SYLLABUS - B.Sc (Garment Manufacturing Technology)

Semesters	Subject code	Title of the paper	Number's of week/ Hrs.	No of Credits	Duration of Exam./ Hrs	Marks in Examination				
I Semester:						Theory	IA	Practical	IA	Total
	GMT 101	English	4	4	3	70	30	-	-	100
	GMT 102	Any Indian Language #	4	4	3	70	30	-	-	100
	GMT 103	Indian Constitution	4	4	3	70	30	-	-	100
	GMT 104	Textile fibers and yarns	4	4	3	70	30	-	-	100
	GMT 105	Apparel Production Technology-I	4	4	3	70	30	-	-	100
	GMT 106	Sewing Technology	4	4	3	70	30	-	-	100
	GMT - L 107	Textile fibers and yarns	3	2	3	-	-	40	10	50
	GMT - L 108	Apparel Production Technology-I	3	2	3	-	-	40	10	50
	GMT - L 109	Sewing Technology	3	2	3	-	-	40	10	50
		Co-curricular activities	-	-	-	-	-	-	-	50
		Total for I Semester		**30**						**750**
II Semester:										
	GMT 201	English	4	4	3	70	30	-	-	100
	GMT 202	Any Indian Language #	4	4	3	70	30	-	-	100
	GMT 203	Environmental Studies	4	4	3	70	30	-	-	100
	GMT 204	Fabric formation and structure	4	4	3	70	30	-	-	100
	GMT 205	Apparel Production Technology-II	4	4	3	70	30	-	-	100
	GMT 206	Computer Aided Design (CAD)	4	4	3	70	30	-	-	100
	Open Core	**Open Elective**	**4**	**4**	**3**	**70**	**30**	**-**	**-**	**100**
	GMT – L 207	Fabric Analysis	3	2	3	-	-	40	10	50
	GMT – L 208	Apparel Production Technology-II	3	2	3	-	-	40	10	50
	GMT – L 209	Computer Aided Design (CAD)	3	2	3	-	-	40	10	50
		Co-curricular activities								**50**
		Total for II Semester		**34**						**850**
III Semester:										
	GMT 301	Communication skills in English –I	4	4	3	70	30	-	-	100
	GMT 302	Any Indian Language #	4	4	3	70	30	-	-	100
	GMT 303	Computer Fundamentals	4	4	3	70	30	-	-	100
	GMT 304	Chemical Processing of Textiles	4	4	3	70	30	-	-	100
	GMT 305	Apparel Machineries and Maintenance	4	4	3	70	30	-	-	100
	GMT 306	Creative Pattern Making	4	4	3	70	30	-	-	100
	Open Core	**Open Elective**	**4**	**4**	**3**	**70**	**30**	**-**	**-**	**100**
	GMT – L 307	Garment Construction-I	3	2	3	-	-	40	10	50
	GMT – L 308	Apparel Machineries and Maintenance	3	2	3	-	-	40	10	50
	GMT – L 309	Creative Pattern Making	3	2	3	-	-	40	10	50
		Total for III Semester		**34**						**850**

IV Semester:										
	GMT 401	Communication skills in English –II	4	4	3	70	30	-	-	100
	GMT 402	Any Indian Language #	4	4	3	70	30	-	-	100
	GMT 403	Computer Applications	4	4	3	70	30	-	-	100
	GMT 404	Fashion Marketing And Merchandising	4	4	3	70	30	-	-	100
	GMT 405	Advanced Pattern Making	4	4	3	70	30	-	-	100
	GMT 406	Garment Production Machinery And Equipments	4	4	3	70	30	-	-	100
	Open Core	**Open Elective**	**4**	**4**	**3**	**70**	**30**	**-**	**-**	**100**
	GMT – L 407	Garment construction –II	3	2	3	-	-	40	10	50
	GMT – L 408	Advanced Pattern Making	3	2	3	-	-	40	10	50
	GMT – L 409	Garment Production Machinery And Equipments	3	2	3	-	-	40	10	50
		Total for IV Semester		**34**						**850**
V Semester:										
	GMT 501	Traditional Textiles & Historic Costume	4	4	3	70	30	-	-	100
	GMT 502	Fabric Dyeing and Printing Technology	4	4	3	70	30	-	-	100
	GMT 503	Industrial Management	4	4	3	70	30	-	-	100
	GMT 504	Elements Of Fashion Design	4	4	3	70	30	-	-	100
	GMT 505	Industrial Engineering	4	4	3	70	30	-	-	100
	GMT 506	Quality Control in Apparel Industry	4	4	3	70	30	-	-	100
	Open Core	**Open Elective**	**4**	**4**	**3**	**70**	**30**	**-**	**-**	**100**
	GMT - L 507	Fabric Dyeing and Printing Technology	3	2	3	-	-	40	10	50
	GMT - L 508	Industrial Pattern Making and Garment Construction	3	2	3	-	-	40	10	50
		Total for V Semester		**32**						**800**
VI Semester:										
	GMT 601	Knitting Technology	4	4	3	70	30	-	-	100
	GMT 602	Statistical application in Textile Industry	4	4	3	70	30	-	-	100
	GMT 603	Entrepreneurship Development	4	4	3	70	30	-	-	100
	GMT – L 604	Industrial Pattern Making	3	2	3	-	-	40	10	50
	GMT – L 605	Garment Construction-III	3	2	3	-	-	40	10	50
	GMT – L 606	CAD in Apparel Industry	3	2	3	-	-	40	10	50
	GMT 607	Seminar		2						50
	GMT 608	Project work		4						100
		Total for VI Semester		**24**						**600**
		Grand total for 6 Semesters		**188**						**4700**

***Practical Subjects.**

**** Excluding marks for Co-curricular activities (B.Sc GMT 1st and 2nd Sem)**

Matrix for 3 Years Bachelor's Program shall be as follows

Sl No	Courses	I SEM		II SEM		III SEM		IV SEM		V SEM		VI SEM		Total	
		C	M	C	M	C	M	C	M	C	M	C	M	C	M
1.	Hard Core	12	300	12	300	12	300	12	300					48	1200
2.	Soft Core	18	450	18	450	18	450	18	450	28	700	18	450	118	2950
3.	Open Elective			4	100	4	100	4	100	4	100			16	400
4.	Project Work/ Seminar											6	150	6	150
5.	Co-curricular Activities	4	100											4	100
	Total	34	850	34	850	34	850	34	850	32	800	30	600	188	4700

Question Paper Pattern For I to VI Semester

Sl.No	Type of Questions	Number of Questions	Each Question Carries Marks	Total Marks
1	Objectives	10	1	10
2	Short Answers	04	5	20
3	Long Answers	04	10	40
Grand Total				70

I Semester **GMT-104 TEXTILE FIBERS AND YARNS**

1	Introduction to textiles, Fiber definition, classification of textile fibers- Natural, manmade. Characteristics of textile fibers- Identification of textile fibers-Microscopic, Burning, Solubility, Visual.	14 hrs
2	Spinning-Definition, Classification of spinning, Opening, cleaning, blending, doubling, Carding, combing, drawing, and roving.	14 hrs
3	Textile Yarns- Definition, classification of yarns- Simple & Fancy yarns, and their applications. Yarn properties- Yarn linear density, size, twist in yarn, and twist direction, strength & uniformity, Yarn count	14 hrs
4	Introduction to manufacture of sewing threads – Definition of sewing thread numbering, methods of manufacturing and their properties.	14 hrs
References:	1. Cook J. Hand book of Textile fibre, Vo1.1&II Marrow Wat Ford, England 2. Sreenivasamoorthy.H.V. "Introduction to textile fibers", 1987 3. Klien.W.G."The technology of short staple spinning 'Textile institute Manchester,1988. 4. Shenai V.A., Textile fibres, Sevak Bombay, 1980. 5. B.C. Goswamy, "Textile yarn".	

I Semester **GMT-105 APPAREL PRODUCTION TECHNOLOGY-I**

1	Pattern Development –Human anatomy, Human figure, types and variations, principles of 8/10 head theory. Anthropometric measurements, vertical, horizontal, circumference. Pattern making tools, & equipments.	14 hrs
2	Methods of pattern making (drafting, draping, flat pattern techniques).Preparation of basic Bodice block, front, back, sleeve. Dart manipulation.	14 hrs
3	Apparel Industry: Introduction to apparel industry. Organization of apparel industry. Over view of apparel manufacturing technology. Overview of cutting department spreading, Types of lay- single ply, multiply, stepped ply.	14 hrs
4	Forms of Spreading- One way face to face, two way. Spreading methods-manual spreading, Spreading carriage, automatic spreading machine.	14 hrs
References:	1.Rajesh Bheda "Managing Productivity in the Apparel Industry" CBS Publishers & Distributors (2006) 2.Helen Joseph Armstrong "Pattern Making for Fashion Design", Dorling Kindersley India Pvt.Ltd.(2009) 3.Mary Mathews, "Practical clothing construction" Thomson & co., madras, 1974. 4. Jacob Solinger., "Apparel Manufacturing Handbook", VanNostrand Reinhold Company(1980). 5.Herold Carr and Barbara Iatham "The technology of clothing manufacture", Om book service 1994.	

I Semester **GMT-106 SEWING TECHNOLOGY**

1	Introduction to sewing, history of sewing machines, types of sewing machines, parts & functions of single needle machine, double needle machine, over lock machine.	14 hrs
2	Formation of stitch, stitch types & classification. Features & uses of chain stitch lock stitch, Multi thread chain stitch, over edge chain stitch & covering chain stitch, attachments used in Sewing machine.	14 hrs
3	Machine planning- definition, what are the factors affecting the machinery allocation. Machine layout- definition, Basic concept of machine layout, what are the factors affecting machine layout.	14 hrs
4	Seams & seam finishes- definition, types of seams and seam finishes and their applications. Sewing machine- maintenance, common problems & remedies.	14 hrs
References:	1. Jacob So linger., "Apparel Manufacturing Handbook", VanNostrand Reinhold Company (1980). 2. Herold Carr and Barbara Latham "The technology of clothing Manufacture", Om book service 1994. 3 Laing R.M. Webster J. "Stitches and seams", The textile institute1998. 4 Shaeffer Clair "Sewing for apparel Industry" Prentice Hall, New Jersey2001. 5 "Apparel Manufacturing Process", Kunz.	

GMT-L-107 TEXTILE FIBERS AND YARNS

Practical

3hrs/week/batch

1	Visual identification of staple, filament yarns, & fancy yarns. Cross view, longitudinal views of textile fibers.
2	Identification of fibers – Microscopic, Burning, Physical and chemical test..
3	Testing Yarn- Twist & Count, strength, uniformity etc.
4	Assignment – Collection of different types of fibers and their properties.
5	Sewing thread testing.

