UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.TECH. FOOTWEAR SCIENCE AND ENGINEERING

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA9121	Applied Mathematics for Leather Technology	3	1	0	4
2.	FW9151	Theory and Practice of Leather Manufacture (For B.E. Mechanical Engg.)	3	0	0	3
3.	FW9152	Mechanics of Machinery (For B.Tech Leather Technology students)	3	0	0	3
4.	FW9111	Anatomy and Solid Modelling of Foot	3	0	0	3
5.	FW9112	Technology of Footwear Manufacture	3	0	0	3
	E1	Elective I	3	0	0	3
PRACTICAL						
5.	FW9114	Footwear Fabrication - I	0	0	6	3
		TOTAL CREDITS	**15**	**1**	**6**	**19**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	FW9121	Technology of Speciality and non-Leather Footwear	3	0	0	3
2.	FW9123	Materials Science	3	0	0	3
3.	FW9122	Footwear Machinery	3	0	0	3
4.	E2	Elective II	3	0	0	3
5.	E3	Elective III	3	0	0	3
PRACTICAL						
6.	FW9125	Footwear Fabrication - II	0	0	6	3
7.	FW9126	Testing of Footwear Materials and Products	0	0	4	2
		TOTAL CREDITS	**15**	**0**	**10**	**20**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	E4	Elective IV	3	0	0	3
2.	E5	Elective V	3	0	0	3
3.	E6	Elective VI	3	0	0	3
PRACTICAL						
4.	FW9131	Seminar	0	0	2	1
6.	FW9132	Project Work Phase – I	0	0	24	6
		TOTAL CREDITS	**9**	**0**	**24**	**16**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	FW9141	Project Work Phase – II	0	0	24	12
		TOTAL CREDITS	**0**	**0**	**24**	**12**

LIST OF ELECTIVES

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	FW9161	Computational Methods and Computer Graphics	3	0	0	3
2.	FW9162	Footwear Chemicals and Polymers	3	0	0	3
3.	FW9163	Computer Aided Design and Manufacture for Footwear	3	0	0	3
4.	FW9164	Modern Footwear Styling	3	0	0	3
5.	FW9165	Organisation and Management of Footwear Sector	3	0	0	3
6.	FW9166	Safety in Footwear Industry	3	0	0	3
7.	FW9167	Quality Control Management in Footwear Industries	3	0	0	3
8.	CL9157	Operations Research (elective offered by Dept of Chemical Engineering)	3	0	0	3
9.	TX9170	Financial Management (elective offered by Dept of Textile Technology)	3	0	0	3
10.	TX9171	Industrial Relations and Labour Laws (elective offered by Dept of Textile Technology)	3	0	0	3
11.	CL9158	Total Quality Management (elective offered by Dept of Chemical Engineering)	3	0	0	3

MA9121	APPLIED MATHEMATICS	L	T	P	C
	(Common to Chemical Engineering)	3	1	0	4

UNIT I TENSOR ANALYSIS 9

Tensor Algebra, Metric Tensor, Christoffel Symbols and covariant differentiation, Riemann-Christoffel Curvature Tensor, Cartesian Tensors

UNIT II FOURIER TRANSFORMS 9

Fourier Transforms, Complex, Sine and Cosine Transforms, Finite Fourier Transforms, Applications to heat conduction problems

UNIT III CALCULUS OF VARIATIONS 12

Simple variational problems with fixed boundaries, Euler`s equations, conditional extrema, Iso perimetric problems, Approximate solutions, Direct methods, Euler`s finite difference method, Ritz method

UNIT IV METHOD OF WEIGHTED RESIDUALS 7

Basics of variational principle, Applications to ordinary and partial differential equations, sub-domain method, Collocation method, least square method, Galerkin method

UNIT V QUALITATIVE ANALYSIS OF ORDINARY DIFFERENTIAL EQUATION 8

Stability of nonlinear systems, Elements of control Theory

L: 45 , T : 15 , TOTAL : 60 PERIODS

REFERENCES

1. Ramanaiah, G. T., “Tensor Analysis”, S. Viswanatthan Pvt. Ltd., 1990.
2. Narayanan S, Manicavachagom Pillai T K and Ramanaiah G, “Advanced Mathematics for Engineering Students,” Vol.III, S.Viswana, B. than Pvt. Ltd., 1990.
3. Finalyson A., “The Method of Weighted Residuals and Variational Principles”, Academic Press, 1972.
4. Geo, S. G. and Raghavendra V, “Ordinary Differential Equations and Stability Theory”, Tata McGraw Hill, 1980.
5. Pushpavanam S., “Mathematical Methods in Chemical Engineering”, Prentice Hall of India.

FW9151 THEORY AND PRACTICE OF LEATHER MANUFACTURE

(Bridge elective course for B.Tech Leather Technology Students) **L T P C**
3 0 0 3

UNIT I HIDES & SKINS & PRESERVATION 9

Hides and skins – origin, availability, flaying technique, histological characteristics, leather making materials, ante-mortem and postmortem defects and its effects in shoe making. Comparisons between different hides and skins from shoe maker point of view.

UNIT II LEATHER PROCESS TECHNOLOGY 10

Principles and techniques involved in different unit processes and operations in leather processing (pre and post tanning). Bio processing of leather, Eco processing. Process device and importance machines in leather processing and costing of leathers.

