use of shadow angle protractor; types and design of shading devices. Heliodon & its use.

UNIT-V: Day light factor; effect of size and shape of opening for day light, orientation of Fenestration. Ventilation systems.

UNIT-VI: Planning and design of building by considering Passive Cooling and heating; Shadow effects, Orientation, Fenestrations, day light, micro climatic features, wind directions, sunpath diagrams, cavity walls, cross ventilations, stack effect, reverse stack effect etc. to achieve climate responsive design solutions.

Sessional work : Assignments and test on the above topics.

References:

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London-1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982
4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment; UNSW –press-2007.

04AR05 ARCHITECTURAL STRUCTURE-II

Objective: Understanding of Basic Theory and principles of structural analysis and structural properties of elements.

UNIT-I : Fixed beams with concentrated load and uniformly distributed load (over complete span.)

UNIT-II: Continuous beams (without settlement) with uniform sections by three moments. Only vertical load and uniformly distributed load over whole span by theorem of three moments.

UNIT-III: Moment distribution method for symmetrical portal frames with symmetrical load. Only point load and uniformly distributed load over whole span.

UNIT-IV: Understanding and identification of location of forces, bending moment and bending stress in fixed beam, over hanging beams, continuous beams, Portal frames etc.

UNIT-V:
a) Design procedures for simple load bearing foundations.
b) Failure of foundations systems.
c) Improvement of soil properties.

Sessional work :
Assignments and tutorials on the above topics.

Reference :

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.
2. S.Ramanmurtham, Strength of Materials – Dhanpatrai & Sons, Delhi 1990
3. W.A.Nash, Strength of Materials – Schaums Series – McGraw Hill Book Company, 1989
4. R.K.Bansal – engineering Mechanics and Strength of Materials – Lakshmi Publications, Delhi, 1990.

04AR06 ARCHITECTURAL DESIGN STUDIO – IV

Sessional work :

Assignments and drawing on the above topics given in the subject 04AR01 ARCHITECTURAL DESIGN – IV. Viva Voce by external examiner at the end of Semester.

04AR07 BUILDING MATERIALS & CONSTRUCTION STUDIO - IV

Sessional work :

Assignments and drawing on the above topics given in the subject 04AR02 Building Materials & construction – IV. Viva Voce by external examiner at the end of Semester.

04AR08 COMPUTER GRAPHICS STUDIO- II

UNIT-I: Productivity tools : Introduction to tools of productivity – blocks, slide facilities, scriptfiles, attributes Understanding concepts of V.port, concept of object linking, and editing session.

UNIT-II: Introduction to 3D Drafting : Introduction to 3D modeling technique and construction planes, drawing object, 3D surfaces setting up elevation and thickness, and use of dynamic projections. Solid modeling, with driving primitive command and Boolean operation. Use of region modeling solid modife.

UNIT-III: 3D Rendering and setting : Rendering and scene setting to create a photo realistic picture understanding material mapping, environment setting and image filing. Construction of any object or building using above said utilities.

Sessional Work : It includes assignments incorporating the use of CAD in form of drawings. Conversion of 2D drawing of previous semester to 3D using softwares like, Autocad, Sketchup, revit, 3D Max. etc. and presentations through photoshop, Power Point etc.

Viva Voce by external examiner at the end of Semester.

04AR09 WORKING DRAWING-I

Objective : The students shall impart the knowledge of construction details for the execution of building from foundation to roof level.

Contains : Working drawing of load bearing masonary structure for design project done during third semester. The drawing should be in an appropriate scales.

The working drawing should include from foundation level to roof level as follows :

a) Muncipal drawing and detail of all level plans.
b) Detail section showing toilets, Staircase and levels of floors.
c) Working detail of toilet, staircase.

d) Working details of any interesting features in the plan, sections & elevation.
e) Site plan showing drainage layout, landscape layout, internal roads etc.
f) Working details of water supply & electrical layout plan's.

Sessional Work : Assignments and drawing plates on the above topics. Viva Voce by external examiner at the end of Semester.

Suggested text books:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.
4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., "Form defining strategis: experimental architectural design". Wasmuth, 2007.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN BACHELOR OF TEXTILE ENGINEERING SEMESTER PATTERN (CREDIT GRADE SYSTEM) SEMESTER : THIRD

3 TX 01 YARN MANUFACTURING -I

SECTION A

Unit I : **COTTON HARVESTING & GINNING**

Cotton Harvesting: Methods of cotton harvesting, Hand Picking, Machine Picking, Advantages & disadvantages of Hand Picking, Machine Picking. Precautions to be taken while Picking & Storing etc. Trash: its classification, occurrences, Adversity in process and its effect.

Ginning: Objectives of Ginning, Methods of Ginning, Introduction to Roller Gin, Knife roller Gin. Machine and Process parameters in ginning, Pressing and Bailing Process, Developments in Ginning machines.

Unit II: **BLOWROOM:** Brief out line of spinning departments and their objects, Objects of mixing, conventional and modern methods of mixing, Principle & working of mixing machine.

History and developments of blow room lines, Study of different blending methods and their advantages and disadvantages, problems in blending of manmade fibres with cotton, objects of blow room line, various types of modern openers and beaters with their construction and working , comparison of beaters and openers.

Unit III : Lap forming mechanism, Lap measurement mechanism , piano feed regulating motion, calendar roller pressure system, lap rack pressure system and mechanism of auto feeding ,condensers and cages used in blow room line, Material transportation system used in blow room line, Nature of waste extracted in various openers' and beaters ,lap rejection causes remedies , CV% of lap and its importance.

SECTION B

Unit IV : Calculation pertaining to production, cleaning efficiency and blow room efficiency under normal mill conditions, Brief out line of blow room lines setting for both the fibres cotton as well as manmade, Humidification and conditioning of mixing in blow room, Introduction of chute feed systems, types of chute feed system and their working, degree of opening and cleaning of chute feed system, comparative study between chute feed and lap forming system.

Unit V : **CARDING:** Necessity & Objects of carding, Operations involved in carding, Fundamental actions in carding, Detail study with construction and working of carding machine, Various sections of carding machine. India roll and cross roll verga unit, Types of card clothing and their significance and effects. Theories of carding action, Analysis of flat actions and carding force. Introduction to Stripping, Grinding and Burnishing operations. Continuous Feed Vs Lap Feed.

Unit VI : Various settings of card, It's influences on carding quality & production. Transfer mechanism of fibres, Web stripping mechanism, Analysis of stripping process, Consolidation of web into sliver, Trumpet & Calender roller condensation. Parameters affecting Settings, Quality and Production. Concept of draft, Types of Draft, Distribution of draft, Actual and Mechanical draft. Card drive & calculations related to Efficiency, Production of carding machine**.** Carding faults and their origin.

Text Books

1. Spun yarn technology, volume I, Blow room processes - A.Venkattasubramani.
2. Spun yarn technology, volume II, carding - A.Venkattasubramani.

References

1. Technology of Carding – R. Chattopadhyay, NCUTE Publication
2. A practical guide to opening and carding- W .Kein.
3. Khare A R, "Elements of blow room", Sai book center, Mumbai, 1999.
4. Khare A R "Elements of carding", Sai book Centre, Mumbai, 1999.
5. Salhotra K R, "Spinning of Man Mades and Blends on Cotton System", The Textile Association of India, Mumbai, 1989.
6. Chattopadhyay R and Rengasamay R, "Spinning: Drawing, Combing and Roving", NCUTE-Pilot Programme, 1999.

7. Lawrence C A, "Fundamental of Spun Yarn Technology" CRC Press, USA,2003.
8. Oxtoby E., " Spun Yarn Technology ", Butterworth, London, 1987.
9. Klein W., " The Technology of Short-staple Spinning ", TheTextile Institute, Manchester, 1998.
10. Klein W., " A Practical Guide to Opening and Carding ", TheTextile Institute, Manchester, 1999.
11. Lord P.R., " Yarn Production : Science,Technology and Economics ", The Textile Institute, Manchester, 1999.

3 TX 02 FABRIC MANUFACTURING-I

SECTION 'A'

UNIT-I : Classification of different fabric forming systems. Brief outline of process involved in fabric forming by weaving.
Winding :-Objectives, Objectionable faults in yarn and its classification as per uster classimate, Classification of winding process.
High speed winding machines:- Study of various types of creels, tensioners, yarn clearers, traverse motions, thread stop motion, full package stop motion, and anti patterning devices, and calculation regarding high speed winding machines.

UNIT-II : Automatic cone and cheese winding machine:-Construction, working, salient features, creeling unit- balloon controller, Snarl prevention, circular magazine, central unit-tension regulation, splicer, electronic yarn clearer, automatic package doffer, cleaning and dust removal system, internal machine and between machine material flow, advantages and calculation.
Weft winding: -necessity and objective, direct and indirect wefts supply system.

UNIT-III : Construction, working, advantages and calculation regarding:- conventional weft winding machines, modern automatic high-speed weft winding machine and unifill loom winder.
Warping:- necessity, objective and types of warping process, construction, working, advantages, disadvantages and calculation regarding beam warping and sectional warping machine. Modern developments in creel, tensioners, stops motions, head stock and drive of warping machines.

SECTION 'B'

UNIT-IV : Sizing: -necessity and objectives, construction, working, advantages, disadvantages and calculations regarding: Slasher sizing and multi cylinders sizing machine.

Study of types of creel, unwinding tension control system, sow boxes, yarn drying methods and it's equipments. Head stock-lease rod, comb, cut marking motion, beam pressing motion.

UNIT-V : Modern development in Sizing: - limitation of conventional sizing, necessity of modernization and their effect on quality and production of sized warp, driving arrangement of sizing machine-orthodox type drive, slow motion, friction clutch.

Control on sizing machine - size level Control, temperature control, moisture measurement and control, stretch control.

UNIT-VI : Sizing Ingredients:-study of different sizing ingredients with respect to their properties, method of preparation, different requirement of cooking of size paste and method of tests.

Size pick-up-optimum size percentage, factor affecting size pick-up and control.

Type of sizing-heavy, medium, light and pure sizing Size recipe for yarn of polyester, PC, PV blend, sizing calculation-regarding weight of warp, size mixture size consumption, sizing production and efficiency.

Text Books

1. Yarn Preparation (Vol-1 And 2) By R.Sengupta
2. Sizing Method, Material And Mechanism By D.B.Ajgaokar Andtalukdar.

Reference Book

1. Weaving Calcutions By R. Sengupta
2. Textile Mathematics (Vol-3) By J.E.Booth
3. Weaving Technology And Operation By Allan Armored Andwalter S Sondhelm.
4. Weaving Technology By N.M.Kulkarni
5. Weaving Machine Mechanism And Material By M.K.Talukdar.

3 TX 03 TEXTILE FIBRE-I

SECTION A

Unit I : Definition of fibre, textile fibre, staple fibre continuous filament, yarn and thread. Classification of fibers, essential and desirable properties of textile fibers, characteristics of fibre forming polymer, concepts of molecular weight, degree of polymerization, orientation and crystallinity, advantages and disadvantages of natural & manmade fibers.

Unit II : Vegetable Fibers: i) Cotton - Development of fibre in seed, morphological structure, physical, chemical and biological properties, applications. ii) Introduction to other vegetable fibers like hemp, ramie, banana, pineapple fibers: their distinctive features and applications.

SECTION B

Unit III : Vegetable Fibers: i) Jute- retting and extraction process, structure of jute fibre, physical, chemical and biological properties, applications ii) Flax- Retting and extraction process, structure of flax fibre, physical, chemical and biological properties, applications.

Unit IV : Animal Fibers: Wool- Types of wool, grading of wool, morphological structure, chemical composition, physical, chemical and biological properties, applications. ii) Silk - Types of silk, production of silk, chemical composition of silk, physical, chemical and biological properties, applications. iii) Introduction to other animal fibers like, mohair, camel, alpaca. Their distinctive features and applications.

Unit V: Man Made fibres:- definitions of regenerated & synthetic fibres, Introduction to methods of fibre formation – melt spinning, dry spinning and wet spinning. Regenerated fibres: i)Viscose rayon: Manufacturing, physical, chemical properties and applications, ii) High wet modulus and polynosic rayon: manufacturing, properties and end uses,

Unit VI : Cuprammnium rayon: Manufacturing, Physical & chemical properties, and applications. ii) Acetate & Triacetate fibres: manufacturing, physical and chemical properties and End uses.

Text Books

1. Textile Fibres – Vol.-I by V.A.Shenai

2. Fibre Science And Technology by S.P. Mishra

Reference Books

1. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
2. Textile Fibres by H.V.S. Murthy
3. Man Made Fibres – R.W. Moncrieff.
4. Polymer science- V.Gowariker
5. Textile Science- Gohl and Vilensky

3 TX 04 MACHINE DRAWING

SECTION – A

Unit I : Latest L.S.I. Convention s covering the standard practice in machine drawing. Use of specification for limits and fits.

Unit II : Preparation of freehand proportionate sketches of keys, cotter joints, Couplings.

Unit III : Development of surface of cubes , prisms, cylinders, pyramids, Cones, etc.

SECTION – B

Unit IV : Preparation of freehand proportionate sketches of various machines elements such as rivets and rivets joints, welded joints, bearing and bearing mounting.

Unit V : Principles, procedure and preparation of detail drawing.

Unit VI : Principles, Procedure drawing, preparation of assembly drawing and part list for simple machine assemblies.

Text Books :-

1) Machine Drawing By Bhatt & Panchal.
2) Machine Drawing By M. Agrawal & R. Garg.

References Books :-

1) Machine Drawing By R. K. Dhawan.
2) Machine Drawing By N. Sidheswar,P. Kannaiah,VVS Sastry

3 TX 05 THERMAL SCIENCE AND AIR CONDITIONING

SECTION A

UNIT I : Properties of Steam :Enthalpy of water, sensible heat, latent heat, enthalpy, entropy, internal energy, and specific volume of wet , dry and super heated steam, Distinction between vapour and gas, use of steam table, and miller chart, Dryness fraction & measurement of by separating, throttling, and combine calorimeter.

UNIT II : STEAM BOILER :Simple layout of thermal; power plant, Study of construction of the fire tube and water tube boiler such as Cochran, Cornish, Lancashire, and Babcock and Wilcox boiler. Equivalaent evaporation and efficiency of boiler, calculation of chimney height.

UNIT III : Boiler mounting and accessories :-Saftey valves, stop valves, pressure gauge, water level indicator, feed check valve, blow of valve, and fusible plug, super heater, economizer, air preheater.

SECTION B

UNIT IV : Air Compressor : Classification, Cycle of operation, use of compressed air, pneumatic system, study of various pneumatic circuit, & its component, like valves filter, regulator, accumulator, lubricator.

UNIT V : Refrigeration & Psychometry. Different refrigerant & their properties, Various refrigerant system,.Basic psychometric terms (DBT,WBT,DPT,SH,RH,AH), various psychometric processes, Heating, Cooling, Humidification, Dehumidification. Bypass factor, sensible heat factor. Use of psychometric chart. (Numerical related to psychometric).

UNIT VI: Air Conditioning and Distribution System :Central, Unitary, District, Self-contained AC System. Direct expansion, all water, all air combined, constant volume, variable volume, constant temperature, Induction system.Duct design & Air distribution system.