GMT-L-108 APPAREL PRODUCTION TECHNOLOGY -I

Practical

3hrs/week/batch

1	Pattern making tools & equipments. Methods of taking measurements.
2	Drafting of basic bodice block-front, back, sleeve.
3	Dart manipulations- French dart, side seam dart, arm hole, shoulder tip, mid shoulder, Neck dart, center front dart.
4	Facing- Armhole, neck, front placket, neck designs.
5	Development of cowl & gathered neck lines.

GMT-L-109 SEWING TECHNOLOGY

Practical

3hrs/week/batch

1	Single Needle Lock Stitch machine speed control
2	Paper Exercise (a) Straight line (b) Square (c) Triangle (d) Curves (e) S – Curve (f) Rectangle with curve (g) Circles (h) Half circle
3	Fabric exercise (a) Straight lines with Back tack (b) Pin tuck, space tucks (c) Different types of pleats (Knife pleat, box pleat, Inverted box pleat)
4	Types of pockets with flap (a) Square (b) Round (c) V-shape (d) Notch
5	Types of seams (a) Super imposed seam (b) Mock French and French seam (c) Welt seam (d) Flat and Fell seam (e) Lap seam, Bound seam
6	Types of plackets (a) Single placket (b) Double placket (c) Continuous placket
7	Collar preparation (a) Open collar (b) Collar with collar band
8	Types of Cuff (a) Square (b) Round (c) Notch
9	Piping (a) Neck (b) Armhole

II Semester **GMT-204 FABRIC FORMATION AND STRUCTURE**

1	Introduction to fabric. Classification of fabric. Preparatory process to weaving. Methods of fabric formation. Types of looms & parts.	14 hrs
2	Shuttle, shut less loom, basic weaving Concepts. Basic motions of loom- Primary, Secondary & auxiliary motions. Description of dobby, jacquard.	14 hrs
3	Automatic loom - shuttleless looms, rapier, water jet &air jet. Comparison of various looms. Types of Weaves- Plain, twill & satin their derivatives.	14 hrs
4	Decorative weaves – Ordinary & Brighten honey comb, ordinary honey comb weave ,huck a back. on- woven fabrics.	14 hrs
References:	1. Talukdar M.K "Introduction winding and warping" Bombay private circulation 2. Ormerod, "Modern preparatution and weaving machine" 3. Robinson & Marks "Principles of weaving" 4. Sengupta "Yarn preparation". 5. M.K.Talukdar" Weaving, Machines, Mechanisms,Management.	

II Semester **GMT-205 APPAREL PRODUCTION TECHNOLOGY-II**

1	Pattern development: Conversion of darts to tucks pleats & gathers.	14 hrs
2	Layout : Principles of layout, laying of different patterns on different types of fabric. Grain lines, study of grain lines in fabrics and patterns lengthwise, widthwise bias and selvedges.	14 hrs
3	Apparel Industry: Marker making- Types of marker making, types of lay plan, marker efficiency, Position marking, drill marker, notches, thread marker, Fusing machines & their applications.	14 hrs
4	Grading –Definition, principles of grading, types of grading, even & uneven grading. Importance of Grading.	14 hrs
References:	1.Rajesh Bheda "Managing Productivity in the Apparel Industry" CBS Publishers & Distributors (2006) 2.Helen Joseph Armstrong "Pattern Making for Fashion Design", Dorling Kindersley India Pvt.Ltd.(2009) 3.Mary Mathews, "Practical clothing construction" Thomson & co., madras, 1974. 4. Jacob Solinger., "Apparel Manufacturing Handbook", VanNostrand Reinhold Company(1980). 5.Herold Carr and Barbara Iatham "The technology of clothing manufacture", Om book service 1994.	

II Semester **GMT-206 COMPUTER AIDED DESIGN**

1	Introduction t o computers and programming. Computer-definition, history, characteristics and applications. Functions of computer- Primary components, Storage unit & devices.	14 hrs
2	Introduction to MS-office , Operating system, Different parts of windows screen , my computer, windows explorer , creating a folders and finding files and folders.	14 hrs
3	Introduction to MS-word: Excel power point & their features and formatting.	14 hrs
4	Corel Draw- Introduction to Corel draws. Functions and applications. Basics of file handling.	14 hrs
References:	1. Stephen Gray "CAD/CAM in clothing and Textile", Gower Publishing Limited, 1998. 2. W.Aldrich, "CAD in clothing and Textiles", Blackwell science 2nd edition, 1992, ISBN: 0-63-3893-4 3. Jacob Solinger, "Apparel Manufacturing Handbooks", Van no strand and Reinhold Company.	

II Semester Open Elective: GARMENT PRODUCTION TECHNOLOGY

1	Pattern Development –Human anatomy, Human figure, types and variations, principles of 8/10 head theory. Anthropometric measurements, vertical, horizontal, circumference. Pattern making tools, & equipments.	14 hrs
2	Methods of pattern making (drafting, draping, flat pattern techniques).Preparation of basic Bodice block, front, back, sleeve. Dart manipulation.	14 hrs
3	Apparel Industry: Introduction to apparel industry. Organization of apparel industry. Over view of apparel manufacturing technology. Overview of cutting department spreading, Types of lay- single ply, multiply, stepped ply.	14 hrs
4	Forms of Spreading- One way face to face, two way. Spreading methods-manual spreading, Spreading carriage, automatic spreading machine.	14 hrs
References:	1.Rajesh Bheda "Managing Productivity in the Apparel Industry" CBS Publishers & Distributors (2006) 2.Helen Joseph Armstrong "Pattern Making for Fashion Design", Dorling Kindersley India Pvt.Ltd.(2009) 3.Mary Mathews, "Practical clothing construction" Thomson & co., madras, 1974. 4. Jacob Solinger., "Apparel Manufacturing Handbook", VanNostrand Reinhold Company(1980). 5.Herold Carr and Barbara Iatham "The technology of clothing manufacture", Om book service 1994.	

GMT-L-207 FABRIC ANALYSIS

Practical

3hrs/week/batch

1	Collection of fabrics used in apparels & recent trends in fabric development.
2	Analysis of fabric weaves – Plain, twill, Satin, Sateen, rib, basket, even & uneven basket & right hand twill. Herring bone, huck a back, diamond, honeycomb. Denim, crape, Jorje jet, velvet, pile, double cloth.
3	Count –Ends/Inch, Picks/Inch, GSM calculations, crimp calculations. For different types of fabrics.
References:	1. Talukdar M.K "Introduction winding and warping" Bombay private circulation 2. Ormerod, "Modern preparatution and weaving machine" 3. Robinson & Marks "Principles of weaving" 4. Sengupta "Yarn preparation". 5. M.K.Talukdar" Weaving, Machines, Mechanisms,Management.

GMT-L-208 APPAREL PRODUCTION TECHNOLOGY –II

Practical

3hrs/week/batch

1	Preparation of tucks pleats & gathers.
2	Princes style lines & its variations. Types of cuffs, Notch ,square,round.
3	Drafting & construction of shirt collar, peter pan collar, sailor collar.
4	Skirts- A-line skirt, knife pleat, box pleat, with yoke.

GMT-L-209 COMPUTER AIDED DESIGN

Practical

3hrs/week/batch

1	Working on Windows. Operating system- Desktop and their components, my computer, Accessing control panel using mouse & key board, Managing documents-working on files & folders
2	Working on Point –Tolls & menu, drawing & coloring. Working on MS- Office, MS-word, Excel power point tools & menu, printing & saving a document.
3	Corel Draw-Basics, file handling, shapes, lines & curves, colors & fills, working with text, Symbols, clip art.
4	Creation of motifs-Abstract, animated, geometric & floral design- its application on garment.

III Semester **GMT-304 CHEMICAL PROCESSING OF TEXTILES**

1	Introduction to wet processing. Sequence of wet processing operations for cotton, silk, wool, Viscose polyester and nylon. Classification of textile processing machines.	14 hrs
2	Preparatory process: Stitching, Singing, Scouring, Shearing & Croping, Degumming, Bleaching and mercerization.	14 hrs
3	Introduction finishing of textiles. Classification finishing. Temporary& permanent finishes. Study of chemical and mechanical finishing techniques.	14 hrs
4	Finishing of woven fabric study of different finishing machineries- drying machine, Sanforising, calendaring machine.	14 hrs
References:	1. Textile Chemistry Vo.I,II and III, R H Peters, Elsewhere Publishing Co. New York. 2. Chemical Technology of fibrous materials, Sadov, MIR Publications, 1978. 3. Scouring and Bleaching of Cotton, J.T. Marsh, 1979, B I Publications. 4. Technology of Textile Processing Vo1 I,II,III, V AShenai, 1975, Sevak Publications. 5. Chemical processing of textiles- NCUTE Publication.	

III Semester **GMT-305 APPAREL MACHINERIES AND MAINTENANCE**

1	Sewing machine Types – Manual, Semi-automatic and Automatic sewing machines. Construction of Sewing Machine. Function and major Components of sewing machine and their application. Its care and maintenances	14 hrs
2	Different types of machine beds-flatbed, raised bed, post bed, cylindrical bed and side bed. Transmission of power ,Types of belts- Flat belt and v belt….	14 hrs
3	Introduction of stitches, stitch types, stitch diagrams or formation, and steps of stitch formation. Sewing machine needles- types – straight and curved, needle points, sizes and uses of needles.	14 hrs
4	Threading, operation and application of over-lock flat-lock, double needle lock stitch, double needle chain stitch, button hole, button attach, bar-tack, zig-zag, feed off the arm sewing machines	14 hrs
References:	1. A.J Chuter "Introduction to clothing production management" 2. Jacob Soliner "Apparel manufacturing hand book" 3. Shaeffer Clair :Sewing for Apparel Industry" Prentice Hall, New Jersey 2001. 4. Sewing machine technical manuals.	

III Semester **GMT- 306 CREATIVE PATTERN MAKING**

1	Introduction to Pattern making and garment construction. Sleeves- Introduction, variations. Designing and drafting - cap, puff, petal, lantern, bell, leg-o-mutton, wedding sleeve, and bishop sleeve.	14 hrs
2	Sleeve bodice combination. Designing and drafting-Sleeve bodies combination- kimono, dolman, raglan, drop shoulder, and exaggerated arm hole	14 hrs
3	Collars - Introduction and classification Designing and drafting of mandarin collar, roll collar, built up neck lines. Cuff – self faced and roll up	14 hrs
4	Skirts – Introduction and types. Designing and drafting of umbrella, godet and tier skirts . Designing and drafting Pockets and Plackets a. Pointed placket with facing b. Accordion pocket (book pocket) Welt pocket variation- single and double with flap	14 hrs
References:	1.Pattern Making for Fashion Design, Helen Joseph Armstrong, Dorling Kindersley India Pvt. Ltd (2006) 2.Practical clothing construction, Mary Mathews, Thomson & co., madras, 1974. 3.Apparel manufacturing Hand book, Jacob Solinger van Nostrand Reinhold Company. (1980).	