UNIT III FINISHING 7

Chemicals and auxiliaries used in leather finishing, its compatibility with shoe finishes. Application techniques. Texture and special finishes. Assortment.

UNIT IV FOOTWEAR LEATHER MANUFACTURING 12

Process parameters and control for unit operations for Upper leather manufacturing from different kinds of raw materials. Special process techniques for Kid leather, soft upper and upper from sheep. Processes for the manufacture of sole and lining leathers.

UNIT V TANNERY EFFLUENTS 7

Source of generation of liquid and solid wastes in tanneries. Characterization of liquid, wastes and assessment of critical parameters of pollution (solids, BOD, COD, nutrients, metals and phenolics)

TOTAL : 45 PERIODS

REFERENCES

1. Sarkar, K.T., “Introduction to the Principles of Leather Manufacture”, Ajoy Sorcor, Madras, 1981.
2. Dutta, S.S.,” Introduction to the Principles of Leather Manufacture”, Indian Leather Technologists Association, Calcutta, 1980.
3. Thorstenson, T.C.,” Practical Leather Technology”, Robert E. Krieger Publishing Co., Malabar, Florida, 1985.
4. Fred O Flaherty, Roddy, T.W. and Lollar, R.M., “The Chemistry and Technology of Leather”, Vol.I & II, Type of tannages, Rober E. Krieger Publishing Co., New York, 1977.
5. Tchobanoglous, G., Burton, F.L. and Stensel, H.D. (Eds), “Waste water Engineering, treatment, disposal and reuse: Metcalf and Eddy”, 3rd edn. Tata-McGraw Hill Publishing, New Delhi, 1991.

FW9152 MECHANICS OF MACHINERY

(Bridge Elective course for B.Tech Leather Technology students) **L T P C**
3 0 0 3

UNIT I POWER TRANSMISSION 10

Principles of Hydraulic, Pneumatic and mechanical systems of power transmission, Use of these systems either alone or in combination in the working parts of the machine. Electronic, magno-electric, photo-cell and control safety systems.

UNIT II MECHANICAL PROPERTIES AND TRANSMISSION 10

Mechanical properties - Tensile strength, Yield strength, Creep strength, Impact strength, Effect of temperature, Wear resistance- Laws of friction and application - Transmission of power/belt, rope and chain drives, Length Types, Creep, Tensions, Pulleys, conditions for maximum power Transmission.

UNIT III MOTION AND INERTIA 10

Kinematics - Velocity and Acceleration, Analysis of motion of simple mechanisms with special reference to footwear machines, Kinetics- Application of forces in machines - Inertia forces and torque - Fluctuation of energy and speed - Flywheel effect and punching press.

UNIT IV CAMS AND GEAR TRAINS 9

Cams - Types and classification of cams and followers–Construction of cam profiles for different type of followers with simple harmonic, uniform acceleration and retardation motion - Application of simple, compound, reverted and epicycle gear trains.

UNIT V TRANSPORT SYSTEM 6

Different types of material handling system in footwear industry. Manual, semi-automatic and automatic conveyors.

TOTAL : 45 PERIODS

REFERENCES

1. Shigley, J.E. and Vicker, J.J., “Theory of Machines and mechanisms”, McGraw Hill,1995.
2. Paul, B., “Kinematics and Dynamics of Planar Machinery”, Prentice Hall, 1979.

FW9111 ANATOMY AND SOLID MODELLING OF FOOT L T P C
3 0 0 3

UNIT I ANATOMY OF HUMAN FOOT 9

Lower limb - bones, muscles, nerves and fascia, their functions in structural stability (static & dynamic) muscles in helping in walking, muscle relate to limb functions like flexion, extension, etc. Science in Shoe Design.

UNIT II GROWTH AND DEFORMITIES 7

Growth of foot from infancy to maturity, arches of foot, relationship between foot shape and last. Different types of foot deformities like Pes Cavus, Valgus, Blisters, Gangrene, injuries in sports, methods of prevention etc footcare and protection.

UNIT III BIO MECHANICS 7

Free body diagram, analysis - biomechanics of walking, running and other sports. Types of forces - friction, moments.

Gait analysis and foot comfort - gait patterns, pressure distribution etc. in case of normal and abnormal feet.

UNIT IV ESSENTIALS OF THERAPEUTIC FOOTCARE 7

Footwear Criteria to address foot problems; comfort Elements; Principles of protective footwear; Common features of therapeutic footwear.

UNIT V SOLID MODELLING 15

Basic principles of solid modelling and surface modelling using contours and geometry. Use of solid modelling in designing and developing modern foot wear.

Lasts: Different measurement of feet and lasts - methods, units, sizing systems such as English, French, American, German, Japan Mondo-point their conversion and comparison. Materials for last making, manufacturing technique. Model development. Principles of grading - Manual, machine and computer grading.

TOTAL : 45 PERIODS

REFERENCES

1. Hollinshead, H., "Text book of Anatomy", Oxford IBH London 1967.
2. Morton, D.J., "The Human Foot", Hafner Publishing Co., New York, London, 1964.
3. Thornton, J.H., "Text book of Footwear Manufacture", National Trade Press Ltd., London, 1970
4. Edwards, C.A., "Orthopaedic shoe technology", Precision Printing Co., Indiana, 1964
5. Whittle, M., "Gait Analysis: An introduction," butterworth – Heinemann Publication, 2002.