Text Books

1) A course in Refrigeration and Air Conditioning – S. C. Arora, S. Domkundwar. (Khanna Publication.)
2) Thermal Engineering - P. L. Balaney. (Khanna Publication)

References Books

1) Refrigeration & Air Conditioning – P. N. Ananthnarayanan. (TMH Publication)
2) Elements of Heat Engine – R. C. Patel, C. J. Karamchandani. (Charter Publication)
3) Thermal Enginneering B. K. Sarkar. (TMH Publication)
4) Thermal Engineering - S. Domkundalwar. (Khanna Publication)

3 TX 06 Yarn Manufacturing I-Lab.

8 to 10 Practicals based on syllabus of 3 TX 01

3 TX 07 **Fabric Manufacturing I-Lab.**

8 to 10 Practicals based on syllabus of 3 TX 02

3 TX 08 **Machine Drawing-Lab.**

Eight Practicals based on syllabus of 3 TX 04

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SEMESTER : FOURTH

4 TX 01 **YARN MANUFACTURING -II**

SECTION A

Unit I : DEVELOPMENTS IN CARDING

Development in carding with reference to licker-in opening region, importance setting of deflector plate, fibre retriever ,modifications and development in carding back zone ,front zone, different attachments in carding particularly for maintenance point of view, detail study of modern high production cards. Card autolevellers-Principles, Types, Advantages & disadvantages. Control of different waste in carding, fibre neps and their assessment, waste extraction system, suctions points in carding, microprocessors used in carding related to MIS.

Unit II : **DRAWFRAME**

Introduction, objective of draw frame, operating principle; Attenuation (draft): the draft, the drafting operation, drafting force; behavior of the fibres in the drafting zone, friction fields, nature and role of fibre friction in drafting, distribution of draft, additional effects of draft; perfect and real drafting; nature of drafting irregularities; coiling- delivery, condensing, sliver coiling, can changing.

Unit III : **DRAWFRAME**

Drafting force in relation to other parameters- Draft ratio, Roller Setting, Fibre Crimp, sliver density. Roller lapping tendency, Selection of creel and web tension draft. Monitoring and auto leveling: structure of computerized data collection and monitoring systems; Blending at the draw frames: conventional & unconventional operations. Production calculations.

SECTION B

Unit IV : **COMBING PREPARATORY**

Objects, need , different types of passages used. Preparation for combing: outline, operating principles of sliver lap machine, ribbon lap machine, sliver doubling machine and super lap machines; comparative assessment of web doubling and sliver doubling processes**,** Systems of lap preparation configuration of fibre feed and its effect on the quality of product, calculation regarding gearing, draft, production of sliver lap ribbon lap and super lap machines

Unit V : **COMBING**

Combing: Object of combing, introduction, tasks of comber, types of comber, sequence of operation in a rectilinear comber; Technology of combing: parameters influencing combing operation- raw material, material preparation parallelization of fibres in the sheet, sheet thickness (wt.), evenness of the lap sheet, disposition of hooks, degree of combing, noil percentage and fractionating efficiency of comber.

Unit VI: **COMBING**

Combing machines: outline, classification, description of functions- feed, feed of lap sheet, feed device, nipper assembly, cylinder comb, top comb, take-off & the material, piecing, withdrawal of the web and formation of sliver, sliver take-off, drafting arrangement, coiling of sliver, waste removal (stripping), timing diagram of comber motions, automation in comber.

Detailed setting of comber machine and gauges used for setting. Gearing, drafts and production calculation of combing machine.

Text Books

1. Spun yarn technology, volume II, carding - A.Ventasubramani.
2. Chattopadhyay R and Rengasamay R, “Spinning: Drawing, Combing and Roving”, NCUTE-Pilot Programme, 1999.

References Books

1. Khare A R, “Elements of combing”, Sai book center, Mumbai, 1999.
2. Khare A R “Elements of carding”, Sai book Centre, Mumbai, 1999.

3. Salhotra K R, "Spinning of Man Mades and Blends on Cotton System", The Textile Association of India, Mumbai, 1989.
4. Lawrence C A, "Fundamental of Spun Yarn Technology" CRC Press, USA,2003. Oxtoby E., "Spun Yarn Technology ", Butterworth, London, 1987.
5. Klein W., " The Technology of Short-staple Spinning ", TheTextile Institute, Manchester, 1998.
6. Klein W., " A Practical Guide to Opening and Carding ", TheTextile Institute, Manchester, 1999.
7. Spinning of Manmades and Blends on Cotton System, K. R. Salhotra
8. Technology of Carding – R . Chattopadhaya NCUTE Publication
9. Advances in Yarn Production - R . Chattopadhaya NCUTE Publication.

4 TX 02 FABRIC MANUFACTURING II

SECTION-'A'

UNIT-I : Looming: - Working principle of leasing ,including Uster automatic leasing ,drawing in and Reaching in , Warp Knotting and Drop planning. Types of healds and reed and their numbering system.

Fabric formation by weaving- details classification of motions, types of sheds.

Tappet shedding mechanism-Negative and positive tappet shedding, movement of healds, geometry of warp shed ,heald reversing motion principles, split shedding and asymmetrical shedding.

UNIT-II : Shuttle picking and checking mechanism, overpicking and under picking mechanisms, Shuttle box and shuttle checking devices- ideal checking, movement of shuttle during picking, disadvantages of shuttle picking.

Beat up mechanism- eccentricity of sley, mechanics of beat up, bumping condition.

Take up and negative let off motion.

Calculation regarding - average reed space, average pick, efficiency and production, shuttle movement.

UNIT-III: Automatic loom:-limitation of plain loom, introduction to automatic loom, types of automatic loom, characteristics, feature of automatic Loom.

Weft fork- Side and centre weft fork motion warp protector motion, temple devices, and timings of plain loom.

Weft filling - mechanical electrical, photo electrical type. Pirn changing weft repulsing motions - essential attachments, mechanisms, shuttle box, rotary magazine, reserve bunch of weft. Northop's and Ruti C pirn changing mechanism, shuttle eye thread cutter , three try motion , timing and setting of pirn changing loom .

SECTION 'B'

UNIT-IV: Warp stop motion - Electrical, mechanical vibrating bar and Castelleted types. Knock of mechanism.

Shuttle changing loom - Vicker staford, Toyada shuttle changing mechanism, bobbin loader automatic loom winder. Automatic let off, tension control and positive take up on Ruti-C Machine.

UNIT-V: Fancy Weaving:- Visual effect of fabrics extra thread effect , colour weaving effect , colour and weave effect .

Multiple box motion - Drop box and circular box, pick and pick and pick at wheel box motions.

Dobby shedding - Classification of dobbies, left and right hand keighley dobby .Method of pegging legs. Cross border dobby Modern dobbies - Cam dobby, paper card dobby, positive dobby, rotary dobby.

UNIT-VI: Jaquard shedding- classification of jacquards, principle parts of jacquard shedding, S.L.S.C., D.L.D.C., D.L.S.C., Open shed, cross border, fine pitch (vencenzi and verdol), electronically conrol jaquard machine.

Loom faults-Reed marks, shuttle flying out, Loom stopping, shuttle trapping in the warp, Loom banging- off weft cutting , Bumping, Cop knocking off.

Fabric defects and value loss - Grading of fabrics, fabric defects such as warp defect, weft defect their causes and remedies.

Text Books

1) Weaving Machine, Mechanism Management By D.B.Ajagaonkar And M.K.Talukdar

References Books

(1) Weaving Operation by Allen Armorod

(2) Fancy Weaving by K.T. Aswani
(3) Weaving Mechanism vol.II by N.N.Bannarji
(4) Principle of weaving by R. Marks and A.T.C. Robinson

4 TX 03 APPLIED ELECTRONICS & CONTROL SYSTEMS

SECTION A

Unit I : Static charge generation & measurement. Types of materials, conductors, insulators and semiconductors P-Type and N-type semiconductors, P-N junction diode principle. Diode as rectifier, Full wave rectifiers, Zener diode and its use as regulator. Theory of special semiconductor devices like FET, UJT, SCR, DIAC, TRIAC (basic principles and working)

Unit II : Transistor principles, PNP, NPN Transistor, its use as amplifier (CE mode only), oscillators (Heartley, colpitt, phase shift & wien bridge) multivibrators using transistor (Astable, monostable and bistable) Basics of operational amplifier.

Unit III : Study of logic gates (7400 series) flip-flops, study of basic Digital counters (Asynchronous and synchronous), shift register, ADC/DAC, Study of Intel 8085 CPU, General block diagram, Interfacing devices (PPI 8255), its application in speed control, temperature control.

SECTION B

Unit IV : Photoelectric devices : LDR, LED, LASER principles, photodiode, photo transistors, photoelectric relay, photovoltaic cells, photo conductive cells (Introductory aspects) LCD, 7. Segment display.

Unit V : Transducers : Types of transducers active, passive & primary, secondary, electrical and non-electrical, capacitive transducers, inductive transducer, measurement of temperature, pressure measurement of flow, thickness, humidity, strain, displacement.

Unit VI : Open loop, closed loop control system, position and speed control mechanism. Principles, working and characteristics performance of control systems and components for following (Mechanical, Hydraulic, Pneumatic and Electric types) a) Position b) Velocity c) Temperature d) Preure e) Flow f) Level,

Automatic speed control systems in prime movers, types of analysis of performance characteristics.

Text Books

1. Principles of Electronics : V. K. Mehta

References Books

2. Integrated Electronic : Millman Halkies
3. Modern Digital Electronics : R. P. Jain
4. Introduction to Microprocessors : B. Ram
5. Microprocessor, Architecture and applications : Gaonkar
6. Electrical Measurement : A. K. Sawney
7. Instrumentation : Rangan Sharma
8. Control System : Nagrath Gopal
9. Automatic Control Engineering : B. C. Kuo.

4 TX 04 TEXTILE FIBER- II

SECTION A

Unit I : Synthetic fibers: heterochain and carbon chain fibres, theoretical background, addition, condensation polymerization. i) Polyamide: nylon 6 & nylon 66 fibres – raw material, manufacturing, physical & chemical properties, applications. ii) Polyester (polyethylene terepthalate): raw materials, manufacturing, physical & chemical properties, applications.

Unit II : Synthetic fibres: i) polyacrylonitrile fibre: acrylic and modacrylic fibres - manufacturing, physical & chemical properties, applications. ii) polyvinyl alcohol and polyvinyl chloride fibres: manufacturing, physical & chemical properties, applications. iii) polyethylene & polypropylene: manufacturing, physical & chemical properties, applications.

Unit III : investigating structure-idea of infrared spectroscopy, x-ray, electron microscopy, NMR etc; Microstructure and macrostructure of fibres: Recapitulation of crystalline and non-crystalline materials –structure of crystals, polymer crystals, X-ray diffraction and crystallinity, thermal analysis of polymers by DTA, TGA and DSC.

SECTION B

Unit IV : Investigating fibre structure (a) microstructure and macrostructure of natural fibres: cotton and other vegetable

fibres; silk, wool and other animal fibres. (b) microstructure and macrostructure of synthetic fibres: polymer crystallization from the melt or concentrated solution, fibre formation, microstructure of manmade fibres; idea of simple models of fibre structure.

Unit V : (a)Fibre length: (Brief treatment without testing procedure) fibre length variation, technical significance of fibre length. (b) fibre cross-section and linear density: (brief treatment without testing procedure) fibre linear density, fibre cross-sectional shape and surface area, variability in fibre denier; technical significance of fibre fineness; maturity of cotton.(c) environmental effects: (brief treatment without testing procedure): Solvents, moisture and radiation, solubility parameters, Interaction of fibres with moisture, : moisture regain and content, heat of moisture sorption, physical property changes with moisture uptake; idea of the effects of radiation on fibre structure and properties.

Unit VI : Mechanical Properties: a)tensile properties: (brief without trsting procedure) basic definition: true stress, specific stress, tenacity and breaking length, recapitulation of elastic and plastic deformation, Hook's law and poisson's ratio; stress-strain curves, b) elastic recovery, strain recovery, work recovery: shear, bending, torsion and compression physical properties: optical properties, thermal properties, fibre friction , dielectric and effect of static electricity.

Text Books

1. Textile Fibres by H.V.S. Murthy
2. Man Made Fibres – R.W. Moncrieff.

References Books

1. Fiber Science by Steven B. Warner,
2. Physical Properties of Textile Fibres by W.E. Morton and J.W.S. Hearle,
3. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
4. Investigation of Physical Properties of textile fibres- Hearle & Meredith.
5. Textile Science- Gohl and Vilensky

4 TX 05 GARMENT MANUFACTUING TECHNOLOGY

SECTION-A

Unit I : Basics of Apparel production – Brief outline of process involved in garment manufacturing. Cutting room: Importance of cutting,

production processes in cutting room. Planning, Spreading, preparation for sewing. Fusing; purpose, fusing process, fusing machinery. Sewing room: stitches, seams, feed systems. Accessories in apparels: buttons, zips, underlining, weddings, labels and ornamental materials

Unit II : Basic Pattern marking : Measurement taking- Size chart and Measuring of Sizes. Definition of various garments parts & positions. Method: bespoke method & industrial Method (Using Blocks) - Basic block construction - block preparation & correction. Standards norms for different size fit.

Unit III : Drafting: Basic principles & methodologies used to draft standard size block patterns for men, women & kids wear viz, shirts,Pants, blouses, jackets, dresses etc.

Drafting of Sleeve & Collar: - Construction of sleeve block - crown height and its relationship with fit of garment. Types of sleeves. Mounting of sleeve, Method of application. Types of collars, classification. Yokes: Definition, Selection of yoke design, different style of yoke. Plackets: different types of plackets. Computer aided drafting.

SECTION-B

Unit IV : Basic Sewing Techniques:-Seams: definition. Types of seams, seam quality, seam performance, factors to be consideredin the selection of seam, seam finishes, seam defect. Stitches: definition, stitch classes, stitch parameters, factors to be considered in the selection of stitches. Stitching defects. Sewing Thread: Types, construction, sewing thread quality, selection of sewing thread. Sewing needles, machinery and equipments.

Unit V : Pressing Technology: Object, classification, means, components, machinery and equipments, handling systems and boiler room. Garment finishing & Inspectios: Attaching buttons, marking, cleaning ,final touch, fitting quality, viewing of garments and quality standards.

Unit VI : Production Technology: Manual systems, making through, section systems, Progressive bundle systems, Straight line systems, Mechanical transport systems, Selective conveyor belt systems, Unit production systems, Quick response sewing systems.

Text Books

1) Garment Technology for fashion designers by Gerry Cooklin.
2) Introduction to clothing manufacturing by Gerry Cooklin**.**

References Books :

1) Clothing Construction and Wardrobe Planning by Dora S. Lewin, Mabel Goode Bowers, Manetta Knttunen- The Macmillan Co New York.
2) Garment technology by Dr. V. Subramanian- Winter School Booklets 1990
3) BIS Publications 1989.

4 TX 06 **Yarn Manufacturing II-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 01

4 TX 07 **Fabric Manufacturing II-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 02

4 TX 08 **Applied Electronics & Control Systems-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 03.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY
CHEMICAL ENGINEERING
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 CH 01/3 PE 01 APPLIED MATHEMATICS-III / MATHEMATICS-III

1. Prerequisite of Subject
   Engineering mathematics I and
   Engineering mathematics II
2. Objectives of Applied mathematics III. On Completion of the students are expected.
   - To understand Fourier transform & Z-transform, Laplace transform & their application to engineering problems.
   - To know probability and probability distribution.
   - To understand Numerical analysis.
   - To know vector Clarks &their application.

SECTION-A

UNIT –I: Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7 Hrs.)

UNIT-II: Laplace transforms:
Definition, standard forms, properties of Laplace transform, Inverse Laplace transform, Laplace convolution theorem, Laplace transforms and Unit step function, Solution of Linear differential equations. (7 Hrs.)

UNIT-III: Probability & Probability Distribution
Probability: definition, axioms of mathematical probability, complementation rule, Theorem of total probability, Theorem of compound probability, Independent Events, subjective probability, Baye's Theorem, Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (7 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :-

Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic conjugate functions, Milne's method, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem.

(7Hrs.)