III Semester Open Elective: PATTERN DEVELOPMENT IN APPARELS

1	Introduction to Pattern making and garment construction. Sleeves- Introduction, variations. Designing and drafting - cap, puff, petal, lantern, bell, wedding sleeve.	14 hrs
2	Sleeve bodice combination. Designing and drafting-Sleeve bodies combination- kimono, dolman.	14 hrs
3	Collars - Introduction and classification Designing and drafting of mandarin collar, roll collar. Cuff – self faced and roll up	14 hrs
4	Skirts – Introduction and types. Designing and drafting of godet and tier skirts.	14 hrs
References:	1.Pattern Making for Fashion Design, Helen Joseph Armstrong, Dorling Kindersley India Pvt. Ltd (2006) 2.Practical clothing construction, Mary Mathews, Thomson & co., madras, 1974. 3.Apparel manufacturing Hand book, Jacob Solinger van Nostrand Reinhold Company. (1980).	

GMT-L-307 GARMENT CONSTRUCTION-I

Practical

3hrs/week/batch

1	Variation of Sleeves-Construction of - cap, puff, petal, lantern, bell, leg-o-mutton, wedding sleeve, and bishop sleeve.
2	Sleeve bodice combination. Construction of - Sleeve bodice combination- kimono, dolman, raglan, drop shoulder, and exaggerated arm hole
3	Collars-Constructing - mandarin collar, roll collar, and built up neck lines Cuff- self faced and roll up cuff.
4	Skirts a. Constructing a Umbrella Skirt.b. Constructing a Godet Skirt c. Constructing a Separated Tier's
5	Constructing: Pockets and Plackets a. Pointed placket with facing b. Accordion pocket (book pocket) Welt pocket variation- Single, Double with flap.
6	Basic block a. Construction of Basic sloper b. Adaptation of basic block into Princess line
7	Ladies top a. Fullness along princes line. Construction of front with princess line. Attach front & back b. Fullness at semi-yoke above bust.Construction of front with yoke .Attach front & back

GMT-L-308 APPAREL MACHINARIES AND MAINTENANCE

Practical

3hrs/week/batch

1	Thread mounting & Stitch adjustment of 4 thread Over-lock machine
2	Thread mounting & Stitch adjustment of 5 thread Over-lock machine
3	Thread mounting & Stitch adjustment of 6 thread Over-lock machine
4	Thread mounting & Stitch adjustment of 3 thread Flat-lock (Loop Making) machine
5	Thread mounting & Stitch adjustment of 5 thread Flat-lock machine
6	Thread mounting & Stitch adjustment of Double needle lock stitch machine
7	Thread mounting & Stitch adjustment of 2 needle Chain stitch machine
8	Thread mounting & Stitch adjustment of Electronic Button Holler machine
9	Thread mounting & Stitch adjustment of Electronic Button Attach machine
10	Thread mounting & Stitch adjustment of Electronic Bar-tacker machine
11	Thread mounting & Stitch adjustment of Single needle lock Zig Zag machine
12	3 Assignment

GMT-L-309 CREATIVE PATTERN MAKING

Practical

3hrs/week/batch

1	Variation of Sleeves-Drafting - cap, puff, petal, lantern, bell, leg-o-mutton, wedding sleeve, and bishop sleeve.
2	Sleeve bodice combination -Drafting-Sleeve bodies combination- kimono, dolman, raglan,drop shoulder, and exaggerated arm hole.
3	Collars -Drafting mandarin collar, roll collar, built up neck lines.
4	Skirts a.Drafting a umbrella skirt b.Drafting a godet skirt c.Drafting a separated tier's skirt .
5	Constructing: Pockets and plackets a. Pointed placket with facing b. Accordion pocket(Book pocket). Welt pocket variation – single, double with flap

IV Semester **GMT-404 FASHION MARKETING AND MERCHANDISING**

1	Marketing: Objectives and strategies. Types of markets- domestic international. Indian fashion marketing environment, consumer behavior.	14 hrs
2	Survey of marketing: Marketing concepts and terminology. Market segmentation. Fashion image and positioning. Visual merchandising: Definition and purpose. Brief introduction to colour and texture, line and composition and types of displays and setting.	14 hrs
3	Role and Responsibilities of merchandiser, Merchandise buying: Buyers responsibilities and working with merchandising sources, merchandise planning: understanding consumer behavior, Planning and selection of merchandise assortment. Merchandising-Manufacturing interface.	14 hrs
4	Fashion retailing: Types of retail operations. Single or multiple unit stores. Organization with in a store. The store image and positioning. New trends in retailing- Fashion advertising and publicity.	14 hrs
References:	**Mike Easey "Fashion marketing"** 1. Tim Jackson and David Shaw "Fashion buying and merchandising management" 2. Martin.M. Pegler "Visual merchandising and display" 3. Philip Koller "Marketing Management" Analysis, planning, implementation and control. 4. Sharlekar. S.A Salvadore victor. S.J Nirmala Prasad.K "Principles of marketing" Delhi. 5. Kulkarni, Padhan Patil "Modern Marketing Research" Himalayan publishing house.	

IV Semester **GMT-405 ADVANCED PATTERN MAKING**

1	Introduction to children garments. - Standard measurement chart for boys and girls - Drafting of children's basic bodice block	14 hrs
2	Study of anthropometric measurements. Grading –Importance and introductory definition; General principles of grading. Body land marks; Types of grade; Uneven grade; Use of grading chart. Basic grading applications – front, back, sleeve and collar.	14 hrs
3	Study of different styles of woven and knitted children wear for both boys and girls. Steps involved in designing and drafting of children wear. Empire with flare frock a. Tank up Jumper b. Simple knit wear	14 hrs
4	a. Designer's knit wear b. School uniform for boys and girls c. Baba suit	14 hrs
References:	1. Pattern Making for Fashion Design, Helen Joseph Armstrong, Dorling Kindersley India Pvt. Ltd (2006) 2. Practical clothing construction, Mary Mathews, Thomson & co., madras, 1974. 3. Apparel manufacturing Hand book, Jacob Solinger van Nostrand Reinhold Company. (1980).	

IV Semester GMT-406 GARMENT PRODUCTION MACHINERY AND EQUIPMENTS

1	Cutting machine- classification and application – Straight, Circular or round knife cutting machine, band knife cutting machine, die cutting machine and automatic cutters.	14 hrs
2	Different type of feed mechanism and their application – bottom/drop feed, needle feed, top and bottom feed, and differential feed mechanism.	14 hrs
3	Different types of presser foot and their uses, types of fabric guides and their uses. Function of hook sets and loppers – types and uses. Application of folders and attachments in sewing machines.	14 hrs
4	Threading and operation of embroidery machine, Conversion of design from computer to embroidery on the fabric. And automatic pocket attach machine.	14 hrs
References:	1. A.J Chuter "Introduction to clothing production management" 2. Jacob Soliner "Apparel manufacturing hand book" 3. Shaeffer Clair :Sewing for Apparel Industry" Prentice Hall, New Jersey 2001. 4. Sewing machine technical manuals. 5. Gerry cooklin "Introduction to clothing manufacture" 6. Charline Phillips "Sewing machine attachment Hand book".	

IV Semester Open Elective: KNITTING TECHNOLOGY-I

1	Knitting- Definition, History, Classification of knitting. Comparison of woven & knitted fabrics. Types of knitting- Hand & machine.	14 hrs
2	General terms & principles of knitting technology, Basic knitting elements: Needles (Latch needle, Beard needle, Compound needle), Sinker, Cam.	14 hrs
3	Comparison between Warp and Weft Knitting, Knitting structure plain, jersey, rib, and interlock. Knitting Industry in India, Quality Control in Knitting.	14 hrs
4	Care & maintenance of knitted materials & precautions during washing of knitted goods. Methods of maintenance.	14 hrs
References:	1. David J Spencer, "Knitting Technology"Pergamon Press, 1985, New-York. 2. Ajgaonkar, Universal Publishing company, "Knitting Technology" Bombay 1998. 3. Ferry Bracken Berry "Knitter Clothing Technology.	

GMT-L- 407 GARMENT CONSTRUCTION-II

Practical

3hrs/week/batch

1	Construction of children garments.
	a. Empire with flare frock
	b. Tank up Jumper c. Simple knit wear
	d. Designer's knit wear e. School uniform for boys and girls
	f. Baba suit
2	Skirts a. A-line skirt b. Skirt with knife pleat c. Skirt with box pleat - preparation of box pleats - attach waist band d. Skirt with yoke - attach skirt to yoke - attach waist band
3	Shirt a. Construction of front & Back b. Construction of Sleeve, cuff & cuff c. Assemble the parts
4	Ladies shirt a. Construction front b.Construction back c. Attach front, back, Sleeve & collar

GMT-L- 408 ADVANCED PATTERN MAKING

Practical

3hrs/week/batch

1	Drafting for children basic bodice block - Front - Back - Sleeve
2	Drafting of children wear. Empire with flare frock. a. Tank up Jumper. b. Simple knit wear c. Designer's knit wear d. School uniform for boys and Girls e. Baba suit
3	4 Assignments

GMT-L-409 GARMENT PRODUCTION MACHINERY AND EQUIPMENTS

Practical

3hrs/week/batch

1	Thread mounting & Stitch adjustment of 2needle Feed Of The Arm machine
2	Thread mounting, Setting and operating the Auto Zig machine
3	Thread mounting, Setting and operating the Key Holer machine
4	Thread mounting, Setting and operating the Embroidery machine
5	Thread mounting, Setting and operating the waist band attach machine
6	Setting and operating the collar trimming, turning & blocking machine
7	Setting and operating the cuff blocking machine
8	Setting and operating the front placket attachment folder in double needle lock stitch machine
9	Setting and operating the bottom hem folder in single needle lock stitch machine
10	Setting and operating the waist band folder in waist band attach machine
11	Thread mounting Setting and operating of the Automatic pocket attach machine
12	3 Assignment