FW9112 TECHNOLOGY OF FOOTWEAR MANUFACTURING L T P C
3 0 0 3

UNIT I DESIGN AND PATTERN DEVELOPMENT 7

History of shoe – purposes and styles – fashions & designs – selection criteria for last, Forming, conceptual design (Manual & Computer) - Grading Preparation of bottom and insole patterns – Preparation of standards and section for Men, Ladies & Children classic and other types of shoes and boots.

UNIT II CUTTING 6

Selection of materials – Layout preparation – Materials Economy - Principles of cutting – Hand, machine, Scope for automation, Standard time – Quality Control – Clicking room design and management. Fabric, rolls and sheet materials cutting technique.

UNIT III PRE-CLOSING & CLOSING 11

Checking incoming work, stitch making, skiving, punching and gimping, heat embossing, flow moulding, toe puff attachment, attaching linings and scrims, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fasteners and trims.

Threads, needles, Seam and stitch types, preparing for stitching, Dealing with thread breakages, automatic stitching, working environment faults and remedies, Types of stitching machines

UNIT IV LASTING 9

Principles and methods of pre lasting and lasting operation – Manual and mechanical method. Effect of temperature, humidity and materials in lasting and making operations. Types of machinery and the principles involved in mechanical operations. Bottom stock preparation

UNIT V POST LASTING & FINISHING 11

Principles and methods of various post lasting and finishing operation ; Sole attaching – preparation of lasted margin, upper preparation, sole preparation, sole cementing, upper cementing, halogenations; bottom fillers and shanks adhesive drying, heat activation, spotting, pressing, last slipping, health and safety, quality control and fault finding problems- solving, recommended bonding systems. Shoe room technique ,packing and storing technique, Dress shoe, casual footwear, women footwear, work shoe .Ethnic footwear. Jodhpur boot and various boot. Safety footwear.

TOTAL : 45 PERIODS

REFERENCES

1. Patrick, H.J., “Modern pattern cutting and design”, Mobbs and Lewis Ltd., Kettering, England, 1983.
2. Lyon, D., “Modern approach to Footwear pattern cutting”, 2nd Edn. 1979.
3. Thornton, J.H., “Text book of Footwear Manufacture”, National Trade Press Ltd., London, 1970.
4. “Manual of Shoe Making” – Clarks Ltd. (London) 1978.
5. Wilhelm, A., “Tips for shoe production” Vol. I, II & III, Huthig Buch Verlag, Heidelberg, 1988.

FW9114 FOOTWEAR FABRICATION – I L T P C
0 0 6 3

LAST 30

Central line drawing – Measurements – Design Insole pattern – Sole pattern – Forming – clotted, Fabric, Tape & Vaccum Method. Men’s shoe standard and sction preparation (Derby, Oxford, Mocassins, Ankle boots, long boots etc.) Ladies & Children’s standard and section preparation. Design of Toe-Puff, Stiffeners, Sock.

UPPER PREPARATION 30

Leather Assortment – Grading – cuttability etc. Layout preparation on paper & leather. Leather consumption calculation; parallelogram and other methods. Hand and Machine cutting Fabric and other sheet materials; Layout; Preparation and cutting Pre Assemble operation Closing Operation.

TOTAL : 60 PERIODS

FW9121 TECHNOLOGY FOR SPECIALTY & NON LEATHER FOOTWEAR MANUFACTURING **L T P C**
3 0 0 3

UNIT I LASTING **5**

Principles and methods of lasting for different types of construction – Manual and mechanical method. Effect of temperature, humidity and materials in lasting and making operations. Types of machinery and the principles involved in mechanical operations. Management of the lasting and making department.

UNIT II GOOD YEAR WELTED CONSTRUCTION **9**

Principle of Good Year Welted construction; preparation of uppers; Insoles – Rib attaching – Sewing in welt sole attaching – Variation in the welted method. Finishing and machinery.

UNIT III STITCHDOWN AND OTHER CONSTRUCTION **11**

Principle and methodology of Stitchdown Construction. Upper preparation- The machine & sewn method; Veldtschoen construction: Veldtschoen – Turnshoes & Little way method. California , Sanfranscino, DVP and DMS.

UNIT IV SPORTS & MOULDED FOOTWEAR **11**

Footwear's for sports . Relation between surface, activity and footwear. Materials and method of construction Preparation of uppers, sequence of operations, sponge rubber, moulded on slippers, soled rubber moulded on footwear, thermoplastic injection moulded on footwear, cellular polyurethane moulded on footwear, Health and Safety

UNIT V ORTHOPEDIC & THERAPEUTIC FOOTWEAR **9**

Need of Pedorthic and anatomically-correction, friction reduction and comfort qualities, off loading technique, materials and construction, evaluation technique

TOTAL : 45 PERIODS

REFERENCES

1. Thornton, J.H., "Text book of footwear Manufacture", National Trade Press Book Ltd., London, 1970.
2. Skoggard, I.A., "Modern Shoe Making– Lasting", SATRA Publication, Sharpe,1996
3. Miller, R.G., "Manual of Shoe Making", Clarks Ltd., London, 1978

FW9123 MATERIALS SCIENCE **L T P C**
3 0 0 3

AIM

Course deals about various non leather materials in Footwear Industries. Mechanical Properties, Elasticity and their behaviour towards water

UNIT I CHARACTERISATION OF MATERIALS **10**

Outline of spectroscopy methods, x-ray diffraction, electron microscopy, optical microscopy and applications to material characterization and Identification of polymeric materials, glass transition in polymers, methods of measuring it.