UNIT-V: Numerical Analysis:

Solution of algebric and transcendental equations by method & method of false position, Newton-Raphson method Solution of system of linear equations by Gauss Seidal method, Relaxation method. Solution of first order ordinary differential equations by modified Euler's, method Runge - Kutta method.

(7Hrs.)

UNIT-VI: Vector Calculus :-

Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (7Hrs.)

OUTCOMES:

Students are expected to expertise in solving numerical methods, Laplace transform, Fourier Transform & Z-transform

Probability & Probability Distribution and statistics are very useful to them in future curriculum/student.

Complex functions and vector calculus are backbone of future academic curriculum and hence should be in tuch with contents in syllabus.

Design of syllabus is more than sufficient for academic curriculum of student.

Text Books:

1. Higher Engineering. Mathematics by B.S. Grewal, Khanna Publication.
2. A Text Book of Applied Mathematics, Volume-II by P. N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Numerical Analysis- S.S. Sastry.
2. Advancing Engg. Mathematics by E.K.Kreyzig.

3CH02 PROCESS INSTRUMENTATION

Monitoring and control of processes is an important activity of Chemical Engineer. This subject deals with measurement principles of process parameters like temperature, pressure, level flow.

Objectives:

The students will be able:

1. To learn the operating principles, construction and working of temperature, pressure, level and flow measuring devices.
2. To select the most suitable measuring device based on its performance characteristics for specific measuring task.
3. To test, Calibrate, Maintain measuring devices elements.

SECTION A

UNIT-I : Basic method of measurements –Errors in measurements – Types of Errors.

Transducers – definition – classification – Static characterisitics of instruments – Dynamic characteristic. Transmitter –definition – different types. **(8)**

UNIT-II : Temperature measurements: Introduction – Temperature scale – Conventional methods of temperature sensing. Resistance Thermometer Detector (RTD) –Unbalanced Wheatstone Bridge – Direct conversion. Thermistors – Temperature sensing using thermistor – Semiconductor temperature sensor. Thermocouple –Basics of thermocouple – Thermocouple types – Cold junction compensation.Infrared thermometry – Basics of radiation – Emissivity – Methods of sensing –Direct detection – Indirect detection. **(8)**

UNIT-III : Pressure measurements: Introduction – Units of pressure – Types of pressure measurement – Bourdon tube and bellows – SG based pressure sensors –Capacitance type pressure transducers. Low pressure measurements – pirani gauge – Thermocouple gauge – Ionization gauge. **(8)**

SECTION B

UNIT-IV : Basics of fluid flow – Flow meters – Quantum flow measurements, Differential pressure measurement – Principle of the differential pressure flowmeter, Orifice plate, Venturimeter, Flow nozzle, Dall tube, Pitot tube. Variable area flow meter,Magnet Flowmeters – DC Magnetic Flowmeter, Pulsed Magnetic Flowmeter,Permanent Magnet Type Magnetic Flowmeter, AC Magnetic Flowmeter. Positive displacement Flowmeters – Different type of ultrasonic Flowmeter. **(7)**

UNIT-V : Level Measurements – Level transducer with differential pressure sensing –Capacitance based level sensors – Capacitance sensors for conducting liquids –Capacitance sensors for Non – conducting liquids, other liquid sensors – Displacement type level sensor – Ultrasonic type level sensor – Gamma ray level sensor. **(7)**

UNIT-VI : pH measurements – Basic ideas of pH value – Measurement of electrode potentials – Glass electrode – Reference electrode – Calomel electrode – Silver-Silver chloride electrode, Humidity Sensing – Basic ideas of humidity sensing – Humidity measurement by dew point sensing – Humidity measurement using Lithium Chloride. **(7)**

Text Books:

1. Tattamangalam R. Padmanaban "Industrial Instrumentation Principles and Design"
   Springer, 2000.
2. Donald P. Eckman, " Industrial Instrumentation", CBS Publishers, New Delhi,2002.

Reference Books:

1. R.K.Jain, "Mechanical and Industrial Measurements"
   Khanna Publishers, New Delhi, 1999
2. D.Patranabis, "Principles of Industrial Instrumentation",
   Tata McGraw Hill Publishing Ltd, New Delhi, 1999
3. C.D. Johnsons, "Process Control Instrumentation Technology",
   Prentice Hall Inc, 1998
4. A.K.Sawhney, "A Course In Electrical and Electronics Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi, 1999

3CH03 /3PP03/3CT03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :
1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :
1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :
1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.
Axially loaded columns (Euler's and Rankin's formula).

Unit –V:
1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams
Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 CH 04/3 CT 04 CHEMICAL ENGINEERING THERMODYNAMICS-I/ CHEMICAL ENGINEERING THERMODYNAMICS

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: **BASIC CONCEPTS:** The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. **(8)**

UNIT-II: **FIRST LAW OF THERMODYNAMICS:** First law of thermodynamics - Types of energy, work, heat and energy

changes, enthalpy and heat capacity limitations of the first law, application of first law to different processes. **(8)**

UNIT-III: **SECOND LAW THERMODYNAMICS:** Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction. **(8)**

SECTION B

UNIT-IV: REFRIGERATION AND LIQUEFACTION: The carnot refrigerator, the vapour-compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle. **(7)**

UNIT-V: THERMODYNAMIC PROPERTIES OF FLUIDS: Property relations for homogeneous phases, thermodynamic diagram, generalized property correlation for gases. **(7)**

UNIT-VI: THERMODYNAMICS OF FLOW PROCESSES: flow of compressible fluids through ducts, compression processes, steam turbines and nozzles, condensors. **(7)**

Text Books:

1. J.M. Smith and H.C. Van Ness, “Introduction to Chemical Engineering Thermodynamics”, McGraw Hill, 1998
2. K.V.Narayanan, .”A textbook of Chemical Engineering Thermodynamics”, Prentice Hall of India Ltd., 2001

Reference Books:

1. Sadler S. I., J, “Chemical and Engineering Thermodynamics” John Wiley and Sons, Inc. New York, 3rd Ed., 1999
2. Elliot J. R. and Lira C.T., “Introductory Chemical Engineering Thermodynamics”, Prentice Hall, 1999
3. Eastop T. D. and McConkey A.,” Applied Thermodynamics for Engineering Technologists’, Addison Wesley Longman Ltd., England, 5th Ed., 1999

3 CH 05/3 PP05/3 CT 05 PROCESS CALCULATIONS

This subject deals with the fundamentals of chemical engineering operations and processes in an accessible style to help the students gain a thorough understanding of chemical process calculations.

The chief objective of this subject is to prepare students to make analysis of chemical processes through calculations and also to develop in them systematic problem-solving skills. The students are introduced the application of law of combining proportions to chemical reactions, also

to formulating and solving material and energy balances in processes with and without chemical reactions

SECTION A

UNIT-I: Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoults law, partial saturation and humidity. (8)

UNIT-II: Material balances without chemical reactions, stoichiometry and unit operations distillation,absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations. (8)

UNIT-III: Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.

Introduction to unsteady state material balances. (8)

SECTION B

UNIT-IV: Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation. (7)

UNIT-V: Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations. (7)

UNIT-VI: Heating value of fuels. Calculations involving theoretical and excess air, heat and material balances of combustion processes. (7)

Text Books:

1. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, "Chemical Process Principles", Vol 1, John Wiley

3CH06 PROCESS INSTRUMENTATION - LAB

List of experiments:

1. Measurement of temperature using thermocouple or RTD or Thermistor and to find their characteristics.
2. Measurement of high temperature using radiation or Optical pyrometer.
3. Measurement of pressure using LVDT or Strain gauge transducer.

4. Calibration of pressure gauge using Dead Weight Tester.
5. Measurement of level using air purge or capacitance type level detector.
6. Measurement of flow using magnetic flow meter or Ultrasonic flow meter.
7. Calibration of thermocouple/Bimetallic thermocouple/Resistance thermocouple.
8. Calibration of Pressure gauge/ Pnuematic pressure recorder/ Differential pressure recorder.
9. Calibration of Orificemeter/ Venturimeter / Rotameter/ Gas flow meter.
10. Estimation of viscosity by Redwood/ Saybolt/ Ostwald viscometer.
11. Calibration of pH meter.
12. Calibration of Conductivity meter.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

3CH07 / 3PP08 / 3CT08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3CH08 / 3CT09 CHEMICAL ENGINEERING THERMODYNAMICS-I – LAB

List of Study Experiments:

1. Study of low temperature refrigeration system.
2. Study of ranking power cycle.
3. Study of steam nozzles
4. Study of steam turbine
5. Study of boiler
6. Study of mounting accessories of boiler.
7. Study of condensers.
8. Study of economizer and superheater.

9. Visit to thermal power station.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be studied by the student to complete the term work.

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SEMESTER : FOURTH

4CH01 FLUID FLOW OPERATIONS

The subject gives the knowledge of fluid flow and various fluid transportations. This knowledge is useful in different subjects to be studied in Chemical Engineering course.

Objectives: After studying the subject student will be able,

1. To distinguish between different types of fluids.
2. To understand the concept of viscosity.
3. To Calculate flow rates.
4. To understand the principles behind different flow meters.
5. To understand the principle and working of different fluid flow machinery.

SECTION A

UNIT I: Properties of fluids and their classification.
Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids. Forces on submerged bodies. Rigid body motion, pressure measurements, Euler's equation. (8)

UNIT II: Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis; Buckingham'sÐ.theorem ; Dimensionless numbers and their physical significance; Similitude criteria. Mixing and agitation of fluid, Types of mixers and their selection; Power requirement. (7)

UNIT III: Fluid flow: Laminar and turbulent flows; Pressure drop in pipes and tubes, pipe fittings and pipe network and friction factor; Conservation of mass, momentum and energy; Navier-Stokes equation; Mechanical energy balance and Bernoulli's Theorem. (8)

SECTION B

UNIT IV: Flow measuring devices for chemical plants: Orifice meter, nozzle and venturi meters, rotameter and pitot tube. (8)

UNIT V: Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and blowers. NPSH and calibration.
Mixing and agitation of fluids. Compressible fluid flow and aerodynamics. (8)

UNIT VI: Flow past immersed bodies, flow through packed bed fluidized bed.
Introductory concepts of two-phase flow. (6)

Books Recommended:

1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill
2. Chemical Engineering, Vol. 1, Coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford.

4CH02 CHEMICAL ENGINEERING THERMODYNAMICS-II

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: First law of thermodynamics, equation of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattle-Bridgeman equation.
First law applied to thermodynamic processes and calculations of work, free energy and heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between Cp and Cv, compressibility factor and coefficient of thermal expansion, concept of residual entropy and entropy of equilibrium. (8)

UNIT-II: Partial molar and apparent molar properties, Gibbs Duhem equation, chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. (8)

UNIT-III: Colligative properties, Ebulliometric constant. Determination of molecular weight of unknown chemical substances. Solubility law. Vapour liquid equilibrium, T-X-Y diagrams and X-Y diagram for ideal and non ideal system. Raoult's law and Henry's law, Deviations from Raoult's law. Comparison of ideal and non-ideal systems. (8)

SECTION B

UNIT-IV: Phase equilibria in non reacting multi-components, binary and ternary systems. Graphical representation of L/L, L/S and G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Phenol-water systems, Aniline-water-chlorobenzene systems. (7)

UNIT-V: Statistical thermodynamics, thermodynamics probability, its relation with entropy, partition function and its relation with thermodynamic functions, the Boltzman distribution law, Distribution law for chemically reactive system Thermodynamics charts and their uses. Searching of thermodynamics data. (7)

UNIT-VI: Chemical equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, effect of temperature and pressure, Relation between Kp, Kc and Kv, Le-Chatelier's principle. Endo-exothermic reactions. Heterogeneous equilibria, various methods of calculating free enegy charge, equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals. (7)

Text Books:

1. An Introduction of Chemical Thermodynamics: R.P.Rastogi and R.R. Mishra
2. Chemical Engineering Process: Houghen and Watson

Reference Books:

1. Introduction to Chemical Engineering Thermodynamics: J. M. Smith and H. C. Vauhess.

2. Thermodynamics for Chemical Engineering: H. C. Weber and J. P. Meissner.
3. Engineering Thermodynamics: P.K. Nag.

4 CH03 / 4 PP03/ 4 CT03 MACHINE DESIGN & DRAWING

Unit I :

1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :

1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4 CH 04 **APPLIED PHYSICAL CHEMISTRY**

Unit I : **Electrochemistry**

Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on conductivity, Kohlraush law and ionic mobility , Transport number and their determination , Electrolytic concentration cell with and without transference

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation, Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of solubility & solubility products of sparingly soluble salts , Determination of activity and activity coefficient from equilibrium constant, Numericals

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (10 Hrs)

Unit II : **Kinetic theory of gases**

Postulates of kinetic theory, derivation of equation of state, Van-der-waal's equation, critical phenomenon, calculation of critical constants from Van-der-waal's equation, Maxwel-Boltzmann's law of distribution of molecular speed, root mean square speed, average speed and most probable speed, Mean free path, collision diameter, collision number and its derivation, Principle of corresponding state,

Unit III : **Radiation chemistry and spectroscopy**

Radiation chemistry : Photochemical reactions, Lambert's and Beer's law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization .

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, UV- spectra and NMR- Spectra, instrumentation and their applications.

Unit IV : **Surface phenomenon and Catalysis**

Adsorption , Classification of adsorption, Freundlich isotherm , Langmuir theory of adsorption, BET adsorption isotherm and its application for determination of surface area of fine powder. Numerical on isotherm and surface area.

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, mechanism of catalytic action, Enzyme catalyst, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (8 Hrs)

Unit VI : **Chemical Equilibrium and Kinetics**

Chemical equilibrium : Introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .Numericals

Kinetics and molecular reaction dynamics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of complex and polymerization reaction, Methods for determination of order of reactions. Theories of absolute reaction rate, Steady state principle, Composites reactions, Chain reactions and fast reactions, energy of activation and its determination. (8 Hrs.)

Unit VI : **Thermodynamics**

Origin of First law, thermodynamic terms and their definitions, Heat ,Energy and work function Second law, carnot's cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, Entropy of spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partial molar properties, chemical potential,

Third law of Thermodynamics : Entropy and probability, partition functions, Determination of entropy at absolute zero. (8 Hrs.)

Books Recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill

6. Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley publications
7. Principle of Heterogeneous catalysis, J.M.Thomas, W.J. Thomas, John Wiley publications

4CH05 CHEMICAL ENGINEERING OPERATIONS – I (MECHANICAL OPERATIONS)

This subject intends to equip the students with concepts and principles as well as construction of equipments used for handling Mechanical Operations in a chemical plant. This subject gives idea about principles of handling mixtures of solids, liquid and gases. This subject will help students for understanding principles for separation and purification techniques of solid, liquids and gases mixtures.

Objective:

After studying this subject's student will be able to:

1. Explain methods of size reduction and equipments working on those principles.
2. Describe various equipments used for size separation.
3. Identify various other physical properties used for purification solid-solid mixtures and equipments working on this principle.
4. Describe various method of purification of heterogeneous mixture of solid liquid, & equipments like filters, settlers, used for separation of solid liquid mixtures.
5. Identify various types of agitators used for mixing solids-liquids mixtures, power calculation of a mixer.

SECTION A

UNIT-I:
1. Size reduction, stages of reduction, equipment operating variables, laws of energies, energy requirements.
2. Screening: Screen analysis, particle size distribution. (7)

UNIT-II:
1. Classification: Equal falling particles, equipment, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity
3. Sedimentation: Continuous thickners. (8)

UNIT-III:
1. Storage and handling of solids, transportation.
2. Mixing, mixers, agitation, type of equipments. (7)

SECTION B

UNIT-IV:
1. Filtration: Theory, operation, types, flotation agents, flotation cells.