V Semester **GMT-501 TRADITIONAL TEXTILES AND HISTORIC COSTUME**

1	**Traditional Textiles** Traditional textiles of India, Classification, types and uniqueness. Woven-Brocades of Banaras, blauchari, chanderi, tanchoi, kanjivaram, himru,&amru and Dacca muslins	14 hrs
2	**Historic Costume** Introduction – origin of clothing costume of India –Traditional costumes, accessories and ornaments of different states of India. Kashmir, Gujarat, Rajasthan, Assam, Manipur, Maharashtra, Karnataka and Kerala.	14 hrs
3	Study of traditional motifs of different countries and their influence on Indian textiles.	14 hrs
4	Study of traditional costume of – Persian, Mughal, Egyptian, China, Rome, French and America.	14 hrs
References:	1. John Gillow & Nicholas"Traditional Indian Textiles" Thames & Hudson 1993 2. Sharon Lee Tate, "Inside fashion design", Harper & Row publisher. 3. Lesla. K.T. Chas A bernd and Co., "Historic Costume" 4. Dorris Flyn, "Costumes of India", Oxford & IBH publishing co.,	

V Semester **GMT-502 FABRIC DYEING AND PRINTING TECHNOLOGY**

1	Introduction to dyeing process and classification of dyes. Dyeing of textile material by direct, acid, basic, metal complex, vat, disperse and reactive dyes, fastness, properties of their dyes.	14 hrs
2	Study of Dyeing machines: Jigger, padding mangle and winch dyeing machines, cheese dyeing, jet dyeing and garment dyeing machines.	14 hrs
3	Introduction to textile printing-An overview of the printing process. Selection of dyes/pigments/auxiliaries to suit the end use of the printed textile materials.	14 hrs
4	Printing paste ingredients and preparation styles of printing, direct, discharge and resist printing block screen and roller printing garment printing machine, flat bed and rotary screen printing, Developments in printing machinery.	14 hrs
References:	1. Trotman ER, Dyeing & chemical technology of textile fibres. Charles Griffin co., London,1993. 2. James Ronald, Printing & Dyeing of Fabrics & Plastics, Mahajan book distb, 1996. 3. Shenai V.A, "Introduction to the chemistry of dye stuffs, Sevak pub, Mumbai, 1991.	

V Semester **GMT- 503 INDUSTRIAL MANAGEMENT**

1	Management – Introduction-meaning-nature and characteristics of management –scope and functional areas of management –Manage as a science, art of profession, management and administration –roles of management, levels of management, developing of management thought-early management –approaches-modern management approaches.	14 hrs
2	Planning: Nature, importance and purpose of planning process-objectives-types of plans (meaning only)-decision making-importance of planning –steps in planning and planning premises-hierarchy of plans.	14 hrs
3	Organizing and staffing: nature and purpose of organization-principles of organization – principles of organization –types of organization –Departmentation –committees-centralization V/S Decentralization of authority and responsibility. Span of control-MBO and MBE(Meaning only),Nature and Importance of staffing –Process of selection and recruitment.	14 hrs
4	Directing and controlling: Meaning and nature of directing-leadership styles, motivation theories, communication, meaning and importance-co-ordination, meaning and techniques of co-ordination, meaning and steps in controlling- Essentials of a sound control system-methods of establishing control.	14 hrs
References:	1. Banga T.R. "Atext book of Factory Organization". 2. Ormerod, "Management of Textile Production" 3. Bethel,Tann, Atwater and Rung, "Production Control" McGraw Hill Book Co., New York, (1948) 4. Apple. J.M., "Plant Layout and Materials Handling" The Ronald Press Co.,New York (1950). 5. Bang.T.R and Sharma, "Industrial Organization and Engineering Economics.	

V Semester **GMT-504 ELEMENTS OF FASHION DESIGN**

1	Introduction to fashion design and concept on fashion designing. Fashion- origin, Definition and concept. Design- Definition,Elements and principles of design	14 hrs
2	Introduction to fashion house, mass fashion and boutique. Fashion cycle, trends based on climate, age and gender.	14 hrs
3	Colour- Definition, dimensions of colour, hue, value and intensity. Colour schemes-its importance & application.	14 hrs
4	Draping-Introduction to draping,Tool,Equipment and dress forms. Grain ,Preparation of muslin for draping, fabric behavior. Principles and techniques of draping. Draping of foundation patterns-Bodice(Front and back), Skirts and pants	14 hrs
References:	1. Inside fashion design, Sharon Lee Tate, Harper & Row publisher. 2. The Costumes and Textiles of India. Jamila Brij Bhushar, D.B. Taraporevala sons & co., Bombay. 3. Historic Costume, Lesla. K.T. Chas A bernd and Co., 4. Draping for Apparel Industry. Helen Joseph Armstrong. **5.** Draping for fashion design. Hilde Jaffe, Nurie Relis.	

V Semester **GMT- 505 INDUSTRIAL ENGINEERING**

1	Definition and purpose of work measurement basic procedure and techniques of work measurements. Definition of time study, time study equipment and time study forms. Selection of job and steps in making a time study.	14 hrs
2	Productivity: Total productivity, partial factor productivity –definition. , productivity measurement methods and levels of productivity measurements.	14 hrs
3	Method study: definition ,basic procedure and selection of work, recording methods ,movement of workers and materials, string diagram, workers type flow process chart, multiple activity chart and travel chart ,principles of motion economy and classification of movements, micro motion study and development of improved methods.	14 hrs
4	Work study: definition, basic procedure of work study and its advantages. Line balancing: Definition, what are the steps taken to have a properly balanced line, what are the factors affecting the line balance.	14 hrs
References:	1. Wiley Eastern (P) Ltd., "Industrial engineering manual for textile industry" 2. Khanna O.P. and Sarup A., "Industrial Engineering and Management" 3. M.N. Pal, "Work study" 4. Rajesh Beda, "Managing Productivity in Apparel Industry"	

V Semester GMT-506 QUALITY CONTROL IN APPAREL INDUSTRY

1	Definition of quality, quality control, quality assurance, grades & defects. Importance of Quality.	14 hrs
2	Importance of fabric quality control. Knitted &woven fabric defects. Classification & Analysis. Fabric grading systems- 4 point & 10 point.raw material inspection-in Process inspection. Quality control in cutting room, sewing room, & finishing room, Charts and formats.	14 hrs
3	Fabric tests- yarn count & construction, fabric stretch properties, dimensional changes due to laundering, dry cleaning, steaming & pressing. Bowing & skewness. Fabric thickness, Pilling & abrasion resistance. Testing sewing threads, buttons, snap fasteners, zippers & Fusible interlinings.	14 hrs
4	Care labeling of apparels & textiles: care labeling of apparel ISO care symbols. Use of Static's in quality control. Introduction to AQL, ISO, TQM & Six sigma. Seven quality tools-process flow chart, cause & effect diagrams. Check sheets & histograms, Pareto analysis, scatter diagrams, statical process control chart, and use of these charts in quality management programs.	14 hrs
References:	1. Carr and Latham, "Technology of clothing manufacture" 2. Pradeep. V. Mehta "Garment quality conrol" 3. Bone. M " Textile quality; physical methods of product and process control.	

V Semester Open Elective: KNITTING TECHNOLOGY-II

1	Knitting- Definition, history.Classification of knitting. Comparison of woven & knitted fabrics. Types of knitting- Hand & machine, characteristics of knitted goods.	14 hrs
2	General terms & principles of knitting technology, basic knitting elements, Knitting cycle of Beard needle& Latch needle.	14 hrs
3	Knitting types –Warp, weft –classification, knitting structure plain, jersey, rib, and interlock. Circular knitting machine.	14 hrs
4	Care & maintenance of knitted materials & precautions during washing of knitted goods. Methods of maintenance.	14 hrs
References:	1. David J Spencer, "Knitting Technology"Pergamon Press, 1985, New-York. 2. Ajgaonkar, Universal Publishing company, "Knitting Technology" Bombay 1998. 3. Ferry Bracken Berry "Knitter Clothing Technology.	

GMT-L-507 FABRIC DYEING AND PRINTING TECHNOLOGY

Practical

3hrs/week/batch

1	Dyeing of cotton yarn/fabric using direct dyes
2	Dyeing of cotton yarn/fabric using reactive dyes
3	Dyeing of cotton yarn/fabric using Vat/Soluble vat dyes
4	Dyeing of silk with acid and basic dyes
5	Dyeing of silk with metal complex dyes
6	Preparation of printing paste using pigment colours.
7	Printing practice using hand blocks and screens with various classes of dyes.
8	Preparation of screens for screen printing
9	Resist style (Batik) of printing on fabrics
10	Tie and dye printing

GMT L-508 INDUSTRIAL PATTERN MAKING AND GARMENT CONSTRUCTION

Practical

3hrs/week/batch

1	Drafting:
	a. Casual shirt for men
	b. Jeans jacket
	c. Jeans for men
	d. Basic sari blouse and their variations
	e. Basic Sal war kameez and their variations
2	4 Assignments

VI Semester **GMT-601 KNITTING TECHNOLOGY**

1	Knitting- Definition, history.Classification of knitting. Comparison of woven & knitted fabrics. Types of knitting- Hand & machine, characteristics of knitted goods.	14 hrs
2	General terms & principles of knitting technology, basic knitting elements, Knitting cycle of Beard needle& latch needle.	14 hrs
3	Knitting types –Warp, weft –classification, knitting structure plain, jersey, rib, and interlock. Types of threading, production mechanism in raschel and tricot knitting machines.	14 hrs
4	Care & maintenance of knitted materials & precautions during washing of knitted goods. Methods of maintenance.	14 hrs
References:	4. David J Spencer, "Knitting Technology"Pergamon Press, 1985, New-York. 5. Ajgaonkar, Universal Publishing company, "Knitting Technology" Bombay 1998. 6. Ferry Bracken Berry "Knitter Clothing Technology.	