UNIT II COMPONENTS 8

Insole: Raw material - Kind of insoles: Leather Board of stock preparation - Board making. Heel: Injection moulded heels: mould design, raw materials selection - injection moulding and finishing.

UNIT III GRINDERIES AND CHEMICALS 9

Last: Raw material - Manufacture of wooden last, Plastic last and metal last.
Constitutents and Manufacture of fibreboards. Plastic back part insole and stiffener board. Shank, Raw Material - Wood, Fibre board Steel, combined wooden board or steel and board, manufacture technique.
Adhesive: Types of adhesives used in shoe making, raw materials - formulation and manufacture.
Grinderies: Metallic grinderies - tack, rivet and nails, wires - raw materials - sorting and polishing.

UNIT IV FASTENERS & ACCESSORIES 9

Fasteners: Threads, Lace Fabrics: Raw Material – Manufacture Technique and Finishing. Eyelets: Raw materials - designing and manufacturing processes.
Slide fasteners: Types of materials used in slide fasteners - manufacturing processes.
Accessories
Ornaments, embellishments, studs, methods of manufacture, moulding, electroplating and polishing.

UNIT V REINFORCEMENTS 9

Toe-puff and Stiffeners: Types of Toe-puff and stiffeners, manufacture techniques - Paint on liquids, impregnated fabrics, print on hot-melt resin, filmic. Recommended use. Non-metallic grinderies: Reinforcement tape - tape preparation - Vulcanization of adhesive. Fibre fastening, Velcro, etc.

TOTAL : 45 PERIODS

REFERENCES

1. Thornton, J.H., “Text book of Footwear Materials”, The National Trade Press Ltd., London, 1970.
2. Harvey, A.J., “Footwear Materials and Process Technology”, N.Z. Leather & Shoe Research Association, New Zealand,1982.
3. Ahuja, S. and Jespersen, N., “Modern Instrumental Analysis”, Elsevier, 2006.

FW9122 FOOTWEAR MACHINERY L T P C
3 0 0 3

UNIT I HAND TOOLS,UPPER MAKING AND UNITSOLE MAKING MACHINES 8

Hand tools and machinery used in upper making and other auxiliaries operations – General constructions - Principles involved in their working - Power transmissions systems. The machinery: Pattern grading, clicking Press, splitting, skiving, edge-folding, stamp Marking, sewing, punching, crimping, eyeleting, Seam-rubbing and taping, thermo-cementing, Pre-forming, etc.

UNIT II MACHINES FOR SHOE –CONSTRUCTION 8

Machines used in cemented, stitch down, welted, string lasted, DVP & DIP and other types of construction. Principles involved in their working - trouble shooting and & preventive maintenance. Spare parts planning and inventing control.

UNIT III TRANSPORT SYSTEM 5

Different types of material handling system in footwear industry. Manual, semi-automatic and automatic conveyors.

UNIT IV AUTOMATION IN FOOTWEAR MACHINES 11

Application of computer/microprocessor base footwear machine, principle and operation technique, safety measurements computerized controls, micro-processor links, and used of Robotics Die Less Cutting Systems. CAM for automatic stitching and other advance footwear machinery.

UNIT V MODULAR MANUFACTURING AND LAYOUT 14

Productivity improvements: scheduling, Simulation, Toyota and rink system and Lean manufacturing system.

Factors affecting plant location and construction of factory building for balancing the production line in footwear Industry. Application of Neural-network software in layout preparation.

TOTAL : 45 PERIODS

REFERENCES

1. Thornton, J.H, “Text Book of Footwear Manufacture”, National Trade Press Ltd., London, 1970.
2. Blakeman, J., “An Introduction to applied Science for Boot and Shoe Manufacture”, The Anglo American Technical Co.Ltd., London,1924.

FW9125 FOOTWEAR FABRICATION II L T P C
0 0 6 3

LAST 15

Central line drawing – Measurements - Design Insole pattern - Sole pattern - Forming - slotted, Fabric, Tape & Vacuum Method. Men's shoe standard and section preparation (Derby, Oxford, Mocassins, Ankle boots, long boots etc.) Ladies & Children's standard and section preparation. Design of Toe-Puff, Stiffeners, Sock.

10

Practice in CAD/CAM and pattern grading using machine.

UPPER PREPARATION 25

Leather Assortment - Grading - cuttability etc. Layout preparation on paper & leather. Leather consumption calculation: parallelogram and other methods. Hand and Machine cutting Fabric and other sheet Materials: Layout; Preparation and cutting Pre Assembly operation Closing Operation.

BOTTOM STOCK PREPARATION 20

Insole cutting - Sole cutting and cutting other sections/components. Leather/Rubber Sole preparation - Heel attaching - Heel treatment - Edge Treatment - Finishing.

LASTING AND FINISHING **10**

Hand Lasting; M/c lasting for cemented construction.