2. Filter calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration- constant pressure and constant rate and their equipments. (8)

UNIT-V:
1. Centrifuges: Theory, equipments, types and calculations.
2. Cyclones: Hydrocyclones, liquid scrubbers and electronic precipitators. (7)

UNIT-VI:
1. Adsorption, theory, type and application, Langmuir's Freund Lich;s equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidized beds.
3. Recent developments in mechanical operations. **(8)**

Text Books:

1. Bedger and Bencharo, "Introduction to Chemical Engineering". Tata McGraw Hill
2. Narayanan C.M. & Bhattacharya B.C. "Mechanical opeartions for chemical engineers", Khanna Publishers. 3 rd Ed.1999

Reference Books:

1. Coulson and Richardson: Chemical Engineering, Vol. 2
2. Brown,G.G. and Associates "Unit operations" Wiley ,New York

4 CH 06 FLUID FLOW OPERATIONS - LAB

List of Experiments:

1. To obtain the coefficient of discharge for the given enturimeter and obtain its relationship with Reynolds' no.
2. To calibrate the given Rotameter.
3. To obtain the coefficient of discharge for the given orifice meter and obtain its relationship with Reynolds' no.
4. To study the flow and determine critical Reynolds no.
5. To determine the discharge co-efficient of the given v-notch.
6. To verify the Bernoulli's theorem.
7. To determine the viscosity of the given liquids using Stoke's law.
8. To determine the viscosity of a given liquid by measuring efflux time of a given tank. Also determine the diameter of a given capillary and compare.
9. To determine relation between friction factor and Reynolds number for the given flowing fluid through circular pipe.
10. To obtain relation between friction factor and Reynolds number for flow of water through annulus.

11. To determine the resistance offered by various pipe fittings and express them in terms of equipment straight pipe length.
12. To study characteristics curves for a centrifugal pump.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4CH07 CHEMICAL ENGINEERING THERMODYNAMICS-II LAB

List of experiments:

1. Critical solution temperature of phenol water system.
2. Critical solution temperature of phenol water system in presence of impurity like NaCl.
3. Critical solution temperature of phenol water system in presence of impurity like succnic acid.
4. Determination of boiling point elevation in presence of impurity.
5. Determination of freezing point depression in presence of impurity.
6. Study of T-X-Y Diagram.
7. Lowering of vapour pressure.
8. Study of boiling point diagram.
9. Study of ternary diagram.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4 CH08 / 4 PP08 / 4 CT07 MACHINE DESIGN & DRAWING-LAB

DRAWING WORKS:

Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 CH 09 Applied Physical Chemistry Lab

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between ($K_2S_2O_8$+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of

refractive index. Determination of energy of activation, Verification of Freundlich and Langmuirs isotherms. Determination of transport number. (Any 10 Experiments)

4CH10 CHEMICAL ENGINEERING OPERATIONS-I LAB (MECHANICAL OPERATIONS)

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.
4. To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To determine energy consumption and crushing law constants for jaw crusher.
10. To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
11. To determine area of batch thickener by conducting batch sedimentation test.
12. To determine efficiency of Cyclone separator.
13. To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY
POLYMER (PLASTIC)
TECHNOLOGY
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 PP 01 CHEMISTRY AND TECHNOLOGY OF POLYMERS

SECTION-A

Unit I : Introduction to ploymers, classification & types of polymers. Nomenclature. Termoplastics and thermosets. Linear, branches an crosslinked polymer Block and graft copolymer.

Unit II : Manufacture and properties of some important monomers used for commercial production such as ethylene. Propylene, bustadine, styrene, vinylchloride, phenol and M.M.A.

Unit III : Physical and chemical methods of analysis of Monomer and Polymer, Application of IR, NMR, X-ray diffraction HPLC, GLC, TLC to polymer analysis.

SECTION-B

Unit IV : Functionality concept and determination of functional groups. carothers equation and their application principles and distinctive features of polyaddition and polycondensation.

Unit V : Number average and weight average molecular weight and their determination by techniques such as solution viscosities, osmotic pressure, cryoscopic method, end group analysis, ultra centrifigation and kight scatterina.

Unit VI : Chemistry of polymer degradation prevention of polymer degradation and polymer stabilization

- Thermal Degradation - effect of high temp.
- Mechanochemical Transformation and light and ionizing Radition.
- Chemical degradation-Oxidation and degradation by chemical agents.

Books Recommended :

1. Principles of polymerization-G.C.Odlon
2. Text book of polymer chemistry-cliendsivy-Billmever (J.)

3. Kinetic and Mechanism of Polymerization Reactions Allen PEM Patrick C.R. John Wiley,
4. Principles of polymerization Engg.-Biecenbergtr J.A. Sebastian P.H.
5. Text Book of Polymer Science by Dr. Vasant Gowarikar.

3 PP 02 APPLIED PHYSICAL CHEMISTRY

Unit I : High Polymers (Macromolecules)

Nomenclature, functionality and classification of macromolecules, Number average and weight average molecular weight of macromolecules , Methods of molecular weight determination , Viscosity measurement, Membrane osmometry, Light scattering , Sedimentation and ultracentrifuge methods, Intrinsically and Extrinsically conducting polymers, Doped conducting polymers and their applications, Effect of polymer structure on properties of polymers, Numerical on molecular weight determination. (6 Hrs)

Unit II : Electrochemistry

Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on conductivity, Kohlraush law and ionic mobility ,Electrolytic concentration cell

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation,Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of activity and activity coefficient from equilibrium constant

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (8 Hrs)

Unit III : Kinetics and molecular reaction dynamics

Chemical ebuilibrium : introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .

Kinetics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of polymerization reaction, Methods for determination of order of reactions. Theories of reaction rate, (8 Hrs.)

Unit IV : Phase Ebuilibria in simple system and Catalysis

Gibb's phase rule, derivation and definition of terms involved in phase rule, phase diagram of one component system (water system), Two component system (Bi-Cd system)

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (6 Hrs)

Unit V : Thermodynamics

Origin of First law, thermodynamic terms and their definitions, Second law carnot cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. (6 Hrs.)

Unit VI : Radiation chemistry and spectroscopy

Radiation chemistry : Photochemical reactions, lamberts and Beers law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, NMR- Spectra, instrumentation and their applications.

Thermal analysis techniques of polymers : Thermal Gravimetric Analysis (TGA) , Differential Thermal Analysis (DTA), and Differential Scanning calorimetric (DSC) (8 Hrs.)

Books recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill
6. Polymer chemistry, Gowarikar

3PP03 /3CH03 / 3CT03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :
1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :
1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :
1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.

Axially loaded columns (Euler's and Rankin's formula).

Unit -V :
1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI Deflection of beams

Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 PP 04/3CH04 CHEMICAL ENGINEERING THERMODYNAMICS/ CHEMICAL ENGINEERING THERMODYNAMICS-I

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: **BASIC CONCEPTS:** The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. (8)

UNIT-II: **FIRST LAW OF THERMODYNAMICS:** First law of thermodynamics - Types of energy, work, heat and energy

changes, enthalpy and heat capacity limitations of the first law, application of first law to different processes. (8)

UNIT-III: **SECOND LAW THERMODYNAMICS:** Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction. (8)

SECTION B

UNIT-IV: REFRIGERATION AND LIQUEFACTION: The carnot refrigerator, the vapour-compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle. (7)

UNIT-V: THERMODYNAMIC PROPERTIES OF FLUIDS: Property relations for homogeneous phases, thermodynamic diagram, generalized property correlation for gases. (7)

UNIT-VI: THERMODYNAMICS OF FLOW PROCESSES: flow of compressible fluids through ducts, compression processes, steam turbines and nozzles, condensors. (7)

Text Books:

1. J.M. Smith and H.C. Van Ness, “Introduction to Chemical Engineering Thermodynamics”, McGraw Hill, 1998
2. K.V.Narayanan, .”A textbook of Chemical Engineering Thermodynamics”, Prentice Hall of India Ltd., 2001

Reference Books:

1. Sadler S. I., J, “Chemical and Engineering Thermodynamics” John Wiley and Sons, Inc. New York, 3rd Ed., 1999
2. Elliot J. R. and Lira C.T., “Introductory Chemical Engineering Thermodynamics”, Prentice Hall, 1999
3. Eastop T. D. and McConkey A.,” Applied Thermodynamics for Engineering Technologists’, Addison Wesley Longman Ltd., England, 5th Ed., 1999

3 PP05 / 3 CH 05 / 3 CT 05 PROCESS CALCULATIONS

This subject deals with the fundamentals of chemical engineering operations and processes in an accessible style to help the students gain a thorough understanding of chemical process calculations.

The chief objective of this subject is to prepare students to make analysis of chemical processes through calculations and also to develop in them systematic problem-solving skills. The students are introduced the application of law of combining proportions to chemical reactions, also

to formulating and solving material and energy balances in processes with and without chemical reactions

SECTION A

UNIT-I: Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoults law, partial saturation and humidity. (8)

UNIT-II: Material balances without chemical reactions, stoichiometry and unit operations distillation, absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations. (8)

UNIT-III: Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.
Introduction to unsteady state material balances. (8)

SECTION B

UNIT-IV: Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation. (7)

UNIT-V: Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations. (7)

UNIT-VI: Heating value of fuels. Calculations involving theoretical and excess air, heat and material balances of combustion processes. (7)

Text Books:

1. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, "Chemical Process Principles", Vol 1, John Wiley

3 PP 06 CHEMISTRY AND TECHNOLOGY OF POLYMERS-LAB

List of Practicals :

1. Determination of acid value, saponification value, Iodine value, hydroxyl value of polymer.

2. Determination of acetyl value, aldehyde content & functional groups of monomer.
3. Synthesis of Phenol formaldehyde resin ureaformaldehyde resin Hylon-06 polystyrene polyester PMMA.
4. Determination of mole wt. of polymer by end group analysis.
5. Identification of monomers like styrene, M.M.A.
   Other Practicals based on syllabus.

3 PP 07 APPLIED PHYSICAL CHEMISTRY-LAB

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between (K2S2O8+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of refractive index. (Any ten experiments)

3PP08 / 3CH07 / 3CT08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PP09 CHEMICAL ENGINEERING THERMODYNAMICS– LAB

List of Study Experiments:

1. Study of low temperature refrigeration system.

2. Study of ranking power cycle.
3. Study of steam nozzles
4. Study of steam turbine
5. Study of boiler
6. Study of mounting accessories of boiler.
7. Study of condensers.
8. Study of economizer and superheater.
9. Visit to thermal power station.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be studied by the student to complete the term work.

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SEMESTER : FOURTH

4PP01 CHEMICAL ENGINEERING OPERATION-I (Mechanical Operation)

This subject intends to equip the students with concepts and principles as well as construction of equipments used for handling Mechanical Operations in a chemical plant. This subject gives idea ablut principles of handling mixtures of solids, liquid and gases. This subject will help students for understanding principles for separation and purification techniques of solid, liquids and gases mixtures.

Objective :

After studying this subject's students will be able to :

1. Explain methods of size reduction and equipments working on those principles.
2. Describe various equipments used for size separation.
3. Identify various other physical properties used for purification solid-solid mixtures and equipments working on this principle.
4. Describe various method of purification of heterogeneous mixture of solid liquid and equipments like filters, settlers, used for separation of solid liquid mixtures.
5. Identify various types of agitators used for mixing solids-liquids mixtures, power calculation of a mixer.

SECTION-A

Unit I :
1. Size reduction, stages of reduction, equipment operating variables, laws of energies, energy requirements.
2. Screening; Screen analysis, particle size distribution (7)

Unit II :
1. Classification : Equal falling particles, equipment, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity.

3. Sedimentation : Continuous thickners. (8)

Unit III :
1. Storage and handling of solids, transportation.
2. Mixing, mixers, agitation, type of equipments. (7)

SECTION-B

Unit IV : Theory, operation, types, flotation agents, floation cells.
1. Filtration : Theory, operation, types, flotation agents, flotation cells.
2. Filter calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration-Constant pressure and constant rate and their equipment. (8)

Unit V :
1. Centrifuges : Theory, equipments, types and calculations.
2. Cyclones : Hydrocyclones, liquid scrubbers and electronic precipitators. (7)

Unit VI :
1. Adsorption, theory, type and application, Langmuir's Freund Lich's equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidized beds.
3. Recent developments in mechanical operations. (8)

Text Books :

1. Bedger and Bencharo, "Introduction to Chemical Engineering". Tata McGrow Hill.
2. Narayanan C.M. & Bhattacharya B.C. "Mechanical operations for chemical engineers", Khanna Publishers. 3rd Ed. 1999.

Reference Books :

1. Coulson and Richardson : Chemical Engineering Vol.2.
2. Brown, G.G. and Associates "Unit operations" Wiley, New York.

4 PP 02 POLYMER CHEMISTRY

SECTION-A

Unit I : STEP POLYMERISATION : Chemistry and Mechanisr polycondensation reaction, functional groups, kinetic polycondensation reaction reactivity of equivaluer step polymerization, some important step polymer, such poicarbonate, Aromaric-sulphones, Aromatic Polyamides Aromatic Polyethers, Aromatic Sulfides.

Unit II : RADICAL CHAIN POLYMERISATION : Introduction to radical chain Polymerisatin, Comparison of radical and step polymerisation. Chemistry and mechanism of radical chain polymerisation.

INITIATION: Thermal decomposition of initiator, Kinetics of intiation.

RADIX INITIATION: Type of radix initiations, Photochemical initiations bybulk monomer, irradiation of thermal and radix initiation.

INITIATOR EFFICIENCY: Mechanism ofLoweringor initiator efficiency experimental determination ofinitiator efficiency.

Unit III : IONIC Cf-WN POLYMERISATION

CATIONIC CHAIN POLYMERISATION: Comparison of ionic chain polymer withradical chain polymer, Initiations by Protonic acids Lewis acids Propagation. Term ination by transfers, combination with counter ions and backbitting. Inhibitors and Retarders.

ANIONIC CHAIN POLYMERISATION : Comparison of cationic with anionic chain polymerisation. Initiation by nucleophilic initiators, Electron transfer, Various modes of termination such as termination by added transfer agents, hydride elimination and polar monomer .

SECTION-B

Unit IV : COPOLYMERISATION : Chemistry of block. graft, random and alternate copolymer Free-radical-copolyrnerisation. Monomer reactivity ratio and its determination. Co-relation between monomer reactivity ratio and copolymer structure. Factor affecting monomer reactivity. Alfray price equation.

Unit V : STEREO-CHEMISTRY OF POLYMERISAtlO Introduction to isomerism, Tacticity stereo-chemistry of Polymeriaction of monosybstituted ethylenes disubstituted ethylenes, 1.3-btltadience properties of stereogular polymer. Mechamisum of sterespecific placement.

ZIEGLER-NATTA POLYMERIZATION: Componments of ziegler Natta Catalyst. Effect of the compoments on zigler Natta initiator system. Mechanisum of ziegler Natta polymerisation. Metallocene catalysts for polyoleffins, its mechanism.

Unit VI : Chemistry ofThermoseting Polymers .. Chemistry of synthetic and crossl inking thermosetts, such as phenolics, aminoresins, epoxides, unsaturuted polyurathens.

BOOKS RECOMMENDED :

1. Principles of Polymerisation : C.C. Odin.
2. Structure and Mechanism in Vinyl Polymerisation : Marcell Decker.
3. Kinetics and Mechanism of Polymerisation Reaction PEM Allen & C.R. Patrick.
4. Text Book of Polymer : Cliendslvy Vilmeyer
5. Copolymerisation : G.C. Man Marcel Decker.
6. Principals of Polymer Chemistry - P.G. Flory.
7. Polymer Chemistry : Bruno vollmart
8. Polymer Science & Tech. of Plastics & Rubber : P. Ghosh.
9. Physical Chemistry of Polymer - Tager.
10. Polymer Science : V. Gowarikar.