VI Semester **GMT-602 STATISTICAL APPLICATION IN TEXTILE INDUSTRY**

1	Importance and scope of statistical application in textile industry. Classification of statistics: Tabular presentation and graphical re presentation. Frequency, Distribution, grouped and un grouped frequency.	14 hrs
2	Distribution, continuous frequency distribution. Number of classes and size of class intervals. Types of class intervals-inclusive and exclusive type. Cumulative frequency distribution. Tabulation- meaning & Importance. Graphical representation- line diagram, bar diagram, pie chart, histogram & Frequency polygon, frequency curve.	14 hrs
3	Measure of central tendency: Mean arithmetic mean, geometric mean and harmonic Mean, mode & median, definitions of their terms examples to be given from textile and garment field.	14 hrs
4	Analysis of Variance – Elementary concepts of design of experiments. Planning, Investigation & analysis of experimental results. Correlation & correlation co efficient.	14 hrs
References:	1. "Statistics for Textile Technologists" – LHC Tippet, Textile Institute, Manchester, 1973. 2. "Practical Statistics for Textile industry", Part-I and II, GAV Leaf, Textile Institute, 1984. 3. "Statistical methods and their application", BIS Publications. 4. Kothari, "Research Methodology" 5. Booth J.E.,"Textile Testing"	

VI Semester **GMT-603 ENTREPRENEURSHIP DEVELOPMENT**

1	Entrepreneur: Meaning of entrepreneur; Evolution of the concept, functions of an Entrepreneur, types of entrepreneur, Entrepreneur- An emerging class. concept of Entrepreneurship- Evolution of entrepreneurship, development of Entreneurship: Stages in entrepreneurial process; role of entrepreneurs in economic development; entrepreneurship in India; Entrepreneurship- its barriers.	14 hrs
2	Small scale industries: Definition; characteristics; need and rational; objectives; scope; Scope; role of SSI in economic development. Advantages of SSI steps to start and SSI Government policy towards SSI; Different policies of SSI; Government support for SSI During 5 years plans. Impact of liberalization, privatization, globalization on SSI of WTO/GATT supporting agencies of government for SSI, meaning, nature of support; Objectives; functions; types of help; Ancillary industry and tiny industry (definition).	14 hrs
3	Institutional Support: Different schemes; TECKSOK; KIADB; KSSIDC, KSIMC; DIC Single window agency; SISI; NSIC; SIDBI; KSFC.	14 hrs
4	Preparation of Project : Meaning of project; project identification; project selection; Project report; Need and significance of report; concepts; formulation; guidelines by Planning commission for project report; Network analysis; error's of project report; Project appraisal. Identification of business opportunities; Market feasibility study; Technical feasibility study; financial feasibility study & social feasibility study.	14 hrs
References:	1. B.S. Rathore and Dr. Saini. "Handbook of entrepreneurship". 2. C.B. Gupta and P. Srinivasan "Entrepreneurship development. 3. Laxmi Narain, "Principles and Practice of Public Enterprise Management". 4. Entrepreneurship Development Programmes, (EDP): Industries and Commerce Department, TECSOK.	

GMT -L-604 INDUSTRIAL PATTERN MAKING

Practical

3hrs/week/batch

1	Designing and drafting of adult garments. Create a new design and develop the garments.
	a. Formal shirt using specification sheet for men b. Formal wear for women c. Ethnic wear for men d. Ethnic wear for women

GMT –L- 605:GARMENT CONSTRUCTION-III

Practical

3hrs/week/batch

1	Designing and construction of adult garments.
	a. Formal wear for men b. Formal wear for women c. Ethnic wear for men d. Ethnic wear for women

GMT-L- 606 CAD IN APPAREL INDUSTRY

Practical

3hrs/week/batch

1	CAD-Basic pattern making terms editing notch parameters, tables and rule tables. Procedures for digitizing pattern preparation creating and developing the T-Shirts and Ladies top, Using standard measurements.
2	Working on grading –Tools components ,working on marker making – creating pattern and layout for shirt and trousers using standard measurements
3	Digitizing and plotting.
4	Working on Photoshop-Editing the pictures

GMT 607 SEMINAR

The students are required to give the comprehensive presentation in the forms of seminar on the project work carried out in the VI semester. The seminar should be evaluated as Internal Assessment.

GMT 608 PROJECT WORK

The project has to be assigned at the beginning of the sixth Semester .The project group should complete preliminary literature survey and plan of project at the end of sixth semester .The project work should be carried out and completed in Sixth semester.

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SYLLABUS (2016 -17 ONWORDS)

B. Sc STATISTICS (SEMESTER SCHEME)

Theory teaching hours: 4 hrs per week — Practical: 6 hrs per week

Theory Examination: 70 Marks — Duration: 3 hrs

Theory Internal Assignment: 30 Marks

Practical Examination: 40 Marks — Duration: 3 hrs

Practical Internal Assignment: 10 Marks

Descriptive Statistics: First Semester (Paper I) 4 hrs per week					
Unit	**Topics (Theory)**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Introduction of Statistics	3	1	1	--
II	Population and Sample	3	2	1	--
III	Presentation of Data	10	1	1	1
IV	Measures of Central Tendency	15	2	1	2
V	Measures of Dispersion	15	2	1	2
VI	Moments, Skewness and Kurtosis	10	1	2	1
	Total	56	10	6	6
Practical (Paper I) 6 hrs per week					
	Problems based on paper I.	3x2=6 per Week			

Probability Theory & Descriptive Statistics: Second Semester (Paper II) 4 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Theory of Probability	12	1	1	1
II	Random Variables, Probability Distributions	12	2	1	2
III	Mathematical Expectation	12	1	1	1
IV	Moment generating function and cumulants	8	2	1	1
V	Correlation and Regression Analysis	12	4	2	1
	Total	56	10	6	6
Practical (Paper II) 6 hrs per week					
	Problems based on paper II	3x2=6 per Week			

Probability Distributions & C Language: Third Semester (Paper III) 4 hrs per week					
Unit	**Topics (Theory)**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Discrete Probability Distributions	20	4	3	2
II	Continuous Probability Distributions	20	4	2	2
III	C Language	16	2	1	2
	Total	56	10	6	6
Practical (Paper III) 6 hrs per week					
	Problems based on paper III	3x2=6 per Week			
Statistical Inference: Fourth Semester (Paper IV) 4 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Theory of Estimation	18	4	2	2
II	Interval Estimation	10	2	1	1
III	Testing of Hypothesis	18	2	1	2
IV	Non – parametric Methods	10	2	1	1
	Total	56	10	6	6
Practical (Paper IV) 6 hrs per week					
	Problems based on paper IV	3x2=6 per Week			
Small and Large Sample Tests & SQC: Fifth Semester (Paper V) 3 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Small and Large Sample tests	8	2	2	1
II	Exact Sampling Distributions	22	4	2	3
III	Statistical Quality Control	18	4	2	2
	Total	48	10	6	6
Practical (Paper V) 3 hrs per week					
	Problems based on paper V	3X1=3 per Week			

Sample Survey & Design of Experiments Fifth Semester (Paper VI) 3 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Design of Sample Survey	22	4	3	3
II	Analysis of Variance	8	2	1	1
III	Design of Experiments	18	4	2	2
	Total	48	15	7	6
Practical (Paper VI) 3 hrs per week					
	Problems based on paper VI	3 x1=3 per Week			
Multiple Correlation & Applied Statistics Sixth Semester (Paper VII) 3 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Multiple, Partial Correlation and Regression	12	2	2	1
II	Time Series	12	3	1	2
III	Index Numbers	12	3	1	2
IV	Demography	12	2	2	1
	Total	48	10	7	6
Pratical (Paper VII) 3 hrs per week					
	Problems based on paper VII	3x1=3 per Week			
Operations Research Sixth Semester (Paper VIII) 3 hrs per week					
Unit	**Topics**	**Teaching Hours**	**No. of Questions to be asked**		
			1 Mark	5Marks	10Marks
I	Linear Programming Problem	20	3	2	2
II	Concept of Duality	4	2	1	1
III	Transportation and Assignment Problem	14	3	1	1
IV	Game Theory	10	2	1	2
	Total	48	10	7	6
Practical (Paper VIII) 3 hrs per week					
	Problems based on topics I to V	3x1=3 per Week			

Note:

1. Students must complete all the practicals to the satisfaction of the teacher concerned.

2. Students must produce the laboratory journal along with the completion certificate signed by the Head of the Department at the time of practical examination.

3. Structure of the evaluation of Practical Paper

(A) Continuous internal evaluation:

(i) Journal 5 marks

(ii) Attendance in the practicals 5 marks

(B) Practical examination:

Duration: 3 hours + additional 5 minutes for viva during practical examination.

(i) Questions on MS-EXCEL to be performed on computer during examination - 5 marks

(ii) Questions based on other practicals to be performed using calculators - 30 marks

(iii) Viva-voce - 5 marks

Total: 40 marks

FIRST SEMESTER (PAPER I)

Paper - I: Descriptive Statistics

Objectives:

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.

At the end of this course students are expected

(i) to tabulate statistical information given in descriptive form.

(ii) to use graphical techniques and interpret them.

(iii) to compute various measures of statistical constants.

(iv) to analyze data pertaining to attributes and to interpret the results.

(v) to summarize and analyze the data using computer.

(vi) to apply statistics in the various fields.

1. Introduction to Statistics: (2hrs)

1.1 Meaning and definition of Statistics.

1.2 Limitation of Statistics

2. Population and Sample: (4hrs)

2.1 Characteristics of data: Attributes: Nominal scale, ordinal scale, Variables: Discrete and continuous variables,

2.2 Types of data: (a) Primary data, Secondary data.

2.3 Notion of a statistical population: Finite population, infinite population, Notion of random sample.

2.4 Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRWOR) stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

3. Presentation of Data (10hrs)

3.1 Classification: Raw data and its classification, discrete frequency distribution, Sturge's rule, continuous frequency distribution, inclusive and exclusive methods of classification, Open end classes, cumulative frequency distribution and relative frequency distribution.

3.2 Graphical Presentation of Data: Histogram, frequency curve, frequency polygon, Ogive curves, stem and leaf chart, Pie-Chart

3.3 Pareto diagram.

3.4 Examples and Problems.

4. Measures of Central Tendency (14hrs)

4.1 Concept of central tendency of statistical data: Statistical average, characteristics of a good statistical average.

4.2 Arithmetic Mean (A.M.): Definition, Properties of Arithmetic Mean, merits and demerits, trimmed arithmetic mean, weighted arithmetic mean.

4.3 Mode: Definition, formula for computation (with derivation) graphical method of determination of mode, merits and demerits.

4.4 Median: Definition, formula for computation (with derivation) graphical method of determination of median, merits and demerits.

4.5 Empirical relation between mean, median and mode.

4.6 Partition Values: Quartiles, Deciles and Percentiles.

4.7 Geometric Mean (G.M.) Definition, Properties of G.M, merits and demerits.

4.8 Harmonic Mean (H.M.) Definition, merits and demerits. Order relation between arithmetic mean, geometric mean, harmonic mean (proof for n = 2).

4.9 Weighted Mean: Weighted A.M., G.M. and H.M.

4.10 Examples and Problems.

5. Measures of Dispersion (16hrs)

5.1 Concept of dispersion, characteristics of good measure of dispersion.

5.2 Range: Definition, merits and demerits.

5.3 Semi-interquartile range (Quartile deviation).

5.4 Mean deviation: Definition, merits and demerits, minimality property (without proof).

5.5 Mean square deviation: Definition, minimality property of mean square deviation (with proof), Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, combined variance (derivation for 2 groups), combined standard deviation, generalization for n groups.