Practice in classic shoe making; moccasin construction; practice in shoe finishing. **10**

TOTAL : 90 PERIODS

REFERENCES

1. Bordoli, B., "The Boot and Shoe Maker", (4 volumes) The Gresham Publishing Co.Ltd., London, 4th edition, 1966.
2. Katz, R.J., "Footwear: Shoes and Socks You can make Yourself" Reinhold, New York, 1979.
3. "Manual of shoe designing ", CLRI Publications, 1999.

FW9126 TESTING OF FOOTWEAR MATERIALS & PRODUCTS **L T P C**
0 0 4 2

Methods of sampling and conditioning of footwear materials and end products.

Physical and chemical analysis of leather upper, lining, toe-puff / stiffener, insole and sole.

Physico-mechanical properties of non-leather upper and lining materials and coated fabrics-pH and chloride content

Physico - mechanical properties of rigid Cellulose - Woven and Non-Woven insole

Testing of shoe - visual and physico-mechanical tests like seam strength, strap strength, Toe load, Heel pull-off (ladies), top-line strength, water resistance etc.

Testing of footwear grinderies and accessories.

Testing of safety shoe.

TOTAL : 60 PERIODS

REFERENCES

1. BIS Standards.
2. "Quality manuals of footwear materials", CLRI publications, 2000

FW9131 **SEMINAR** **L T P C**
0 0 2 1

Students are expected to pursue one month industrial training during the summer vacation. Seminar presentations need to be made based on their comprehension on their industrial exposure.

FW9132 **PROJECT WORK PHASE I** **L T P C**
0 0 12 6

Under Project Work Phase I the students are expected to pursue preliminary work on a project undertaken by and assigned to him/her by the Department. A report should be submitted based on the information available in the literature or data determined in the laboratory/industry. The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree programme. Project Work Phase I is intended to facilitate the better completion of project extended through Project Work Phase II in Semester IV.

VIVA VOCE

The object of the viva-voce examination is to determine whether the objectives of the Project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the Project Work.

FW9141 **PROJECT WORK PHASE II** **L T P C**
0 0 12 6

The students should continue their work proposed in Project Work Phase I and are expected to complete the proposed work. A report should be submitted based on the data determined in the laboratory/industry. The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree programme. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the programme.

VIVA VOCE

The object of the viva-voce examination is to determine whether the objectives of the Project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the Project Work.

FW9161 COMPUTATIONAL METHODS AND COMPUTER GRAPHICS L T P C
3 0 0 3

UNIT I SOLUTION OF LINEAR EQUATION AND INTERPOLATION 9

Solution of a linear system by Gaussian, Gauss-Hordon, Jacobi and Gauss- seidal methods. Interpolation with Newton divided differences – Lagrange's polynomial – numerical differentiation with interpolation polynomials0. Numerical integration by trapezoidal, Simpsons rule and two point Gaussian quadrature.

UNIT II INITIAL AND B.VP FOR ODE 9

Taylor series, Euler, Modified Euler, Runge Kutta method of Fourth order for First and Second order differential equations – Finite difference solution for the second order ordinary differential equation.

UNIT III FINITE ELEMENT METHOD 9

Integral Formulation and variational methods – Mathematical concepts, weak formulation of BVP, variational methods of approximation, Two dimensional BVP – Model equation, Finite element discretization, Interpolation – function, Assembly of element equation, Axisymmetric problems- Mesh generation and interposition of Boundary condition.

UNIT IV TWO DIMENSIONAL GRAPHICS 9

Line, circle, ellipse drawing algorithim, line attributes, curve attributes, character generation, line clipping algorithm, two dimensional geometric transformations.

UNIT V THREE DIMENSIONAL GRAPHICS 9

Bezier curves, Bezier surfaces, generation of quadric surfaces, Three dimensional geometric transformations, viewing transformations – projections.

TOTAL : 45 PERIODS

REFERENCES

1. Grewal, B.S. and Grewal J.S." numerical methods in Engineering & Sciences", Khann Publications, New Delhi 1999.
2. Reddy, J.N." An Introduction to Finite Element Methods", Second Edition, McGraw Hill Inc. New York, 1993.
3. Hearn .and Bakes, "Computer Graphics"(2nd Edition), Printice Hall of India, 1998.

FW9162 FOOTWEAR CHEMICALS AND POLYMERS L T P C
3 0 0 3

UNIT I POLYMERIC MATERIALS FOR FOOTWEAR INDUSTRY 15

i. Definition and classification of polymers - Chemistry and mechanism involved in different polymerisation processes such as Stepwise, Addition, Ring opening, Free Radical polymerisations (Bulk, solution, suspension and emulsion polymerisations) – Copolymerisation - Anionic and Cationic polymerisations.

ii. Chemistry & Technology involved in manufacturing of following polymeric materials : Natural & synthetic rubber PVC - Polystrene - PU, LDPE & HDPE Polypropylene - Nylon

– EPDM- Polyesters - Polyamines - EVA-ABS - Acrylics - Fibre Reinforced Plastics - Poromerics / PVC or PU coated fabrics.

UNIT II MODIFICATIONS OF POLYMERIC MATERIALS FOR DIFFERENT FOOTWEAR COMPONENTS 10

i. Polymer Blending : High polymer blends - Plasticization – Other additives, fillers, Antioxidants, flame retardants, stabilizers, colorants and pigments - Post reactions of polymers

ii. Moulding techniques and equipment used in fabrication of polymer products such as : Injection moulding, calendering, Reaction Injection moulding (RIM), Blow moulding etc.