4 PP03/ 4 CH02 / 4 CT03 MACHINE DESIGN & DRAWING

Unit I :

1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :

1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4PP04 MATERIAL SCIENCE & TECHNOLOGY

UNIT I : **NATURE OF MATERIALS:** Micro and macro structures, properties and definitions; mechanical, thermal, chemical, electrical and magnetic properties, processing of metals and alloys - casting - hot and cold rolling - extrusion - forging - deep drawing - plastic deformation of metal, single crystals and polycrystalline metals - recovery and recrystallization of plastically deformed metals. (7)

UNIT II : **FERROUS METALS:** Pure iron; cast iron; mild steel, stainless steels, special steels and alloys; high temperature steels; iron - iron carbide phase diagram; heat treatment of plain - carbon steels. Manufacture, properties and application in chemical industries. (8)

UNIT III : **NON-FERROUS METALS:** Lead, tin and magnesium; manufacturing methods, properties and application in process industries.

NON METALS:

i. POLYMERIC MATERIALS: Polymerization reactions - Industrial polymerization methods - Crystallinity and stereo-isomerism in same thermoplastics - thermosetting elastomers - creep and fracture of polymeric materials.

ii. COMPOSITE MATERIALS: Fiber - reinforced - plastic composite materials - manufacturing methods - concrete - asphalt and asphalt mixtures - wood - sandwich structures.

iii. CERAMIC MATERIALS: Ceramic crystal and silicate structures processing of ceramics - properties-glasses - enamels. (16)

UNIT IV : **INORGANIC MATERIALS:** Manufacture of cement and its properties; special cement; cement concrete; reinforced and prestressed concrete: their properties and applications; mixing and curing. (3)

UNITS V : **CORROSION:** Definition and scope; basic theories and mechanism of corrosion; types of corrosion; application of corrosion; theories in equipment design and fabrication - anti-corrosion methods. (6)

UNIT VI : **COATINGS:** Organic paints and coatings; metal coatings; ceramic coatings; lining.

SELECTION OF MATERIALS: General criteria for selection of materials of construction in process industries. (5)

Books recommended:

1. Material Science and Processes, by S.K. Hajra Chaudhary.
2. Nature and properties of Engineering Materials by D. Jastrebski.
3. Material Science for Engineers, by Van Valack.

4 PP 05 MOMENTUM TRANSFER OPERATIONS

Unit I : Introductory Concepts about Fluids, Fluid statics and Fluii Kinemarics: Units arid Jimeris/ohs; dimensional analvsis. Fluids and Non Fluids, Nature of Fluid. Compressible and incompressible. Newtonian/Non Newtonian fluid, Viscosity of fluid. Newton's law of Viscosity.

Fluid Statics: Pascal Law, Hydrostatic equilibrium for compessible and incompressible fluid. U tube manometer, inclined manometer, differential manometer, inverted U manometer.

Fluid Kinematics : Types of fluid flow, potential flow fully developed flow, Steady and Unsteady flow, Uniform and noi uniform flow, Laminar and turbulent flow, Reynolds number and Reynolds experiement. Description of velocity field for laminar flow through cylindrical tube between two parallel plates. Vortex flow, free vortex and forced vortex .

Unit II: Continuity equation for fluid flow (in differential form for three dimension and integral form for one dimension)

Bernoulii's equation for potential flow, Kinetic energy. correction fluid friction iA pipe flow, concepts of friction factor. Relationship between friction factor and Reynolds No., pressure drop (Head loss due to friction). f Vs. NRC chart, Head loss due to sudden enlargement, sudden contraction, frictional losses due to fittings and valves, Power requirement for flow.

Unit III : Measurement of fluid flow:- Orificement, venturimeter Rotameter, Pitot tube, Notches and Weirs. Hot wire Anemometer quantity meter.

SECTION-B

Unit IV : Transportation of fluids : Description of pipe, tubings and valves and fittings. Pumping Devices for Liquids :

a) Centrifugal pump : Working principle, construction, Head developed by pump, Cavitation,N.P.S.H., priming, Performance and Characteristics curves, multistage pumps.

b) Positive Displacement Pump: Construction and working principle of-

I) Reciprocating Type: Piston, plunger and diaphram pump.

2) Rotary Type : Gear Pump, monopump, venetype and combination pump.

Unit V: Motion of particles through fluids, Mechanics of particle motion and equation for one dimensional motion of particle through fluid, terminal setting velocity, drag coeff, Stoke's law, Cd Vs. NRC, packed bed, loading and flooding point, fluidished bed and its types.

Unit VI : Hydraulic Fluid Power: Principle of power hydraullss, hydraulic fluids, hydraulic piping, tubing, sealing.

Hydraulic valves: Relief valves, R-type, Servo valves.

Hydraulic Systems:

1) Function and application of: Hydraulic accumulator, differential hydraulic accumulator, differential hydraulic accumulator, intensifer, ram, lift, riveter, gane.

Hydraulic Circuits: Symbols employed in various circuits.

hydraulic circuits used in plastic processing machineries.

LIST OF BOOKS :

1) Chemical Engineering. Vol.1, By J.M. Coulson and J.F.Richardson.
2) Momentum Transfer Operation by S.K. Gupta.
3) Unit Operations of Chemical Engineering W.L. McCabe & J.C. Smith.
4) Fluid Mechanics by - Rao
5) Fluid Mechanics by - R.K. Bansal
6) Fluid Mechanics by - Modi & Seth.
7) Plastics Molding Plants Vol.-I.
(Hydraulics, Compression and Transfer Equipments) By - M.G. Munns, Published.
8) Unit Operation I (Mech. Operation) by Gavane.
9) Unit Operation II (Mass Transfer) by Gavane.

4PP06 CHEMICAL ENGINEERING OPERATION-I (Mechanical Operation) –LAB

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.
4. To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To determine energy consumption and crushing law constants for jaw crusher.
10. To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
11. To determine area of batch thickener by conducting batch sedimentation test.
12. To determine efficiency of Cyclone separator.
13. To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.(Mechanical Operation)

4 PP 07 POLYMER CHEMISTRY-LAB

8 to 10 Practicals based on 4 PP 02 POLYMER CHEMISTRY

4 PP08/ 4 CH07 / 4 CT07 MACHINE DESIGN & DRAWING

DRAWING WORKS:
Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 PP 09 MOMENTUM TRANSFER OPERATIONS

1. Reynold's experiment.
2. To verify Bernouli's (equation) theorem.
3. To study frictional characteristics of fully developed flow.
4. To study losses in fittings.
5. To determine coefficient of discharge of venturimeter.
6. To determine coefficient of discharge of orificemeter, Flow of fluid through notches.
7. To compare the coefficient of drag (Cd) and Reynolds number of sphere.
9. To study sedimentation and to determine area of thickner from Batch Test.
10. Determination of viscosity of hydraulic fluid.
11. To study Characteristics Curves of centrifugal and reciprocating pump.
12. Study of various Hydraulic circukts.
    Any other experiment based on the above syllabut.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS PRESCRIBED FOR
FOUR YEAR DEGREE COURSE IN
BACHELOR OF TECHNOLOGY
(CHEMICAL TECHNOLOGY)
FOOD, PULP & PAPER, OIL & PAINT AND
PETRO CHEMICAL TECHNOLOGY
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)
THIRD & FOURTH SEMESTER

SEMSTER : THRID

3 CT 01 APPLIED ORGANIC CHEMISTRY

SECTION-A

Unit I :
1) Aromatic hydrocarbons : Preparation, properties and applications of Benzene, Naphthalene and Anthralene
2) Heterocyclic compounds : Classification of heterocyclic compounds, preparation, properties and applications of pyrrole, thiophene, furan, pyridine, & quinoline.

Unit II :
1) Alcohols : Basic concepts, classification of alcohols, preparation, properties and applications of Lauryl & Cetyl alcohol.
2) Phenols : Basic concepts, classification, preparation, properties and applications of phenol, resorcinols, cresols, catechol and pyrogallol.

Unit III :
1) Acids and Esters : Basic concepts, preparation, properties and applications of Aceto acetic acid, malonic acid and their esters.
2) Amines and their derivatives : Basic concepts, classification of amines, preparation, properties and applications of aniline and Benzene diazonium chloride.

SECTION-B

Unit IV :
1) Study of Chemistry of Unit Process : Nitration, nitrating agents, kinetics and mechanism of aromatic nitration. Technical preparation of nitrobenzene and nitronaphthalene.
2) Study of Chemistry of Unit Process : Sulphonation and Sulphation : Sulphonating & Sulphating agents, kinetics

of mechanism of sulphonation. Technical preparation of Sulphonation of Benzene and sulphation of alpha lauryl alcohol.

Unit V : 1) Study of Chemistry of Unit Process : Halogenation : Halogenating agents, thermodynamics, kinetics. Technical preparation of DDT and Vinyl chlorides.

2) Principles of polymer chemistry and practices : Classification of polymerisation. Types of polymers. Technical preparation of Polyvinyl chloride, Bakelite.

Unit VI : 1) Carbohydrates : Basic concepts, classification, industrial applications of glucose, sucrose and starch.

2) a) Chemicals in food products : Study of preservatives, sweetening agents and antioxidants.

b) Chemistry of natural products : Classification of terpenes, alpha pinene, creramiol.

BOOKS RECOMMENDED :

1) Organic Chemistry (Vol. I & II) : I.L.Finar, Longman Group Ltd. and the English Language Book Society, London, 6th edition.

2) Advance Organic Chemistry : Fieser and Fieser, Asia Pub. House, Mumbai, 1961.

3) Unit Process in Organic Synthesis : P.H.Groggins, McGraw Hill, 5th edition.

3 CT 02 APPLIED PHYSICAL CHEMISTRY-II

Unit I : **Macromolecules :** Nomenclature, functionality and classification of macromolecules, Number average and weight average molecular weight of macromolecules , Methods of molecular weight determination , Viscosity measurement, Membrane osmometry, Light scattering , Sedimentation and ultracentrifuge methods, Intrinsically and Extrinsically conducting polymers, Doped conducting polymers and their applications, Effect of polymer structure on properties of polymers, Numerical on molecular weight determination. (6 Hrs)

Unit II : **Electrochemistry :**

Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on

conductivity, Kohlraush law and ionic mobility ,Electrolytic concentration cell

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation, Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of activity and activity coefficient from equilibrium constant

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (10 Hrs)

Unit III : Thermodynamics

Origin of First law, thermodynamic terms and their definitions, Heat ,Energy and work function Second law, carnot's cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, Entropy of spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partial molar properties, chemical potential,

Unit IV : Photo- chemistry, spectroscopy and advanced analysis Techniques

Photo- chemistry : Photochemical reactions, lamberts and Beers law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, NMR- Spectra, instrumentation and their applications.

Thermal analysis techniques of polymers : Thermal Gravimetric Analysis (TGA) , Differential Thermal Analysis (DTA), and Differential Scanning calorimetric (DSC) (8 Hrs.)

Unit V : Kinetics and molecular reaction dynamics

Chemical equilibrium : introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .

Kinetics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of polymerization reaction, Methods for determination of order of reactions. Theories of reaction rate,

Unit VI : Surface phenomenon and Catalysis

Adsorption , Classification of adsorption, Freundlich isotherm , Langmuir theory of adsorption, BET adsorption isotherm and its application for determination of surface area of fine powder. Numerical on isotherm and surface area.

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, mechanism of catalytic action, Enzyme catalyst, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (8 Hrs)

Books recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill
6. Polymer chemistry, Gowarikar.

3CT03 /3CH03 / 3PP03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :
1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :
1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :
1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.

Axially loaded columns (Euler's and Rankin's formula).

Unit –V :
1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams

Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 CT 04 APPLIED THERMODYNAMICS

SECTION-A

Unit I :

Text Books:

1. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, "Chemical Process Principles", Vol 1, John Wiley

3 CT 06 APPLIED ORGANIC CHEMISTRY-LAB

1) Identification of pure organic compounds on the basis of reactions of the functional groups (any four compounds)
2) Separation of the two component simple mixture and their identification (any four mixtures)
3) Simple organic preparations :
   i) Acetanilide
   ii) Nitro Acetanilide
   iii) Aspirin
   (any two)

BOOK RECOMMENDED :

Laboratory Hand Book of Organic Qualitative Analysis and Separation : Kulkarni V.S., D. Ramchandra & Co., Pune.

3 CT 07 APPLIED PHYSICAL CHEMISTRY-II LAB

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between ($K_2S_2O_8$+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of refractive index.
(Any 10 experiments)

3CT08 /3CH07 / 3PP08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.

6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3CT09 APPLIED THERMODYNAMICS – LAB

Practicals :

Ten experiment based on the above syllabus evenly distributed, shall be performed and report/journal there of should be submitted by each student.

The practicals shall consist of practicals and viva-voce based on the syllabus and preactical work.

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SEMSTER : FOURTH

4 CT 01 ENGINEERING MATHEMATICS-II

Students are expected to be aware of the statements of the reievant tneorerns without mastering their proofs.

Unit I : Partial Differential Equations Basic concepts (@J 1.1), Vibrating string (@11.2), separationof variables (@11.3), one dimensionalheatf1ow(@11.5), Heatflow in an infinitebar {@11.6) (10 periods)

Unit II: Complex numbers and analytic functions
Complexnumbers(@12.1), polar fonn(@12.2),Complex function limit, derivative analytic function (@12.4), Cauchy Riemann Equat.ons, Laplace's Equation(@12.5), rational functions(@12.6), Exponential function (@12.7), Trigonometric and hyperbolic functions (@12.8), logarithm{@12.9)
(10 periods)

Unit III : Numerical Analysis
Errors in computation (@19.1), Solution of Equations by iteration, Newton - Raphson method (@19.2) Fmite differences {@19.3}, Interpolation (@19.4), Numerical integration using rectangular, trapezoidal and Simpson's rule, numerical differentiation (@19-6) (10 periods)

Unit IV : Optimization Basic concepts (@22.1), Linear programming{@22.2), Simplex method{@22.3),(@~2.4)
(l0 periods)

Unit V : Probability and Statistics
Sample mean and variance (@23.3), probability (@23.S), Permutations and combinations (@23.6), descrete and continuous distributions (@23.7), mean and variance of a distribution (@23.8), Binomial, Poisson distributions (@23.9), Normal distribution (@23.10) (10 periods)

Unit VI : Probability and Statistics (continued)
Random sampling (@23.12), Estimation of parameters (@23.13), confidence intervals (@23.14), Testing of hypothesis (@23.15), Fitting straight lines (regression analysis) (@23.20)
(10 periods)

Note : Numbers in bracket refer to section number; T1 "Advanced Engineering Maths" by Erwin Kreyszig (Finn jdn), Wiley Eastern.

Books Recommended :

1) Elements of Applied Mathematics: P.N. Wartikar & J.N. Wartikar
2) A text book of Applied Mathematics: P. N. Wart i ku r & J. N. Wartikar
3) Advanced Engg.Mathematics - Erwin Kreyszig, Wiley Eastern (5th Edition)
4) Higher Engg.Mathemetics . B.S.Greval.

4 FT 02 FOOD TECHNOLOGY-I

CHEMISTRY OF FOODS

Development of Food Chemistry :
History of Food Chemistry. Nature and Origin of life. Basic activities of animals and plants and their relations.

Water and Ice:
Importance of water in foods. Structure of water and ice. Concept of bound and free water and their implications.

Carbohydtrates :-
Nomenclature, Classification and structure of Carbohydrates. Chemical reactions of carbohydrates. Physical and Chemical properties of sugars, starch, pectic substances, gums and other polysacchrides, Functional properties of carbohydrates in foods.

Lipids:
Definition and classification of lipids, Chemistry of fatty acids and glycerides, Physical and chemical characteristics.
Chemistry of processing of fats and oils, hydrogenated fats, shortening agents and confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Functional properties of lipids in foods.