5.6 Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation

5.7 Examples and Problems.

6. Moments, Skewness and Kurtosis (10hrs)

6.1 Raw moments ( ) for grouped and ungrouped data.

6.2 Moments about an arbitrary constant for grouped and ungrouped data ( ).

6.3 Central moments ( ) for grouped and ungrouped data, Effect of change of origin and scale, Sheppard's correction.

6.4 Relations between central moments and raw moments (upto 4-th order).

6.5 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.

6.6 Bowley's coefficient of skewness: Proof of Bowley's coefficient of skewness lies between −1 to 1, interpretation using Box plot.

6.7 Karl Pearson's coefficient of skewness.

6.8 Measures of skewness based on moments(,).

6.9 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions.

6.10 Measures of kurtosis based on moments, (,)

6.11 Examples and Problems.

Practical (16 Experiments)

Part A: Manual Calculation

1. Presentation of Data: Frequency Table (Univariate and Bivariate data), Graphs: Stem and Leaf curve, Pie-diagram, Histogram, frequency curve, frequency polygon, cumulative frequency curves (Ogives) Interpretation of data
2. Measures of Central tendency: Arithmetic mean, Geometric mean, Harmonic mean, Weighted Arithmetic Mean, Combined Mean, Median, mode and other partition values. (Ungrouped and Grouped data)
3. Measures of Dispersion: Quratile Deviation, Mean Deviation, Standard deviation and Coefficient of Variation (Ungrouped and Grouped data)
4. Moments (First four) about origin and mean (Ungrouped and Grouped data)
5. Coefficient of skewness and Kurtosis (Karl – Pearson, Bolwey's and based on Moments)
6. Box Plot.

Part B: Using Microsoft Excel

1. Introduction to MS Excel – functions and statistical Data analysis
2. Classification, tabulations and frequency tables
3. Histogram, frequency curves, ogives, Pareto diagram
4. Two way tables and Box plots
5. Descriptive Statistics.

Note: 1. It is mandatory to have statistics laboratory, equipped with computers, MSoffice, Calculators.

2. Students are required to perform practical using Data analysis pack and functions of MS Excel as well as they are required to attach print outs of work done.
3. The proposed batch size of statistics practical is not more than 10 students per batch.
4. Every student should acess to computer individually.

Reference Books

1. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1. The World Press Pvt. Ltd., Kolkata.
2. Mukhopadhyay, P.: Mathematical Statistics (1996), MacMillan Publishing Co. New York.
3. S.C.Gupta and V.K.Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
4. Spiegel M.R. (1967): Theory and problem of Statistics, Schaum's Publishing Series.
5. Amir D. Aczel and Jayael Soundarpandiyan, Complete Business Statistic: McGraw Hill Education (6th Edition).
7. K. V. S. Sarma: Statistics Made Simple: Do it yourself on PC. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Palli and Bagavathi: Statistics

SECOND SEMESTER (PAPER – II)

Paper - II: Probability Theory and Descriptive Statistics

Objectives : The main objective of this course is to introduce to the students the basic concepts of probability, axiomatic theory of probability, concept of random variable, probability distribution (univariate and bivariate) discrete random variables, expectation and moments of probability distribution.

By the end of the course students are expected

1. to distinguish between random and non-random experiments.
2. to find the probabilities of events.
3. to obtain a probability distribution of random variable (one or two dimensional)
4. to apply standard discrete probability distribution to different situations.
5. to compute the relationship between the two variables and anyalysis.

Prerequisite: Permutation and Combination, Binomial theorem, Algebra of sets.

1. Introduction of Probability (12hrs)

1.1 Basic terminology

1.2 Mathematical Probability and its limitations, Problems on it.

1.3 Concept of Statistical Probability and its limitations.

1.4 Axiomatic approach to probability(only definition).

1.5 Theorems on probabilities events.

1.6 Concept of Conditional Probability

1.7 Multiplication theorem of Probability for dependent and independent two events (with proof) and generalization to three events, Problems on it.

1.8 Concept of Total Probability and Bayes's Theorem (with Proof)

1.9 Examples and Problems.

2. Univariate Probability Distributions (Discrete and continuous Sample Space) (12hrs)

2.1 Concept and definition of a discrete and continuous random variable.

2.2 Probability mass function (p.m.f.) and probability density function (p.d.f) cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete and continuous random variable, properties of (c.d.f.).

2.3 Two – Dimensional Random Variables, Joint probability mass function, Marginal probability function, Conditional probability function, Distribution function, Marginal Distribution functions, Joint Probability Density function, Marginal Probability density function, Conditional probability density function, Conditional Distribution function

2.4 Examples and Problems using descrite and continuous random variables.

3. Mathematical Expectation (Univariate & Bivariate Random Variables) (12hrs)

3.1 Definition.

3.2 Theorems on expectations of sum and product of two jointly distributed random variables.

3.3 Concept of conditional expectation.

3.4 Definitions of conditional mean and conditional variance.

3.5 Definition of raw and central moments.

3.6 Definition of covariance.

3.7 Variance of linear combination of variables.

3.8 Examples and Problems.

4. Moment Generating Function and Cumulants (8hrs)

4.1 Definition of moment generating function

4.2 Limitations of moment generating function

4.3 Properties of moment generating function (without proof)

4.4 Definition of cumulants and Properties of cumulants

4.6 Examples on moment generating function and cumulants.

5. Correlation and Regression Analysis (12hrs)

5.1 Bivariate data, bivariate frequency distribution.

5.2 Concept of correlation between two variables, positive correlation, negative correlation, zero correlation.

5.3 Scatter diagram, conclusion about the type of correlation from scatter diagram.

5.4 Covariance between two variables: Definition, computation, effect of change of origin and scale.

5.5 Karl Pearson's coefficient of correlation (r): Definition, computation for grouped and ungrouped data and interpretation. Properties: (i) $-1 \; r \; 1$ (with proof), (ii) Effect of change of origin and scale (with proof).

5.6 Spearman's rank correlation coefficient: Definition, computation and interpretation (without ties), Spearman's rank correlation coefficient (derivation of formula in case of without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

5.7 Examples and Problems.

5.8 Concept of regression, lines of regression, fitting of lines of regression by the least squares method, interpretation of slope and intercept.

5.9 Properties of regression lines and coefficients (with proof)

5.10 Examples and Problems.

Practical (16 Experiments)

Part A: Manual Calculation

1. Computation of Probabilities (using mathematical probability)
2. Computation of probabilities using addition and multiplation theorems
3. Computation of conditional probabilities by using Baye's theorem
4. Computation of probability mass functions of discrete random variables
5. Computation of probability density functions of continuous random variables.
6. Computation of joint, marginal probability distribution for discrete and continuous random variables.
7. Computation of Mean, standard deviation, variance, covariance for discrete and continuous random variables.

8. Fitting of linear and non linear curves reducible to linear form (two variable only)

9. Karl Pearson's coefficient of correlation, Spearman's coefficient of rank orrelation,

10. Regression analysis: Lines of regression (linear case only) and other related problem.

Part B: Using Microsoft Excel

1. above experiments using Microsoft excel.

Reference Books

1. Miller and Fruend: Modern Elementary Statistics.

2. Mukhopadhyay, P.: Mathematical Statistics (1996), New Central Book Agency, Calcutta, Introduction to Mathematical Statistics, Ed. 4 (1989), MacMillan Publishing Co. New York.

3. S.C.Gupta and V.K.Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

4. E.J.Dudewicz and Satya N Mishra: Modern Mathematical Statistics, John Wiley & Sons Singapore.

5. Amir D. Aczel and Jayael Soundarpandiyan, Complete Business Statistics: McGraw Hill Education (6th Edition).

6. K. V. S. Sarma: Statistics Made Simple: Do it yourself on PC. Prentice Hall of India Pvt. Ltd., New Delhi.

8. Spiegel M.R. (1967): Theory and problem of Statistics, Schaum's Publishing series

THIRD SEMESTER (PAPER III)

Probability Distributions & C Language

1. Discrete Probability Distributions (16hrs)

1.1 Uniform discrete distribution on integers 1 to n: p.m.f., c.d.f., mean variance, real life situations, Moment Generating function, first four moments using m.g.f

1.2 Bernoulli Distribution: p.m.f., mean, variance, moments, Moment Generating function, first four moments using m.g.f

1.3 Binomial Distribution: p.m.f. Recurrence relation for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, moments, Mean Deviation about mean, skewness (comments when $p = 0.5$, $p > 0.5$, $p < 0.5$), Moment Generation function, first four moments using m.g.f. Cummulants and its Recurrence relation, skewness and kurtosis, Fitting of Binomial Distribution.

1.4 Hypergeometric Distribution: p.m.f., Computation of probability, situations where this distribution is applicable, Binomial approximation to hypergeometric probabilities, mean and variance of the distribution.

1.5 Poisson Distribution: p.m.f. Derivation of Poisson distribution as a limiting case of binomial distribution. Moments, Mode, Recurrence Relation for the moments, Moment Generating Function, Cumulants, first four moments using m.g.f. skewness and kurtosis, Additive Property of Independent Poisson Variates, Fitting of Poisson Distribution.

1.6 Negative Binomial Distribution: Definition, moment generating function, Cumulants, first four moments using m.g.f, skewness and Kurtosis, Fitting of Negative Binomial distribution.

1.7 Geometric Distribution, Lack of Memory, Moments of Geometric distribution, Moment Generating Function of Geometric distribution.

1.8 Examples and Problems on the discrite distributions.

2. Continuous Probability Distributions (20hrs)

2.1 Rectangular or Uniform distribution, its moments, its m.g.f, skewness and kurtosis, Mean deviation about mean.

2.2 Normal (Statandard) distribution, its chief characteristics and normal probability curve. Its mode and median, its m.g.f, & c.g.f, first four moments of normal distribution, skewness and

kurtosis, Mean deviation from the mean of normal distribution, Area property of normal probability curve, fitting of normal distribution.

2.3 Gamma distribution, its m.g.f and c.g.f. first four moments, skewness and kurtosis, additive property of Gamma distribution.Limiting form of Gamma distribution.

2.4 Beta distribution of First Kind, its constants, Beta distribution of Second kind, its constants, Examples and problems on Beta distribution of first and second kind.

2.5 Exponential Distribution, its m.g.f and first four moments, examples on it.

2.6 Cauchy's Distribution, its moments if exists.

3. Programming in C – Language. (20hrs)

3.1 Introduction to C, variables, Data types - Declarations, Type conversions, increment and decrement operators, Bitwise, Logical and Assignment operators.

3.2 Expression and Conditional Expressions, Control structures, If-Else, SWITCH, WHILE, FOR and DO WHILE Loop structures. Break continue, GO o's and Label Statements. Function, function returning, Non-integers. Function arguments - Static and register variables.