UNIT III PROPERTIES, SPECIFIC USES AND TESTING OF DIFFERENT POLYMER MATERIALS 8

Properties and test procedures for polymer materials such as rheological, mechanical, electrical, thermal, chemical and comfort -suitability of polymer materials for different components of footwear such as upper, lining, shank, insole, outer sole, heel, thread etc.

UNIT IV ADHESIVES 6

Adhesive formulations involving starch, glue, latex, rubber solutions, chloroprene, PU etc. - Properties of adhesives & their choice for different purposes and in construction as in DIP, DVP, cemented etc. Mechanism of adhesion.

UNIT V FOOTWEAR DRESSING CHEMICALS 6

Formulation of polymeric materials such as shoe polishes, upper dressings, glazing materials, lacquers, binders, resins - Properties and their application in footwear industry. Manufacture of shoe finishes.

TOTAL : 45 PERIODS

REFERENCES

1. Miles, D.C. and Briston, J.H., “Polymer Technology”,Temple Press, London, 1965.
2. Flory, P.R., “Principles of Polymer Chemistry”, Cornell University Press, Ithaca, New York, 1953.
3. Kaufman, H.S. and Falcetta, J.J., “Introduction to Polymer Science and Technology”, John Wiley & Sons, New York, 1977.
4. Harvey, A.J., “Footwear Materials and Process Technology”, LASRA Publications, New Zealand, 1982.

FW9163 COMPUTER AIDED DESIGN AND MANUFACTURE FOR FOOTWEAR

L	T	P	C
3	0	0	3

UNIT I COMPUTER APPLICATIONS IN FOOTWEAR SECTOR 12

Definition, historical development, scope of applications and advantage. CNC devices for computer aided cutting including laser and water jet, computer aided manufacturing.

UNIT II HARDWARE IN CAD 12

Introduction, Principles, Capabilities and operation of graphical workstations, central processing units, graphic terminals, input/output devices, interface and storage devices, net-working concepts of LAN and WAN.

Digitization : 2D & 3D Coordinate extracting, principles of digital and analog conversion, digital input/output processing systems.

UNIT III PATTERN ENGINEERING 8

Computerized techniques for pattern generation, grading and assessment of footwear patterns, consumption calculations, pattern nesting and costing, stitching etc. through computerized techniques.

UNIT IV LAST MODELLING 7

Digitization with Microscribe; manipulation and optimization of digitized last; use of macros; last comparison; grading wizard; flattening; 3D visualization of last and styles; concept of e-last; introduction to sole and sole mould design.

UNIT V ADVANCED COMPUTATIONAL TECHNIQUES IN CAD, RAPID PROTOTYPING 6

Principles and practice; simulation – concepts and applications.

TOTAL : 45 PERIODS

REFERENCES

1. Groover, M.P. and Zinimers, M.P., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India, 1984.
2. Newman and Sul, S.P., "Introduction to Computer Graphics", Published by Morgan Kaufmann,1995
3. Harrington, S., "Computer Graphics : A programming approach", 2nd Edn., Published by Elsevier, 1997.
4. Zandi, "Computer Aided Design and drafting", Published by Delmer,1985.
5. Pratt, W., "Digital Image Processing", 1978.
6. Desai and Abel, "Introduction to FEM".
7. "Step by Step guide to CAD for footwear": CAD Centre, SDDC, CLRI.
8. Rapid prototyping; AU – FRG publications, 1984.
9. Buchner, J., "Simulation: QUEST manual" : EDS Technologies, Published by Springer, 2003.

FW9164 MODERN FOOTWEAR STYLING L T P C
3 0 0 3

UNIT I HISTORICAL EVALUATION & INTERNATIONAL TRENDS 10

Historical evaluation of footwear styling. Seasonal influences on fashion, cultural and geographical instances on footwear fashion. Market research and track record.

UNIT II FASHION CONSIDERATIONS 9

Design Criteria through effect of shape, colour, pattern, texture and decorative materials. Life cycle of fashion

UNIT III PRODUCT DEVELOPMENT 9

Market Strategy - Prototype Development - Field test and evaluation - Standard preparation - Second prototype - Final run. Costing

UNIT IV PRESENTATION TECHNIQUES 9

Organisation of shows and preparation of art portfolios; advertising; effect of foreign languages in the presentation and promotional activities.

UNIT V FASHION FORECAST 8

Direction of fashion trends in footwear production and marketing.

TOTAL : 45 PERIODS

REFERENCES

1. Cott, N.F., "American Shoe Making", Shoe Trades Publishing Co., Cambridge. 1993.
2. "Apparel International" Published by P.F collier and sons, U.K, 1961.
3. "Shoes and Leather News",Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.

FW9165 ORGANISATION AND MANAGEMENT OF FOOTWEAR SECTOR

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UNIT I PRODUCTION MANAGEMENT 12

Overview of production management and organization in a factory. The functions of a production manager in production planning and control. Production cost, Introduction to work study. Method study and work measurement, materials handling, Manpower planning lay outing equipment selection.

UNIT II MARKETING STRATEGY 10

i. Consumer psychology - factors affecting supply and demand - Market channels in the domestic market - Export Import policy.

ii. Product Development : Style creation - Prototype preparation - Market feed back - pilot production - specification - Final prototype.