Protein:
Importance of proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and proteins Sources and distribution of proteins. Isolation identification and purity of proteins, Denatruation Functional properties of proteins in food.

Fruits and Vegetables:
Plant Cells and tissues, their structure, functions and physiology, Chemical Composition of edible plant tissue. Texture of fruits and vegetables. Effects of cooking on texture and composition of fruits and vegetables.

Meat. Fish and Poultry :
Animal Proteins, Structure and chemical composition of muscles, Myoglobin and hemoglobin - Post - Mortem charges regor mortis. Methods of cooking and processing and their influence on texture. Physical and chemical changes during cooking Palatability characters; texture and tenderness. Structure

and composition of eggs. Cbemistry and functional properties of eggs.

Milk and Milk Products :

Composition of milk, Physical and chemical properties of milk protein and effects of processing on these. Chemistry of milk product like cheese, cream, butter, ghee etc.

Miscellaneous:

Sensory perception of tests and flavors. .Browing reactions, Nutritive and non-nutritive sweetners. Food dispersions and their implications on foods.

Books Recommended :

1. Food Chemistry by L.H. Meyer, Publishers, Van Nostrand Reinhold Co.New York, Latest Edition.
2. Principles of Food Science- Edited by Owen R. Fennema, Part I Food Chemistry, Publishers Marce Dekker, Inc. New York.
3. The Chemical Analysis of Foods and Food Products : Morries, B.Jacobs 3rd Edition, Publishers Van. Nostrand Company, INC. Princeton, New.
4. Introduction to the Biochemistry of Foods by J..B.S. Braverman, Publishers Elsevier Publishing Co. Amsterdam, Latest Edition.
5. The Spice Hand Book by J. W.Patty, Publishers Chemical Publishing Co. Inc.New York,. Latest Edition.
6. Food Theory andApplication by Paul, Pauline and Palmer, Helen H., Publishers, John Wiley and Sons. NewYork,. Latest Edition.

4 PT 02 PULP & PAPER TECHNOLOGY-I
CHEMISTRY OF WOOD AND PULP OF PAPER MATERIALS

Species, anatomy and physical properties of Wood:-

Classification of woods, plants used in pulp and paper, gross structure of trunk, structure elements of wood, fiber dimensions water conducting system, food conducting system, reactions of wood, bark and its structural elements, dec of wood, physical properties of wood.

Fiber morphology: Cell formation and growth, fiber structure, chemical composition of wood, non-wood fibers used in pulping bast, fruits, grass, leaf, animal, mineral and synthe: ic fibers.

Cellulose: Chemistry and location in the cell, isolation molecular constitution, microfibrils, crystalline and amorphoupus Pulp of Paper biogenesis of the cell wall, Polysacchrides, sorption, swelling and solution of cellulose, degradation reactions of pulp of paper.

HemicelluJoses : Structure and properties of hemicelluloses.

Lignin: Lignification in wood, biological and biochemical aspects of lignin information, structure and properties of lignin, separation of lignin from woody

tissues and Fiber laboratory separation, commercial separation, analysis of 'lignin and utilization of Lignin.

Books Recommended :

I. "The Chemistry of Cellulose" by Emil Hauser, John Wiley & Sons, New York.
2. "The Methods of Cellulose Chern. " by Charles Dorce, Chapman & Hall, L.
3. High Polymers Vol V (Part-I to V) edited by Emil Ott & Others, Interscience Publishers.
4. Publishing Processes by S.A.Rydholm, John Wiley & Sons, Inc.,New York.

S. Pulp & Paper : Chemistry & Chemical Technology by James P. Cascy.

4 OT 02 OIL & PAINT TECHNOLOGY-I
(CHEMISTRY OF OIL AND FATS)

Natural Fats : Their Sources, classification and composition Constituents of natural fats : Glycerides, Phospholipids, Fatty acids, non-glycerides constituents, toxic constituents and detoxication, Nutritional functions of Fats.

Glycerides and fatty acids : Nomenclature, Structure, occurence in fats. Physical properties of fats and fatty acids. Elementary ideas on their liquid properties, solution properties and spectral properties.

Chemical reaction of fats and their fatty acids. Chemistry of hydrogenation, hydrogenolysis, autoxidation, polymerisation dehydration, pyrrlysis, halogenation, sulpation and sulphonation esterification, interesterification and hydrolysis and hydraziolysis, Chemical Oxidation of fatty acids, Significance and importance of these reactions.

Physical and Chemical characteristics : Elementary methods of oilseeds, oils, fats and fatty acids. Identification of fats. Detection of adulternation in fats and Indian standards for oils and fats. Oils Antioxidant and synergists.

Books Recommended :

1. Industrial Oil and Fat Products Ed. : A.E.Bailey. Interscience & Sons New York, London, Sydney 3rd Edition.
2. An Introduction of the Chemistry and Biochemistry of Fatty Acids : Gumstone.
3. Progress in the Chemistry of Fats and other liquids (Vols. 1 to 11) T.R.Holmann, Pergamon Press.
4. Fatty Acids : K.S.Markley, Inter Sc.Publishers, 2nd edition, New York.

5. Industrial Chemistry of Fats and Waxes : T.Hilditch Balliere Tindall and Cox, London 2nd Edition.
6. In-Hibiton of Fat Oxidation Processes :K.A. Allen
7. Rancidity of Edible Fats : C.H.Lea, His Majesty's Stationary Office, London, Latest Edition.
8. Analysis of Fats and Oils : V.V.Mellen Bacher, Garrard Press Publishers, Illinois, Latest Edition.
9. Technical Books of Oils and Fats Analysis : L.V.Cocks.

4 PC 02 PETROCHEMICAL TECHNOLOGY-I

CHEMISTRY OF PEIROLEUM HYDROCARBONS

Origin, occurence, exploration or" crude' petroleum (Oil). Geophysical methods used in prospecting. Drilling. Production transportation and storage of crude oil. Hydrocarbon resources in India, history and future trends.

Classification and description of crude oils.

Hydrocarbon composition of petroleum and petroleum products (liquid and gas). Nonhydrocarbon compounds in petroleum.

Use of modem physico-chemical techniques such as UV.I.R.NMR Mass spectroscopy, GLC etc. in petroleum and product analysis and hydrocarbon molecular structure determination of petroleum fractions.

Thermodynamics, reaction mechanism and kinetics of principle catalytic and non-catalytic chemical and group reactions of hydrocarbons such as cracking, Pro lysis, reforming, isomerization, alkylation, hydrogenation, oxidation halogenation, polymerization etc.

Sources of hydrocarbons other than crude oil, future automative fuel sources, new and future energy sources.

Books Recommended :

1. Chemical Technology of Petroleum by Gruse and Stevens, Mc Graw Hill. Latest Edition.
2. Hydrocarbons from Petroleum by Rossini and Mair, Reinhold, Latest Edition. J
3. Modern Petroleum Technology by G..D. Hobson and W.Pohl. Applied Sciences Publishers, Latest Edition.
4. The Petroleum Chemicals industry by Goldstein and Waddams, E.& F. N. Spon Ltd. Latest Edition.
5. The Chemistry of Petroleum Hydrocarbons, Vols. I.Il & III edited by Brooks. Board, Kruiz and Schmerling, Reinhold Latest Edition.
6. Chemicals from Petroleum by Waddams, John Murry, London, Latest Edition.

7. An Introduction to Industrial Organic Chemistry by P. Wesiman, Applied Science, Latest Edition.

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4 CT03 /4 CH02 / 4 PP03 MACHINE DESIGN & DRAWING

SECTION-A

Unit I :
1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :
1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4 CT 04 MATERIAL TECHNOLOGY

SECTION-A

Unit I : Crystalline and non crystalline structure sensitive and insensitive properties and defects in crystals. Corelation of mechanical properties with reference to structure.

Unit II: Effect of temperature on mechanical properties various rnetho of improving the strength failure under service conditions

Unit III : Solid solutions phase diagrams and their relation to meta properties with reference to steels and cast irons.

SECTION-B

Unit IV : Heat treatment of steels and common on ferrous alloyes.

Unit V: Elastomers and plasiomers, molecular structure and properties of polymers, ceramic materials and retractories, High ternperature oxide ceramics glasses and their properties, composite materials.

Unit VI : Corrosion: Electrode potentials e.m.f and galavanic series, polarization forms of corrosion, rate factors, inhibition, prevention, control and testing, Corrosion behaviour of metals and alloys chemical resistance of polymers, Forming processes and corrosion. Non destructive methods of testing, Metallic, Plastic and other protective coatings.

Books Recommended :

1. Nature and properties of Engineering Materials by D.Jastrebski.
2. Introduction to Materials science by Guy.
3. Materia! Science and Processes by SK.Hajra Chaudhry
4. Material Science for Engineers by Van Valack.

4 CT 05/ 4CH01 FLUID FLOW OPERATIONS

The subject gives the knowledge of fluid flow and various fluid transportations. This knowledge is useful in different subjects to be studied in Chemical Engineering course.

Objectives: After studying the subject student will be able,

1. To distinguish between different types of fluids.
2. To understand the concept of viscosity.
3. To Calculate flow rates.
4. To understand the principles behind different flow meters.

5. To understand the principle and working of different fluid flow machinery.

SECTION A

Unit I: Properties of fluids and their classification.
Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids. Forces on submerged bodies. Rigid body motion, pressure measurements, Euler's equation. (8)

Unit II: Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis; Buckingham'sÐ.theorem ; Dimensionless numbers and their physical significance; Similitude criteria. Mixing and agitation of fluid, Types of mixers and their selection; Power requirement. (7)

Unit III: Fluid flow: Laminar and turbulent flows; Pressure drop in pipes and tubes, pipe fittings and pipe network and friction factor; Conservation of mass, momentum and energy; Navier-Stokes equation; Mechanical energy balance and Bernoulli's Theorem. (8)

SECTION B

Unit IV: Flow measuring devices for chemical plants: Orifice meter, nozzle and venturi meters, rotameter and pitot tube. (8)

Unit V: Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and blowers. NPSH and calibration.
Mixing and agitation of fluids. Compressible fluid flow and aerodynamics. (8)

Unit VI: Flow past immersed bodies, flow through packed bed fluidized bed.
Introductory concepts of two-phase flow. (6)

Books Recommended:

1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill.
2. Chemical Engineering, Vol. 1, Coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford.

4 FT 06 FOOD TECHNOLOGY-I -LAB

General methods of proximate analysis of food materials. Analysis of Oils and Fats, Chemical Analysis of carbohydrates and proteins, taniles vitamanies etc. colorimetric methods for starch. and qualitative detection of carbohydrates and proteins, taniles, vitamins etc. Colorimetric methods for starch, polyphenols, carotenes Xanthophylls etc. Paper chromatography and qualitative detection of carbohydrates, proteins and, tats oils, Colour. test for oil.

Qualitative and quantitative analysis of acided and antioxidates. Chemical Preservations like benzoic acid and sulfur dioxide, Non-Nutritive Sweetness and emulsifying agents.

Books Recommended :

1. The Chemical Analysis of Foods, Sixth Edition by David Perason, J.O.A. Churbcill, 104 Gloucester place London. 70
2. Manual of Analysis of Fruits and Vegetable Products: S.Ranganna, Ph.D. Central Food Technological.
   Research Institute, Mysore, Publisher, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Food Analysis by A.G. Woodman, 4th Edition, Publishers, Mc.Graw Hill Book Company, INC, New York and London, Latest Edition.
4. Modem Food Analysis by F.Leslie Hart A.N. and Hary John Stone Fishes. Ph.D. Publishers, Springer - Verlag. Berlin Heidelberg, New York, Latest Edition.
5. Food Analysis by RLees, Published by Leonard Hill Books, London.
6. Official Methods of Analysis of Association of Official Analytical Chemists, Pub.Associ. Office, Anal, Chemist, Washington D.C. Latest Edition.
7. Approved Methods of the American Association of Cereal Chemist, Vols. I & II, Latest Edition. Published by American Association of Cereal Chemist inc. Paul, Minnesota U.S.A.

4 PT 06 PULP & PAPER TECHNOLOGY-I- LAB

Determination of various components of wood such as moisture content. ash content, Water Solubility, alkali, solubility extractives, lignin Cellulose; hemicellulose, holocellulose pentosans etc. Microscopic observations of fibrous materials.

4 OT 06 OIL AND PAINT TECHNOLOGY-I -LAB

Determination of various Physical and Chemical characteristics of oils, fats and waxes, colour, solubility and thermal test for purity. Analysis of oil

seeds and cakes, estimation of rancidity. Analysis of nickel catalysts and acid oils determination, Physical and Chemical, characrcrisitcs of vanaspatis, margarine and ghee. Detection of adulternarion.

Use of microscope, colonmeter, spectrophotometer, pl-l meter, untometer, polarimeter, viscometer, penetrometer and dialatometer.

4 PC 06 PETROCHEMICAL TECHNOLOGY-I -LAB

Analysis and testing of Petroleum and petroleum products Determination of acidity saponification Value, iodine value, Bromine Number, Smoke point, Aniline point and Diesel index, Cloud and Purpoint Flash and Fire point by different apparatus (Abel, Penxky-Martens, Cleveland) Congealing, Melting and Proprnelting point of waxes, Drop point and Cone- Penetration of Greases, Softening point and cone penetration of Bitumens etc.

Books Recommended :

1. I.P.Standards for Petroleum and its products. Published by Applied Science Publishers Ltd., London, 33rd Edition. Latest Edition.
2. Methods of Testing for Petroleum and its products, IS/1448 Part-I to Part IV published by Indian Standards Institution, New Delhi, Latest Edition.
3. American Standards for Testing materials, Publishers by ASTM, New York, Latest Edition.
4. Criteria of quality of Petroleum Products - I.P., Allinson. Applied Science Publishers Ltd., London, Latest Edition.
5. Quality Assessment of Petroleum Products - Edited by George Sell, I.P.London, Latest Edition.

4 CT07 /4 CH07 / 4 PP08 MACHINE DESIGN & DRAWING-LAB

DRAWING WORKS:

Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 CT 08 MATERIAL TECHNOLOGY-LAB

Ten experiments based on the above syllabus evenly distribute shall be performed and a report/journal there of submitted by each student.

The practical Examination shall consist of practicals and viva voce based on the syllabus and practicals.

4 CT 09 /4 CH 06 FLUID FLOW OPERATIONS - LAB

List of Experiments:

1. To obtain the coefficient of discharge for the given venturimeter and obtain its relationship with Reynolds' no.
2. To calibrate the given Rotameter.
3. To obtain the coefficient of discharge for the given orifice meter and obtain its relationship with Reynolds' no.
4. To study the flow and determine critical Reynolds no.
5. To determine the discharge co-efficient of the given v-notch.
6. To verify the Bernoulli's theorem.
7. To determine the viscosity of the given liquids using Stoke's law.
8. To determine the viscosity of a given liquid by measuring efflux time of a given tank. Also determine the diameter of a given capillary and compare.
9. To determine relation between friction factor and Reynolds number for the given flowing fluid through circular pipe.
10. To obtain relation between friction factor and Reynolds number for flow of water through annulus.
11. To determine the resistance offered by various pipe fittings and express them in terms of equipment straight pipe length.
12. To study characteristics curves for a centrifugal pump.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

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Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS
PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
B.E. BIOMEDICAL ENGINEERING
III & IV SEMESTER EXAMINATIONS
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)
THIRD SEMESTER

Inpalnt Training & Industrial Visit in the faculty of Engineering & Technology

1) a) the inplant training shall not be compulsory,

b) the inplant training shall be taken by students strickly during Summer vacation. after IVth or VIth Semester examination and / or during Winter vacation after Vth or VIIth Semester examinations,

c) the inplant training shall not be part of examination system, however, student shall prepare and submit report after completion of training to the concerned Head of Department alongwith certificate issued by the industry,

d) the inplant training shall be of minimum two weeks duration,

e) there shall not be any liability whatsoever on the Institution with respect to implant training of the students,

f) students shall undertake inplant training on their own risk and cost. An undertaking in this regards signed by student and parents shall be submitted before proceding for training to the concerned Head of Department/ Head of Institution.

g) the students shall complete inplant training under the supervision of concerned person in the industry,

h) Institutes shall help students to organise inplant training by way of correspondance,

2) Industrial Visit : Industrial visit may be organised for the students. Students should prepare & submit the report on Industrial visit to the concerned Head of Department/Head of Institution.