3.3 Arrays and. Strings - Array Declaration Multi dimensional Arrays Strings / Character Arays, Array initialization - Pointers and Addresses. Pointers and Arrays - Pointer to functiois.

3.4 Structures and functions, Arrays of structures, Fields, Unions - type definiton standard input and output - formatted output - output - Access to the standard library.

Practical

Part A: Manual Calculation

1. Computation of probabilities using Binomial distribution
2. Fitting of Binomial Distribution
3. Computation of probabilities using Poisson distribution
4. Fitting of Poisson distribution
5. Computation of probabilities using Hypergeometric distribution.
6. Fitting of Negative Binomial distribution.
7. Computation of probabilities using Normal distribution

8. Fitting of Normal distribution

9. Write algorithm flow chart and c programming to the following

1. Calculation of A.M, G.M and H.M for ungrouped data
2. Calculation of A.M, G.M and H.M for discrete frequency distribution
3. Calculation of A.M, G.M and H.M for continuous frequency distribution
4. Calculation of median and quartiles for discrete frequency distribution
5. Calculation of median and quartiles for continuous frequency distribution
6. Calculation of Mean deviation about mean for discrete frequency distribution
7. Calculation of Mean deviation about mean for continuous frequency distribution
8. Calcuation of mean and standard deviation for ungrouped data
9. Calculation of mean and standard deviation for discrete frequency distribution
10. Calculation of mean and standard deviation for continuous frequency distribution

Part B: Using Microsoft Excel

1. Fitting of Binomial, Hypergeometric, Poisson, Normal distribution.

Reference Books

1. Hogg, R. V. and Craig R. G.: Introduction to Mathematical Statistics, Ed. 4. (1989), MacMillan Publishing Co., New York.
2. Hoel, P. G.: Introduction to Mathematical Statistics (1962), John Wiley and Sons, New York.
3. Feller, W.: Introduction to Probability Theory and Its Applications, Vol.I (1963), Asian Publishing House Bombay.
4. Mood, A. M. and Graybill, F. A. and Boes D.C. E.: Introduction to Theory of Statistics, Ed. 3 (1974), McGraw Hill and Kagakusha Ltd. London.
5. Mayer, P. N.: Introduction to Probability and Statistical Applications, Addison Wesley Publishing Co., Massachusetts).
6. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
7. Ross: Probability theory, Pearson Publishers.
8. K. V. S. Serma: Statistics Made Simple: Do it yourself on PC.
9. E.Balaguruswamy: Programming in ANSI C", Tata McGraw – Hill.
10. Yashwant kanetkar: "Let us C" BPP Publications.
11. P.B.Kotur: Computer Concepts and C programming, Sapna Book House, Bangalore.

FOURTH SEMESTER (PAPER – IV)

Statistical Inference

1. Theory of Estimation (18hrs)

1.1 Point Estimation - Problem of Point estimation - Properties of estimators- Consistency and Efficiency of an estimator. Sufficiency of a statistic - Neyman- Fisher factorization theorem (discrete case) - Simple problems.

1.2 Unbiasedness - Properties, MVUE, BLUE, Cramer- Rao inequality - simple problems.

1.3 Methods of estimation: Method of Moments, Method of Maximum Likelihood, properties of estimators obtained by these methods -simple problems.

2. Interval Estimation (6hrs)

2.1 Interval Estimation - Confidence Interval for proportions, mean(s), variance, and variance ratio based on chi square, student's t, F and Normal distributions.

3. Testing of hypothesis (18hrs)

3.1 Statistical Hypothesis, Problem of testing of hypothesis, Definition and illustrations of i) Simple hypothesis ii) composite hypothesis, Null and Alternative Hypothesis, type I error type II errors, critical region probabilities of type I error and type II errors, simple problems

3.2 Definition and illustrations of i) level of significance ii) observed level of significance (p-value) iii) size of test iv) power of a test

3.3 Definition of most powerful (M.P) level test of simple null hypothesis against simple alternative. Statement of Neyman – Pearson (N-P) lemma for constructing the most powerful level test of simple null hypothesis against alternative hypothesis, Illustrations.

3.4 Power function of a test, power curve, definition of uniformly most powerful (UMP) level test for one sided alternative, Illustrations.

1. Non-parametric test (8hrs)

1.1 Idea of non-parametric problems. Distinction between a parametric and a non-parametric problem. Concept of distribution free statistic. One tailed and two tailed test procedure of i) Sign test ii) Wilcoxon signed rank test iii) Mann-Whitney U test, iv) run test for

randomness, one sample and two sample problems. Solmogorov-Smirnov test for completely specified uni-variate distribution (one sample problem only) for two sided alternative hypothesis. Median test.

Practical Part A: Manual Calculation

1. Method of Maximum likelihood estimators
2. Method of Moments
3. Confidence interval for sample mean, sample proportion
4. Determination of Probability of type I and type II errors, power of test
5. Construction of most powerful(M.P) test
6. Construction of uniformly most powerful(UMP) test

Part B: Using Microsoft Excel

Above experiments which are applicable.

Reference Books

1. Lindgren, B.W.: Statistical Theory (third edition) collier Macmillan International Edition, Macmillan publishing Co., Inc. New York.
2. Mood, A.M., Graybill, F. and Bose, D.C.: Introduction to the theory of Statistics (third edition) International Student Edition, McGraw Hill Kogakusha Ltd.
3. Hogg, P.V. and Craig, A.J.: Introduction to Mathematical Statistics (fourth edition), Collier Macmillan International Edition, Macmillan Publishing Co. Inc., New York.
4. Siegel, S.: Nonparametric methods for the behavioural sciences, International Student Edition, McGraw Hill Kogakusha Ltd.
5. Hoel, Port, Stone: Introduction to statistical Theory, Houghton Mifflin Company (International) Dolphin Edition.
6. J.D. Gibbons: Non parametric Statistical Interence, McGraw Hill Book Company, New York.
7. Daniel: Applied Nonparametric Statistics, Houghton Mifflin Company, Roston.
8. V.K. Rohatgi: An introduction to probability theory and mathematical statistics, Wiley Eastern Ltd., New Delhi.
9. Kendall and Stuart: The advanced Theory of Statistics, Vol 1, Charles and company Ltd., London.

10. Dudeweitz and Mishra: Modern Mathematical Statistic, John Wiley and Sons, Inc., New York.
11. Kale, B.K.: A First Course In parametric Inference.
12. Kunte, S., Purohit, S.G. and Wanjale, S.K.: Lecture Notes on Nonparametric Tests.
13. B.L. Agarwal: Programmed Statistics: New Age International Publications, Delhi.
14. Sanjay Arora and Bansi Lal: New Mathematical Statistics (Ist Edition), Satya Prakashan16/17698, New Market, New Delhi,5(1989).

FIFTH SEMESTER (PAPER – V)

Small and Large Sample Tests & SQC

2. Small and Large Sample Tests (8hrs)

2.1 Introduction of sampling, Parameter and statistic, Sampling distribution, standard error, unbiased estimator,

2.2 Tests of significance, Null hypothesis, alternative hypothesis, errors in sampling, critical region and level of significance, one tailed and two tailed tests, critical or significant values, procedure of testing of hypothesis

2.3 Test of significance for large samples: Sampling of attributes, test for single proportion, test of significance for difference of proportions, Sampling of Variables, test of significance of single mean, test of significance of difference of means, test of significance of difference of standard deviations

3. Exact Sampling Distributions (22hrs)

3.1 Chi-square Variate: Derivation of the chi-square distribution, m.g.f and c.g.f of chi-square distribution, constants of chi-square distribution, limiting form of chi-square distribution, mode and skewness of chi-square distribution, Additive property of chi-square variates, Theorems of chi-square variates, Conditions for the validity of chi-squre test, Application of chi-square distribution.Chi-square test for population variance, goodness of fit, independence of attributes.

3.2 Student's "t", Derivation of student's t- distribution, Fisher's "t", Distribution of Fisher's "t", Constants of t-distribution, Limitting form of t-distribution, Application of t-distribution, t-test for single mean, difference of means, sample correlation coefficient, regression coefficient.

3.3 F-statistic, derivation of Snedecor's F – distribution, constants of F-distribution, Mode and Points of inflexion of F-distribution, Application of F-distribution: F-test for equality of population variances, Relation between t and F distribution, F and chi-square distribution.

4. Statistical Quality Control (18hrs)

4.1 Need for Statistical Quality Control techniques in Industry - Causes of Quality variation control charts - Use of the Shwhart - control chart - Specification and tolerance limits - 3 sigma limits - warning limits - application of theory of runs in quality control.

4.2 Control chart for variables - X Chart - R chart - purpose of the charts - Basis of subgrouping - plotting X and R results - determining the trial control limits Interpretation of control charts X and R

4.2 Control chart for attributes - purpose of the chart - P chart - np chart - construction of P and np chart - choice between chart for P and chart for np - construction of c-chart.

4.3 Acceptance of sampling plans for attributes - Producer's risk and consumer's risk - concepts of AQL, LTPD, AOQ, AOQL, ATI and ASN - single, double and Multiples sampling plans OC, AOQ, ATI curves for single and double sampling plans.

Practical

Part A: Manual Calculation

1. Test of mean and difference of means for large samples
2. Test of proportion and difference of proportion for large samples
3. Test of difference of standard deviations for lagre samples
4. Tests based on chi-square distribution i) goodness of fit ii) independence of attributes iii) population variance
5. Tests based on t – distribution i) single mean ii) difference of two sample means iii)sample correlation and regression coefficient
6. Tests based on F – distribution equality of population variance
7. Non – parametric tests: Sign, Wilcoxon's signed rank test, Mann – Whitney U test, Run test, median test, Kolmogorov – Smirnov test
8. Construction of Mean and Range charts
9. Construction of Mean and Standard deviation charts
10. Construction of p – chart
11. Construction of np – chart
12. Construction of c – chart
13. Construction of OC curve, AOQ, AOQL, ATI for Single sampling plan
14. Construction of OC curve, AOQ, AOQL, ATI for double sampling plan

Part B: Using Microsoft Excel

Above all experiments using Microsoft excel

Reference Books

1. Hogg, R. V. and Craig R. G.: Introduction to Mathematical Statistics, Ed. 4. (1989), MacMillan Publishing Co., New York.
2. Hoel, P. G.: Introduction to Mathematical Statistics (1962), John Wiley and Sons, New York.
3. Feller, W.: Introduction to Probability Theory and Its Applications, Vol.I (1963), Asian Publishing House Bombay.
4. Mood, A. M. and Graybill, F. A. and Boes D.C. E.: Introduction to Theory of Statistics, Ed. 3 (1974), McGraw Hill and Kagakusha Ltd. London.