UNIT III PERSONNEL MANAGEMENT 10

Principles - Motivation, Employee training and development - Jop analysis, Recruitments. Performance Evaluation Technique, wages and salary, labour laws and factory acts in footwear industry.

UNIT IV ERGONOMICS AND COMMUNICATION 7

i. Basic man/machine relationship - Machine organisation in industrial environment.

ii. Recording, Storage& retrieval of information - instruction - reporting information feed back process - telephone and other communication means - memoranda.

UNIT V FOOTWEAR TRADE AND INDUSTRY IN INDIA 6

Structure and concentration of the industry, production, employment, sub-contracting systems and trade practices in different sectors of industry. Origin of industry and its growth trends. Industrial/trade policies and role of various developmental organisations. International trade in footwear in relation to leather manufactures, export procedures, incentives, duties and major importing countries and competitors.

TOTAL : 45 PERIODS

REFERENCES

1. Boon, G.K., “Technology and employment Footwear Manufacturing”, Sijthoff and Noordhoff,Published by BRILL,1980.
2. Mehta, P., “Managerial Economics”, Sultan Chand Co., 1985.
3. Shukla, M.C., “Business Organization & Management”, Sultan Chand & Co, Published by Progoti publishers,1969.
4. Rugman, A.M. “International Business Firm Environment”, Mcgraw-Hill., New York, Published by Taylor and Francis, 2002.
5. “Employment and working conditions and Competitiveness in the Leather and Footwear Industry”, ILO, Report II, Published by international labour organization, Geneva, 1995.
6. Kanawaty, G., “Introduction to work study”, Published by International Labour Organisation, 1992.

FW9166 SAFETY IN FOOTWEAR INDUSTRY L T P C
3 0 0 3

UNIT I SAFETY PROGRAMMES 10

Safety in Industries; Need for development; Importance of safety consciousness in Indian Footwear Industry. Elements of safety programme; Effective realisation of economic and social benefits; Effective communication; Training at various levels of production and operation; Psychological attitude towards safety programmes.

UNIT II INDUSTRIAL SAFETY 9

Footwear industry and allied fields; Potential hazards; Job safety analysis; Toxic, explosive and inflammable chemicals; Safe handling and operation of materials and machineries. Promotion of Industrial Safety : Safety Standards; Role of Government; Safety Organisation; Management and Trade Unions in promoting industrial safety.

UNIT III ACCIDENTS & SAFETY PERFORMANCE 10

Industrial accidents; Identification of accident spots; Accident prevention; Accident proneness; Fire prevention and fire protection; Identification of vulnerable areas of accidents.

Safety Performance: Appraisal; Effective steps to implement safety procedures; Periodic inspection and study of plant layout and maintenance; Proper selection and replacement of handling equipments; Personal protective equipments.

UNIT IV POLLUTION 8

Atmospheric pollution; Waste and dust; Toxic Materials and gases; Environmental pollution by footwear industry.

UNIT V HEALTH HAZARDS AND LEGAL ASPECTS 8

Health and occupational hazards; Health standards and rules; Safe working environment; Legislations, Factories, Labour Welfare, ESI and Workmen Compensation Acts.

TOTAL : 45 PERIODS

REFERENCES

1. Handley, W., "Industrial Safety Hand Book", 2nd Edn., McGraw Hill Book Company, 1977.
2. Heinrich, H.W., Petenen, D. and Roos, N., "Industrial accident prevention", McGraw-Hill, New York, 1980.
3. Blake, R.P., "Industrial Safety", 2nd Edn., Prentice Hall Inc., New Jersey, 1963.
4. Stellman, J.M. "EN-344 standards" Published by International labour Organisation, 1998.

FW9167 QUALITY CONTROL AND MANAGEMENT IN FOOTWEAR INDUSTRIES

L T P C
3 0 0 3

UNIT I CONCEPTS OF QUALITY 9

Definition of quality, quality control theory, fundamentals of statistics and probability, confidence intervals, testing significance, statistical process control techniques, analysis, defect diagnosis and prevention.

UNIT II QUALITY IMPROVEMENT 9

Concepts of TQM, TQC, KANBAN, Zero defects, JIT – continuous improvement – HRD in quality management – quality grades, Dr. Derming's 14 points management concept, TQA.

UNIT III STANDARDIZATION 9

Historical development of standards, aims techniques, management, formulations, implementation of international and national standards – economic benefits.

UNIT IV QUALITY ASSURANCE SYSTEM 9

Introduction to ISO – 9000 and 14000 and related international /national standards, case study.

UNIT V ACCREDITATION AND CERTIFICATION BODIES 9

Relevant standards, internal and external audit, corrective action, remedies.

TOTAL : 45 PERIODS

REFERENCES

1. A.J. Duncan, "Quality Control and Industrial Statistics", Homewood, Illinois, Published by Irwin, 1986.
2. "International Organization for Standardization" case postale 56, CH-1211-Geneva 20, Switzerland.
3. "Bureau of Indian Standards", New Delhi.

CL9157 OPERATIONS RESEARCH

(Elective offered by Department of Chemical Engineering) L T P C

3 0 0 3

UNIT I MATHEMATICAL PROGRAMMING 12

Introduction, Linear Programming, Solution by simplex method, Duality, Sensitivity analysis, Dual simplex method, Integer Programming, Branch and bound method, Geometric programming and its application.