3BM01 **TRANSFORMS & PROBABILITY**

Unit I: Fourier Series: Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Sawtoothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity

Unit II: Fourier Transform (FT) and its properties; Inverse Fourier Transform; Fourier transform of derivative; Convolution; Application of Fourier Transform in solving partial differential equations - Laplace's Equation (2D only), Heat Conduction Equation (I D only) and Wave Equation (I D only).

Unit III : Calculus of Complex Variable: Functions; Limits and Continuity; Analytic Functions; Cauchy Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and it's application to evaluation of integral; Introduction to Conformal Mapping; Simple problems.

Unit IV : Probability and Statistics:

Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; . General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability

Unit V : Distributions - Probability mass function; Probability density function; Distribution Function; Expectation; Variance; Probability Distribution-Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting.

Unit VI : Graph Theory:

Graphs; Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path, Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut Set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs . Network; Flow Augmenting Path; Ford-Fulkerson Algorithm for Maximum Flow; Max Flow - Min Cut Theorem

Text Books:

I. Grewal B S: Higher Engineering Mathematics (thirtyfifth edn) - Khanna Pub.

2. Lakshminarayan- Engineering Math 1.2.3

3. Prasad: Partial Differential Equations, New Age International

4. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill

5. Ross S L: Differential Equations - John Willey & Sons.

6. Bhat: Modern Probability Theory, New Age International

7. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.

3BM02 **HUMAN PHYSIOLOGY**

Unit I : Basic Biological (Biophysical & Biochemical) Principles:

Diffusion, surface tension and viscosity - their characteristics, factors influencing and biological applications. Osmosis - osmometers,laws of osmosis, biological applications, relation with depression of freezing points. Acids, bases and pH. Colloids - classification,properties - optical and electrokinetic, biological importance of colloids. Dialysis and ultra-filtration. Electrophoresis: Principles & applications, Gel electrophoresis. Adsorption. Gibbs-Donnan equilibrium. Radioactivity - radioisotopes and their biological applications. Principles of radioimmunoassay (RIA), autoradiography. The resting membrane potential. The action potential. Electrotonic potentials. Propagation of nerve impulse in different types of nerve fibers. Compound action potentials.

Unit II : Genetics:

Nucleic acid- I. Structure of DNA- Physical & Chemical properties of DNA & RNA, Ultra structure & types of DNA & RNA(indetails), Brief idea about super coiling of DNA Semiconservative mode of replication of DNA, Mechanism of replication of DNA"Genetic code. Genetically relation of color blindness and ocular albinism.Chromosome

aberration- Structural aberration- Deletion- Duplication- Inversion- translocation. Numerical aberration (Polyploidy - &aneuploidy- Hyper & hypo). Gene mutation- classification- spontaneous & Induced- Chemical mutation- Practical Application of mutation.

Unit III : Blood Vascular system

Composition and functions of blood. Plasma proteins - normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood - origin, formation, functions and fate. Hemoglobin - functions, compounds and derivatives. Abnormalhemoglobin-overview. Thalassemia-brief idea. Different types of anemia and their causes-overview. Erythrocyte sedimentation rate(ESR) and its significance. Hematocrit. PCV, MCV, MCH~ MCHC. Blood volume -normal values, regulation. Blood coagulation -factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups - ABO systems and Rh factors. Bloodtransfusion.UItra structure & functions of blood vessels (artery & vein). Structure type and function of capillaries. Differences between artery &vein.

Unit IV : Muscular Physiology:

Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles. Difference between skeletal, smooth andcardiac muscles. The sarcotubular system. Red and white striated muscle fibers. Single unit and multi unit smooth muscle. Motorpoint. Properties of muscle: excitability and contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Electromyography. Muscle contraction - E C Coupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast musclefibers, Isotonic & Isometric contraction.

Unit V : Neuro Physiology:

Electron microscopic structure of nerve cell or neurons. Neuroglia. Myelinated and unmyelinated nerve fibers. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers. Synapses - types, structure, synaptic transmission of the impulse, synaptic potentials, neurotransmitters. Motor unit. Injury to peripheral nerves- degeneration and regeneration-brief idea. Automatic nervous system - Introduction, Comparison of autonomic & somatic nervous system, Anatomy of autonomic motor pathways - Pre-ganglionic neurons, autonomic ganglia, sympathetic ganglia, autonomic plexus, post-ganglionic neurons structure of sympathetic and parasympathetic division. ANS- neurotransmitter and receptors- cholinergic neurons & receptors. Receptor agonist & antagonist. Physiological effect of ANS- sympathetic & parasympathetic response. Integration & control of autonomic function- autonomic Reflexes, autonomic control by higher centers.Neural Transmission- Introduction, Autonomic Synaptic Transmission-Modes of transmission, sympathetic & parasympathetic response. CNS Synaptic transmission- Electrical synaptic transmission & chemical synaptic transmission.Neuro muscular Junction - The neuromuscular junctions - structure, events in transmission, end-plate potential, post titanic potential.

Unit VI : Cardio Vascular System

Structure & function of Heart & blood vessels (m1ery, vein and capillary) (Anatomical position, chambers of heart.) Blood circulationthrough heart. Special Cardiac cycle. Heart Sound , Blood vessels - type, Structure & function, Systemic & pulmonary circulation. Blood - composition, Function,

blood group, Blood clotting. Cardiac cycle and cardiac output. Blood Pressure-regulation & controlling factors.

. Renal System- Function of kidney, Anatomy & Histology of Nephron & collecting duet. - Urine formation (Filtration, reabsorbtion and secretion)- Counter - current system of urine concentration, Anomalies in urine concentration. Physiology Practical Code: BME 392

Text books

1. Snell, Bio Physical Principles of Structure and functions
2. Ruch and Patton, Bio Physics and Medical Physiology

Reference books

1. Concise medical physiology by Sujit K. Chaudari , New central book Agenc Pvt. Ltd.
2. Textbook of Physiology by Chattergi

3BM03 TRANSDUCER AND SIGNAL CONDITIONING

SECTION A

UNIT I: Transducer : Defination, Classification, Selection criteria.Errors Loading effects, Basic configuration of control system Transducer specifications. (07)

UNIT II: Displacement,Fore & Torque Transducers: Displacement Resistive, Inductive, Strain gauge, Capacitive, Piezo electric Digital, fibre optic, Laser type transducers.

Force-Force measuring transducers, Electric load cell,LVDT, Piezo electric type.

Torque Strain Gauge transducers. (08)

UNIT III: Temperature Transducers: Temperature scales,Glass thermometers,Bimettalic & memory shaped alloy thermometers, Semiconductor, temprature detector (thermistor & P-N junction). Resistance themometer, Themocouples,Ultrasonic, Crystal, Infrared thermometers

Velocity Transducers: Tachometers, Toothed rotor tachometers,photo electric, Stroboscopic principles. (09)

SECTION-B

UNIT IV : Flow Transducers: Basic measurement principles, Bernoulli's theorem, Differential pressure type (Orifice, Ventury,Anubar Pitot tube),Variable area type, Magnetic, Ultrasonic,Positive displacement type ,Mass flow meter, Annemometer,Total flow meter.

Level Transducers:For liquids & solids - float type displacer, Diaphragm box level gauge ,DP cell Ultrasonic, Radioactive transducers,Microwave. (10)

UNIT V: Pressure Transducers: Pressure scales & standards, Manometers, Elastic(Bellows,Bourdon tube,Diaphragm)type, Electrical pressure sensors (LVDT,Strain gauge,load cell,Piezo-electric,Capacitive),Differential pressure sensors(Capacitive,Force balance & vibrating cylinder type),vacuum pressure measurement, thermal conductivity & ionization type, Transducers for very high pressure measurement. (09)

UNIT VI: Humidity Transducers:Psycrometer,Hygrometer(Hair,wire & Electolysis type),Dew point meter.Piezo-electric humidity meter,Infrared conductance & Capacitive type probes for moisture measurement.Acoustic Transducer & sound level measurement. pH & Conductivity sensors:pH scales & standards,principle of pH measurement,Different types of reference & measuring electrodes.Principles of conductivity measurement, conductivity cells & bridges. (09)

REFERENCE BOOKS :

1. Measurement System by E.O.Doebelin
2. Principles of Industrial Instrumentation by Patranbis
3. Experimental Methods for Engineers by J.P.Holman
4. Mechanical Industrial Measurements by R.K.Jain

3 BM04 ELECTRONIC DEVICES & CIRCUITS

SECTION-A

UNIT I: Diodes : Characteristics of semiconductor diodes,diode resistanse. Rectifying circuits & do power supplies,HWR,FWR,BR,comparison. Filter circuits for power supplies: Inductor, Capacitor, LC, IT Filters.

UNIT II : Concept of amplification,Ai,Av and Ap; Ri,Ro.Conversion efficiency. Basic transistor operation,Basic characteristics of transistor amplifier. Transistor input characteristics,CB amplifier CC amplifier.

UNIT III: The CE amplifier Graphical analysis, Input & output resistance, Input wave form consideration, Comparison of amplifiers. Transistor biasing : Stability Factor, CB bias , Emitter bias, Bias compensation.

SECTION-B

UNIT IV : Oscillatars : Effect of positive feedback. phase-shift oscillator, Wein-Bridge oscillator, RC Oscillator, Transistor as a switch, switching time in transistors, Multivibrators.

UNIT V : FET amplifiers: Advantages & disadvantages of FET. Principle of operation, characteristics, Comman source AC amplifier. Fixed Bias. Source follower, Frequency Response. Introduction is MOSFETS.

UNIT VI: Opto Electronic Devices : Fundamentals of light, photoconductive sensors, photodiodes, phototransistors, their principle of operation & applications.photovoltaic sensors.photoemiss ive sensors.Light emitters,Alphanumeric displays. photocouplers.

Text Books :

1. Malvino : Principles of Electronics (TMH)
2. Millmam & Halkias : Electronic Devices & Circuits (Mc Graw Hill)
3. Millmam & Halkias: Integrated Electronics (Mc Graw Hill)
4. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).

3BM05 BIOPHYSICS

Unit I :- Body fluid: Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates: Arrhenius equation. Photochemical reaction, the law of photochemistry, fluorescence and phosphorescence, Principles of colorimeter, Beer-Lambert's law.

Unit II :- Biophysical activity of heart: electrical activity of the heart, junctional tissue of heart.(Myogenic and neurogenic heart-conducting system of heart). monophonic and biphasic recordings, original and propagation of excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiography, waveform and easurement, ECG in diagnosis, arrhythmia's, flutter, fibrillation, vulnerable period, phonocardiography, ballistocardiography.

Unit III :- Biophysical activity of brain and other organs: electrical activity of brain, waveforms & measurements, electrogastrography, electroneurography, nerve conduction studies, electroretinography, electroocculography, recording electrodes, interfaces,skin contact impedance, biological transducers, receptor potentials.

Unit IV :- Introduction to electrical simulation: Properties of nerve fibers - excitability, conductivity, all-ornonelaw, accommodation, adaptation, summation, refractory period, indefatiguability impedance & current distribution, dielectric properties of biological materials, skin impedance, total body impedance, impedances at high frequencies, high voltage & transient properties, patient safety, electrical shocks and hazards, leakage currents, types & measurements, protection against shock, burn & explosion hazards.

Unit V :- Radioactivity: Radio emission, radioisotopes, law of radioactive decay, half life period, production of radio isotopes for medical use, electromagnetic radiation, interaction of radiation with matter, exponential attenuation, half value thickness, photo electric, Compton and pair production process and their significance in radiology, radiation units, detection and measurements of radiation

Unit VI :- Introduction of ultrasonic wave: Ultrasonic wave motion, wave characteristics, intensity, and ultrasound properties in body (velocity, attenuation, reflection, refraction and absorption). Use of ultrasound in biological field.lntroduction of magnetic field: Optical activity and magnetic rotation of substances, dipole moments, magnetic properties of substances. Useful and harmful effects of magnetic fields, radio waves, micro waves, ultra violet radiation and infrared radiation on human beings.

Text books

1. W.R.Hendee & E.R.Ritenour, Medical Physics.
2. Massey and Meredeth, Medical Physics.

Reference books

1. Plummer, Bio Chemistry - The Chemistry of Life, Mc Graw Hill.
2. Patrick Rcully, Electrical Simulation & Electropathology, Cambridge University press
3. Joseph Bronzino, Biomedical Instrumentation.
4. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill
5. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book.

3BM06 HUMAN PHYSIOLOGY-LAB

8-10 Experiments based on 3 BM 02 Human Physiology.

3BM07 TRANSDUCER AND SIGNAL CONDITIONING - LAB

LIST OF EXPERIMENTS

1. Testing & calibration of T,J,K,R & S thermocouples
2. Callibration of pt-100.
3. a) Callibration of strain indicator
   b) Weight measurement by load cell.
4. Study of LVDT & irrs application in thickness measurement
5. Level measurement by capacitance probe.
6. Flow measurement by Differential pressure type transducers
7. Study of Bellows,Bourdon tubes & Diaphragms.
8. RPM measurements using photodetector technique.
9. Study of electrical pressure probes.

10. Study of pH meter,conductivity meter.
11. Humidity measurement by psycrometer.

Note : Students are expected to perform minimum eight experiments

3BM08 ELECTRONIC DEVICES AND CIRCUITS-LAB

8-10 Experiments based on 3 BM 04 Electronic Devices & Ckts.

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FOURTH SEMESTER

4BM01 OBJECT ORIENTED TECHNOLOGIES

SECTION-A

Unit I : Objects & Classes in C++ : Declaring & using classes, Constructors, Objects as functions arguments, Copy Constructor, Static class data. Arrays of objects, C++ String class.

Unit II : Operator overloading : Overloading unary & binary operators. Data conversion. Pitfalls of operator overloading. Pointers & arrays. Pointers & functions. new & delete operators. Pointers for objects.

Unit III : Inheritance in C++ : Derived class & base class, Derived class constructors, Function overloading, class hierarchies, Public and private inheritance, Multiple inheritance. Containership : classes within classes.

SECTION-B

Unit IV : Virtual functions concepts, Abstracts classes & pure virtual functions. Virtual base classes, Friend functions, Static functions, Assignment and copy initialization, the this pointer. Dynamic type information.

Unit V : Streams & Files in C++ : Stream classes, stream errors, disk file I/O with streams, File pointers, Error handling in file I/O. File I/O with members functions, overloading the extractions & insertion operators, Memory as a stream object, command-line arguments. Multifile programs.

Unit VI : Function Template, Class templates, Exception syntax, Multiple exceptions, exception with arguments. Introduction to the Standard Template Library. Algorithms, Sequential Containers, Iterates, Specialized iterates, Associative containers. Function objects.

Text-Books :

1. Robert Lafore Object-Oriented Programming in C++ (Galgotia)
2. Herbert Schildt C++ : Complete Reference (TMH)

References :

1. Bjarne Stroustrupe C++ Programming Language (Addison-Wesley)
2. Venugopal Mastering C++ (TMH)
3. Lipmann C++ Primer (Addison-Wesley)

4BM02 ANALOG AND DIGITAL ICS

SECTION-'A' (8 hrs/unit)

UNIT-I : Introduction to ICs: Monolithic IC technology,the planner process, fabrication, BJT, FETs, CMOs Technology, characteristic of IC components, LST, Operational amplifier, Block schematic internal circuits, Level shifting,Overload protection,study of IC 741 op-amp,Measurement of op-amp parameter.

UNIT-II: Liner and Non-Linear Application Op-amp:-Inverting and noninverting amplifiers, Voltage follower, integrator, differentiator differential amplifier, Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using opamps. Astable, bistable and monostable multivibrator using opamps.

UNIT-III: Other linear ICs:- Block schematic of regulator IC 723, and applications, SMPS, Block schematic of timer IC 555 and application as a timer, astable, monostable, bistable multivibrator and other applications.

SECTION-'B'

UNIT-IV: Basic Logic Circuits:
Logic gate charcteristics,NMOS invertor, propogation delay,NMOS logic gate,CMOS invertor,CMOS logic gates, BJT invertor, TTL NAND gate, TTL output stage. TTL logic families, ECL circuits,comparision of logic families.

UNIT-V: Combinational Digital Circuits: Standard gate assemblies, Binary address, Arithmetic functions, Digital comparator, Parity check generators, Decode-multiplexer, Data selector multiplexer, Encoder, ROM, 2-dimensional addressing of ROM, ROM applications, PROM.

UNIT-VI: Sequential Circuits and Systems:Bistable Latch, Flip-Flops clocked SR, J-K, T, D type shift Registers, F.F.Design of counters, Ripple and synchronous types, application of counters, Dynamic MOS shift registers,RAM Bipolar RAM cells.

BOOKS :

1. Millaman : Microelectronic : 2nd Ed.Mc Graw Hill.
2. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).
3. Gayakwad : Op-Amp & Linear IC's, 2nd Ed.
4. Malvino & Leach : Digital Principles & Applications, 4th Ed. Mc Graw Hill.

4BM03 NETWORK ANALYSIS

SECTION-A

Unit I : a] Terminal Element Relationships: V-I relationship for Inductance and Capacitance- Constant Flux Linkage Theorem and Constant Charge Theorem- v-i relationship for Independent Voltage and Current Sources - v-i relationship for dependent voltage and current sources- Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.

b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal vs mesh analysis

Unit II : Network Theorems : Linearity and superposition, source transformations, Thevinin's theorem , Norton's theorem, Maximum power transfer theorem, Delta-wye transformations Reciprocity theorem, Milliaman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorems.

Unit III : Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of d.c steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method-Determination of initial conditions.

SECTION-B

Unit IV : a] Review of Laplace Transforms: Laplace Transform-Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms-Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. *(Review to be done by students. No class hour will be spent for this review.)*

b] Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots,

Unit V : a] Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor, phasor relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors.

b] Fourier Series: Fourier Series representation of non-sinusoidal periodic waveforms - Fourier Coefficients-Determination of Coefficients-Waveform Symmetry-Exponential Fourier Series-Discrete Amplitude and Phase Spectra-Steady State Solution of Circuits with non-sinusoidal periodic inputs by Fourier Series

Unit VI : Two Port Networks: two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network Functions-Pole Zero plots and steady state response from pole-zero plots.

Books Recommended :-

1) Engineering Circuit Analysis, 6/e By Hayt & Kemmerly, TataMcgraw Hill, 2004
2) Network Analysis, By M.E. Van Valkenberg, PHI, 2005
3) Electrical Circuits – David Bell, Oxford University Press, 2008
4) Linear Circuit Analysis, 2/e – De Carlo and Lin, Oxford University Press, 2009
5) Network Analysis, P. Ramesh babu, SCITECH Publications, Chennai, 2009
6) Circuit and Network Analysis By Sudhakar Shyammohan, Tata Mc Graw Hill, 2005
7) Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, Oxford University Press, 2010.

4BM04 SOCIAL SCIENCES & ENGINEERING

ECONOMICS

SECTION - A (8 hrs/unit)

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy.

Unit II : Indian Parliament : composition and powers.
President of India : Election and Powers.
Council of Ministers and Prime Minister

Unit III: Impact of Science and Technology on culture and Civilization.
Human Society : Community Groups, Social Control : Meaning, Types and Agencies. Marriage and Family : Functions, Types and problems.

SECTION - B

Unit IV: Nature and scope of Economics : Special significance of Economics to Engineers.
Production : Factors of production, Laws of return, Various Economic systems, Forms of Business Organisation.

Unit V : Banking : Functions of Central and Commercial Banks.
Taxation : Principle of taxation, Direct and Indirect taxes.
Market : Forms, perfect and imperfect competition, pricing under perfect and imperfect competition, prices discrimination under monopoly.

Unit VI: Economics of Development : Meaning, Characterisitcs of under development, obstacles to Economic growth and vicious circle of poverty.
Economic Planning : meaning, objective and salient features of current five years plan of India.
Planning horizons, life structuring the alternatives.
Economics of comparision of different alternative projects.

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. Joshi G.N. : The Constitution of India, Macmillan India Ltd.
3. Mahajan : The Constitution of India, S.Chand, New Delhi.
4. Maclaver and Page : Principle of Sociology.
5. Davis K. : Human Society
6. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
7. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
8. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
9. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi

P.M.Sundharam
10. Dhingra I.C. : Indian Economy
11. E.Kuper : Economics of W.R.Development, McGraw Hill Co.,
12. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4BM05 BIOMATERIALS & BIOMECHANICS

Unit I :- Introduction: Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials.Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with biometal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants.

Unit II :-: Introduction of polymers, Polymeric implant materials, Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Synthetic polymeric membranes and their biological applications.Ceramic implant materials: Definition ofbioceramics. Common types ofbioceramics: Aluminium oxides, Glass ceramics,

Composite implant materials: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out).

Unit III :- Biocompatibility & toxicological screening of biomaterials: Definition of biocompatibility, blood compatibility and tissue Compatibility. Toxicity tests: acute and chronic toxicity studies, sensitization, carcinogenicity, mutagenicity and special tests.Sterilisation techniques: ETO, gamma radiation, autoclaving. Effects of sterilization on material properties. Testing of biomaterials/lmplants: In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals):
biological performance of implants. Ex-vivo testing: in vitro testing simulating the in vivo conditions.

Unit IV :- Hard tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models - anisotropy, Electrical properties of bone, fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones, mechanical properties of collagen rich tissues, teeth and its properties.

Unit V :- Soft tissues: Structure and functions of cartilages, tendons, ligaments, soft tissue mechanics, mechanical testing of soft tissues standard sample preparation, cross-section measurement, clamping of the specimen, strain measurement, environmental control, time dependent properties of testing. Biomechanics of joints: Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee, mechanics of ankle.

Unit VI :- Locomotion: Human locomotion, gait analysis and goniometry, Ergonomics, F:oot Pressure measurements - Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis.Cardiovascular mechanics: Heart valves, artificial heart valves, biological and mechanical valves development.Fluid mechanics: introduction, viscosity and capillary viscometer, laminar flow, turbulent flow.

Test books

1. J B Park, Biomaterials - Science and Engineering, Plenum Press,
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House,
3. Alexander R Mc Neill, Biomechanics, Chapman and Hall,

Reference books

1. Jonathan Black, Biological Performance of materials, Marcel Decker,
2. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers.
3. Eugene D. Goldbera, Biomedical Ploymers, Akio Nakajima.
4. Lawrence Stark & GyanAgarwal , Biomaterials
5. L. Hench & E. C. Ethridge, Biomaterials - An Interfacial approach.
6. A Z Tohen and C T Thomas, Manual of Mechanical Orthopaedics
7. D N Ghista and Roaf, Orthopaedic Mechanics, Academic Press
8. VC Mow and W C Hayes, Basic Orthopedic Biomechanics, Lippincott, Raven publishers.

4BM06 OBJECT ORIENTED TECHNOLOGIES-LAB

LIST OF PROGRAMS

The sample list of program is given below. This list can be used as guide line for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1 Write a C++ program to implement a stack with its constructor and two member functions PUSH and POP

2 Write a C++ program to find product of two same numbers from 0 to 9 stored in an object array of 10 objects and then free the memory space occupied by an object array

3 Write a C++ program to overload minus operator as an unary and binary operator

4 Write a C++ program using friend operator function to overload plus binary operator

5 Write a C++ program to calculate the circumference of an earth (subclass) after getting distance of it measured from sun from planet (super class)

6 Write a C++ program for an inventory that stores the name of an item, the number on hand, and its cost. Include an inserter and an extractor for this class

7 Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file

8 Write a C++ program that counts number of words in a file

9 Write a C++ program to create an abstract class area having an abstract function get Area which will find an area of derived classes rectangle and triangle

10 Write a C++ program to create a generic function that swaps the values of the two variables it is called with"

4BM07 ANALOG & DIGITAL IC'S - LAB

List of Expermients:

1. INV-NON INV Amplifer using IC 741.
2. INTEGRATOR & DIFFERTIATOR using IC 741.
3. Voltage follower using IC 741.
4. Weinbridge oscillator using IC 741.
5. Astable Multivibrator using IC 741.
6. Astable Multivibrator using IC 555.
7. Voltage regulator using IC 723
8. Verification of MUX using IC 74151.
9. Study of various DEMUX chips & verification of DEMUX using IC 74155.
10. Verification of transistor inverter.
11. Verification of BCD to seven segment using IC 7447.
12. Verification of J-K FF by using IC 7476.
13. Verification of Comparator using IC 7485.
14. Verification of BCD to demical decoder using IC 7442.
15. Verification of decade counter.
16. Code converters using PLAs.

NOTE : Any six from Sr.No. 1 to 7 and six from Sr.No. 8 to 16.

4BM08 NETWORK ANALYSIS-LAB.

Any TEN experiments based on contents of 4 BM 03 NETWORK ANALYSIS

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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ENVIRONMENTAL STUDIES

Total Marks : 100

PART-A

SHORT ANSWER PATTERN **25 Marks**

1. The Multidisciplinary nature of environmental studies

. Definition, scope and importance.
. Need for public awareness.

(2 lecture hours)

2. Social Issues and the Environment

. From Unsustainable to Sustainable development
. Urban problems related to energy
. Water conservation, rain water harvesting, watershed management
. Resettlement and rehabilitation of people; its problems and concerns. Case studies.
. Envionmental ethics : Issues and possible solutions.
. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
. Wasteland reclamation.
. Consumerism and waste products.
. Environment Protection Act.
. Air (Prevention and Control of Pollution) Act.
. Water (Prevention and Control of Pollution) Act.
. Wildlife Protection Act.
. Forest Conservation Act.
. Issues involved in enforcement of environmental lesislation.
. Public awareness. (7 lecture hours)

3. Human Population and the Environment

. Population growth, variation among nations.
. Population explosion - Family Welfare Programme.
. Environment and human health.
. Human Rights.
. Value Education.
. HIV / AIDS.
. Women and Child Welfare.
. Role of Information Technology in Environment and human health.
. Case Studies. (6 lecture hours)

PART-B

ESSAY TYPE WITH INBUILT CHOICE **50 Marks**

4. Natural resources :

. **Renewable and non-renewable resources :**

. Natural resources and associated problems.

- Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
- Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
- Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

. Role of an individual in conservation of natural resources.

. Equitable use of resources for sustainable lifestyles.

(8 lecture hours)

5. Ecosystems

. Concept of an ecosystem.

. Structure and function of an ecosystem.

. Producers, consumers and decomposers.

. Energy flow in the ecosystem.

. Ecological succession.

. Food chains, food webs and ecological pyramids.

. Introduction, types, characteristic features, structure and function of the following ecosystem :-

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lecture hours)

6. Biodiversity and its conservation

. Introduction - Definition : genetic, species and ecosystem diversity.

. Biogeographical classification of India.

. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

. Biodiversity at global, National and local levels.

. India as a mega-diversity nation.

. Hot-spots of biodiversity.

. Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.

. Endangered and endemic species of India.

. Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

7. Environmental Pollution

. Definition

. Causes, effects and control measures of :-

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

. Solid Waste Management : Causes, effects and control measures of

. Role of an individual in prevention of pollution.

. Pollution case studies.

. Diaster management : floods, earthquake, cyclone and landslides.

(8 lecture hours)

PART-C

ESSAY ON FIELD WORK **25 Marks**

8. Field work

. Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain

. Visit to a local polluted site - Urban / Rural / Industrial / Agricultural

. Study of common plants, insects, birds.

. Study of simple ecosystems - pond, river, hill slopes, etc.

(5 lecture hours)

(**Notes :**

i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.

ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and

iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

LIST OF REFERENCES :-

1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.

2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net **(R)**

3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

4) Clark R.S., Marine Pollution, Clanderson Press Oxford **(TB)**

5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7) Down to Earth, Certre for Science and Environment **(R)**
8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural Histroy Society, Mumbai **(R)**
10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Ca mbridge Univ. Press 1140p
11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284 p.
12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental Science Systems & Solutions, Web Enhanced Edition. 639 p.
13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications **(TB)**
14) Miller T.G.. Jr., Environmental Science, Wadsworth Publishing Co. **(TB)**
15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.
16) Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18) Survey of the Environment, The Hindu **(M)**
19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science **(TB)**
20) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media **(R)**
21) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications **(TB)**
22) Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.
23) डॉ. विठ्ठल घारपूरे : पर्यावरणशास्त्र- पिंपळापूरे ॲन्ड कंपनी पब्लीशर्स, नागपूर.**(R)**
24) Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.: Environmental Studies, Pimpalapure & Co., Publishers, Nagpur. **(R)**
25) R.Rajagopalan : Environmental Studies, Oxford University Press, New Delhi, 2005 **(R)**

(M) Magazine
(R) Reference
(TB) Textbook

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DIRECTION

No. 31/2011 Date : 10/06/2011

Subject : Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology

Whereas faculty of Engineering & Technology in its meeting held on 6th June, 2011 vide Item No. 39 accepted and recommended schemes of teaching & examinations of III to VIII/X as per Credit Grade System of various branches as per Credit Grade System in the faculty of Engineering & Technology for its implementation from the session 2011-2012 in phase wise manner,

AND

Whereas the schemes of teaching & examinations of VII & VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology were accepted by the Hon'ble Vice-Chancellor u/s Section 14 (7) of M.U. Act, 1994 on behalf on Academic Council on 9th June, 2011,

AND

Whereas this schemes of teaching & examinations of various branches as per Credit Grade System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of various branches as per Credit Grade System in the faculty of Engineering & Technology are to be implemented from the academic session 2011-2012,

AND

Whereas syllabi of various branches in the faculty of Engineering & Technology are to be sent for printing.

Now, therefore, I, Dr. Mohan K. Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :-

1) This Direction shall be called "Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering &Technology, Direction, 2011"
2) This Direction shall come into force from the date of its issuance.
3) Schemes of teaching and examinations of III to VIII/X semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH		Appendix No.
1)	Civil Engineering	A
2)	Mechanical Engineering	B
3)	Production Engineering	C
4)	Electrical Engineering (Electronics & Power)	D
5)	Electrical and Electronics Engineering	E
6)	Electrical Engineering (Electrical & Power)	F
7)	Electrical Engineering	G
8)	Electronics & Telecommunication Engineering	H
9)	Electronics Engineering	I
10)	Instrumentation Engineering	J
11)	Computer Science & Engineering	K
12)	Computer Engineering	L
13)	Architecture	M
14)	Textile Engineering	N
15)	Chemical Engineering	O
16)	Chemical Technology (Polymer) (Plastic) Technology	P
17)	Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical) Techology	Q
18)	Information Technology	R
19)	Biomedical Engineering	S

Sd/-
Dr. Mohan K. Khedkar
Vice-Chancellor

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