UNIT II DYNAMIC PROGRAMMING 10

Elements of DP models, Bellman's optimality criteria, Recursion formula, Solution of multistage decision problem by DP method. Application of Heat Exchange Extraction systems.

UNIT III PERT, CPM and GERT 9

Network representation of projects, Critical path calculation, construction of the time-chart and resource leveling, Probability and cost consideration in project scheduling, Project control. Graphical Evaluation and Review Techniques.

UNIT IV ELEMENTS OF QUEUING THEORY 7

Basic elements of the Queuing model, M/M/1 and M/M/C Queues.

UNIT V ELEMENTS OF RELIABILITY THEORY 7

General failure distribution, for components, Exponential failure distributions, General model, Maintained and Non-maintained systems, Safety Analysis.

TOTAL : 45 PERIODS

REFERENCES

1. Taha, H. A., "Operations Research, An introduction", 6th Ed., Prentice Hall of India, New Delhi, 1997.
2. Edgar, T. F., Himmelblau, D. M. and Ladson, L. S., "Optimization of Chemical Processes", 2nd Ed., McGraw Hill, New York, 2003.
3. Berghtler, C. and Philips, D.T., "Applied Geometric Programming", John Wiley, New York, 1976.
4. Roberts. S., "Dynamic Programming in Chemical Engineering and Process Control", Academic Press, New York, 1964.

TX9170 FINANCIAL MANAGEMENT

(Elective offered by Department of Textile Technology) L T P C

3 0 0 3

UNIT I BASIC CONCEPTS 9

Goals and functions of finance; concepts in valuation - valuation of firm; principles of capital investment, information needed to evaluate investments.

UNIT II EVALUATION OF PROJECTS 9

Evaluation of risky investment, required rate of return for projects and companies; divisions and acquisitions.

UNIT III FINANCING POLICIES 9

Financing and dividend policies; theory of capital structure; capital structure decision of the firm, dividends and valuation; short, intermediate and long term financing, expansion and contraction.

UNIT IV WORKING CAPITAL MANAGEMENT 9

Management of liquidity and current assets; working capital management and efficient market consideration; management of cash and marketable securities.

UNIT V ANALYSIS OF FINANCIAL STATEMENTS 9

Tools of financial analysis and control; financial ratio analysis; funds flow analysis and financial forecasting; analysis of operating and financial leverage.

TOTAL : 45 PERIODS

REFERENCES

1. James C. Van Home, “Financial Management and Policy”, Prentice Hall of India Pvt. Limited, New Delhi, 1980.
2. Bhave P.V. and Srinivasan V., “Cost accounting to Textile Mills”, ATIRA, Ahmedabad, 1976.

TX9171 INDUSTRIAL RELATIONS AND LABOUR LAWS
(Elective offered by Department of Textile Technology) L T P C
3 0 0 3

UNIT I DEFINITION AND SCOPE 9
Aim and scope of industrial psychology; Indian labour laws ands their administration – their impact on business and economy.

UNIT II WORKERS EDUCATION 9
Workers education; social responsibility; Industrial harmony and native welfare; labour unrest; collective bargaining.

UNIT III INDUSTRIAL DISPUTES 9
Methods of settlement of industrial disputes, reconciliation, arbitration, adjudication: role of labour welfare officer.

UNIT IV HUMAN RELATIONS 9
Workers participation in industry; human relations in industry.

UNIT V INDUSTRIAL SICKNESS 9
B.I.F.R.; Factories Act.

TOTAL : 45 PERIODS

REFERENCES

1. Yoder D. and Paul Standohar D., “Personal Management and Industrial Relations ”, Prentice Hall of India (P) Limited, New Delhi, 1984.
2. Tripathi P.C., “Personal Management and Industrial Relations”, Sultan Chand and Sons, New Delhi, 1988.

CL9158 TOTAL QUALITY MANAGEMENT
(Elective offered by Department of Chemical Engineering) **L T P C**
3 0 0 3

UNIT I CONCEPTS OF TQM 5
Philosophy of TQM, Customer focus, organization, top management commitment, team work, quality philosophies of Deming, Crosby and Muller

UNIT II TQM PROCESS 12
QC Tools, Problem solving methodologies, new management tools, work habits, quality circles, bench marking, strategic quality planning

UNIT III TQM SYSTEMS 8
Quality policy deployment, quality function deployment, Standardization, designing for quality, manufacturing for quality

UNIT IV QUALITY SYSTEM 10
Need for ISO 9000 system, Advantages, clauses of ISO 9000, Implementation of ISO 9000, quality costs, quality, auditing, case studies

UNIT V IMPLEMENTATION OF TQM 10

Steps, KAIZEN, 5s, JIT, POKAYOKE, Taguchi methods, case studies

TOTAL : 45 PERIODS

REFERENCES

1. Rose J. E., “Total quality Management”, Kogan Page Ltd, 1993.
2. Bank, J., “The essence of Total Quality Management”, Prentice Hall of India, 1993.
3. Bonds, G., “Beyond Total Quality Management”, McGraw Hill, 1994.
4. Osada, T., “The 5S’s, The Asian Productivity Organisation”, 1991 Imami, M., KAIZEN, McGraw Hill, 1996.