5. Mayer, P. N.: Introduction to Probability and Statistical Applications, Addison Wesley Publishing Co., Massachusetts).
6. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
7. Ross: Probability theory, Pearson Publishers.
8. M. B. Kulkarni and S. B. Ghatpande: Discrete Probability and Probability Distributions, SIPF Academy, Nashik.
9. K. V. S. Serma: Statistics Made Simple: Do it yourself on PC.
10. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.
11. Gupta, R.C (1974): Statistical Quality Control.
12. Montgomery, D.C. (1983): Introduction to Statistical Quality Control, John Waley & Sons.

FIFTH SEMESTER (PAPER – VI)

Sample Survey & Design of Experiments

1. Design of Sample Survey: (22hrs)

1.1 Concepts of population and sample. Need for sampling. Complete enumeration vs Sample surveys. Non probability and probability sampling- meaning, need and illustrations; Use of random numbers; Principal steps in a sample survey. Requisites of a good questionnaire; Pilot surveys; Sampling and non sampling errors.

1.2 Simple random Sampling from finite population of size (N) i) with replacement (SRSWR) ii) without replacement(SRSWOR) definitions, population mean and population total as parameters, Sample mean as an estimator of population mean derivation of expectation and standard error of sample mean in case of SRSWR and SRSWOR. Sampling for proportion as an application of a simple random sample, sample proportion as an estimator of population proportion of units possessing a certain attribute, Estimator of standard error of sample proportion in case of SRSWR and SRSWOR.

1.3 Stratified Random Sample: Stratification, basis of stratification, real life situation, stratified random sampling as a sample drawn from individual strata using SRSWOR in each stratum. Stratified sample mean as an estimator of population mean, its expectation and standard error. Problem of allocation, proportional allocation, Neyman's allocation derivation of the expressions for the standard errors of the above estimators when these allocations are used. Gain in precision due to stratification, comparison amongst SRSWOR, stratification with proportional allocation and stratification with Neyman's allocation. Cost and Variance analysis in stratified random sampling; minimization of variance for fixed cost, minimization of cost for fixed variance, optimum allocation, Neyman's allocation as a particular case of optimum allocation in cost and variance analysis.

1.4 Systematic Sampling: Real life situations where systematic sampling is appropriate, Techniques of drawing a sample using systematic sampling. Estimation of the population mean and population total; standard error of these estimators; Comparison of systematic sampling with SRSWOR and Stratified sampling; Comparison of systematic sampling with SRSWOR and stratified sampling in the presence of linear trend.

2. Analysis of Variance (8 hrs)

1.1 Meaning and assumptions. Analysis of variance (fixed effects model) - Analysis of one-way, two-way classified data. Least significant difference. Case of multiple but equal number of observations per cell in two-way classification (with interaction).

3. Design of Experiments: (18hrs)

3.1 Basic terms of design of experiments

3.2 Basic principles of design of experiments: Randomization, replication and local control.

3.3 Completely Randomized Design (CRD): Layout, model (fixed effect) assumptions and interpretations, Breakup of total sum of squares into components, preparation of ANOVA table, testing equality of treatment effects, test for equality of two specified treatment effects using critical difference (C.D).

3.4Randomized Block Design (RBD): Layout, model (fixed effect) assumptions and interpretations, Breakup of total sum of squares into components, preparation of ANOVA table, testing equality of treatment and block effects, test for equality of two specified treatment effects using critical difference (C.D). Efficiency of RBD over CRD

3.5 Latin square designs: Layout, model(fixed effect) assumptions and interpretations, Breakup of total sum of squares into components, preparation of ANOVA table, testing equality of treatment, row and columns effects, test for equality of two specified treatment effects using critical difference (C.D). Efficiency of LSD over i) CRD ii) RBD

3.6 Missing plot technique for RBD and LSD-Estimation for single missing observation.

Practical

Part A: Manual Calculation

1. Analysis of variance for one – way classification
2. Analysis of variance for two – way classification one observation per cell
3. Analysis of variance for two – way classification more than one observation per cell
4. Analysis of CRD
5. Analysis of RBD and Efficiency of RBD w.r.t CRD
6. Analysis of LSD and Efficiency of LSD w.r.t RBD and CRD
7. Analysis of RBD and LSD after estimation of missing values.
8. Simple random Sampling (Estimation of population mean,population total with standard error i) with replacement ii) without replacement)
9. Simple random sampling (Estimation of population proportion, population total with standard errors)
10. Stratified random sampling: Proportional and Neyman allocation, comparison with SRSWOR
11. Stratified random sampling: cost and variance analysis
12. Systematic sampling: Comparision with SRSWOR and Stratified random sampling. Reference Books

1. Federer , W.T. : Experimental Design : Oxford and IBH Publishing Co., New Delhi.
2. Cochran W.G. and Cox, C.M. : Experimental Design, John Wiley and Sons, Inc., New - York.
3. Montgomery , D.C.: Design and Analysis of Experiments, and sons, Inc., New - York.
4. Dass, M.N. and Giri, N.C.: Design and Analysis of Experiments, Wiley EasternLtd., New Delhi.
5. Goulden G.H. : Methods of Statistical Analysis, Asia Publishing House Mumbai
6. Kempthorne, O: Design of Experiments. Wiley Eastern Ltd., New Delhi.
7. Snedecor, G.W. and Cochran, W.G.: Statistical Methods, Affiliated East – West Press, New Delhi. (for 1.8)
8. Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol.II, The world Press Pvt.Ltd. Kolkatta.
9. Gupta S.C. and Kapoor V.K.: Fundamentals of Applied Statistics, S.Chand Sons, New Delhi.
10. C.F. Jeff Wu, Michael Hamda: Experiments, Planning, Analysis and Parameter Design Optimization.
11. Miller and Freund : Probability and Statistics for engineers, Pearson Education, Delhi (for 1.8)

SIXTH SEMESTER (PAPER – VII)

Multiple Correlation & Applied Statistics

1. Multiple, Partial correlation and regression: (12hrs)

1.1 Notion of multiple linear regressions, Yule's notation (trivariate case – sample data only).

1.2 Fitting of regression planes by the method of least squares; obtaining normal equations, solutions of normal equations.

1.3 Definition and interpretation of partial regression coefficient bij.k, units of bij.k definition of multiple correlation coefficients $R_{i.jk}$.

1.4 Interpretation of coefficient of multiple determination $R^2_{i.jk}$ as (i) proportion of variation explained by the linear regression (ii) $R_{i.jk} = 1$, (iii) $R_{i.jk} = 0$. Adjusted $R^2_{i.jk}$. Residual plots, problem of multicolinearity introduction, introduction to stepwise regression.

1.5 Definition of partial correlation coefficient $r_{ij.k}$.

2. Time Series: (12hrs)

2.1 Meaning and utility of time series

2.2 Components of time series; trend, seasonal variations, cyclical variations, irregular fluctuations

2.3 Methods of trend estimation and smoothing: i) moving average, ii) curve fitting by least square principle iii) exponential smoothing

2.4 Measurement of seasonal variations i) simple average method ii) rato to moving averages method.

3. Index Numbers: (12hrs)

3.1 Index Numbers - uses, classification of index numbers - Problems in the construction of index numbers - Methods of constructing index numbers - Unweighted index numbers - weighted index numbers.

3.2 Quantity index numbers - Fixed and chain base index numbers - Optimum test for index numbers - Time reversal test - factor reversal test

3.3 Cost of living index numbers. Considerations in its construction i) family budget method ii) aggregate expenditure method, its uses

4 Demography (12hrs)

4.1 Vital events, vital statistics, method of obtaining vital statistics, rates of vital events, sex ratios, dependency ratio.

4.2 Mortality rates: Crude death rates, specific (age, sex etc) death rate, standardized death rate (direct and indirect) infant mortality rate.

4.3 Fertility rate: Crude birth rates, general fertility rate, specific (age, sex etc) fertility rates, total fertility rates

4.4 Growth/Reproduction rates: Gross reproduction rate, net reproduction rate.

4.5 Life table - Structure - Construction - Relationship between the function of a life table - abridged life table and its use.

Practical

Part A: Manual Calculation

1. Estimation of Trend values by moving average method
2. Estimation of Trend values by least square principle
3. Estimation of seasonal indices by ratio to trend
4. Estimation of seasonal indices by link relatives.
5. Construction of Price Index Numbers
6. Construction of Quatatitive Index Numbers
7. Construction of Cost of living Index Numbers
8. Estimation of Mortality Rates
9. Estimation of Fertility Rates
10. Estimation of Growth Rates
11. Construction of Life Tables
12. Fitting of trivariate regression plane
13. Computation of Multiple, Partial correlation coefficients Reference Books

1. Gupta S.C. and Kapoor V.K.: Fundamentals of Applied Statistics, S.Chand Sons, New Delhi.
2. Gupta S.C and V.K.Kapoor: Fundamentals of Mathematical Statistics, S. Chand sons, New Delhi.
3. Montgomery, D.C. and Johnson L.A. (1976). Forecasting and Time Series Analysis, McGraw Hill.
4. Farmum, N.R. and Stantorr, L.W. (1989). Quantitative Forecasting Methods, PWS Kent Publishing Company, Boston

SIXTH SEMESTER (PAPER – VIII)

Operations Research

1. Linear Programming Problem (20 hrs)

1.1 Statement of the linear Programming Problem (LPP), Formulation of problem as Linear Programming Problem. (i) Canonical form, (ii) standard form.

1.2 Definition of i) a solution ii) a feasible solution iii) a basic feasible solution, iv) a degenerate and non –degenerate solution v) an optimal solution vi) basic and non-basic variables .

1.3 Solution of L.P.P by i) Graphical Method: solution space, unique and non-unique solutions, obtaining an optimal solutions. ii) Simplex Method

1.4 Examples and simple problems

2. Dual (4 hrs)

2.1 Duality Theory: Writing dual of a primal problem, solution of a L.P.P. by using its dual problem.

2.2 Examples and simple problems.

3. Transportation and Assignment Problem (14 hrs)

3.1 Transportation problem (T.P.), statement of T.P., balanced and unbalanced T.P.

3.2 Methods of obtaining basic feasible solution of T.P. i) North-West corner rule
ii) Method of matrix minima (least cost method),
iii) Vogel's approximation method (VAM).

2.3 u-v method of obtaining Optimal solution of T.P., uniqueness and non- uniqueness of optimal solutions,

2.4 Assignment problems: statement of an assignment, balanced and unbalanced problem, relation with T.P., optimal solution of an assignment problem, using Hungarian method.

2.5 Examples and problems.

4. Game Theory (10 hrs)

4.1 Description of games

4.2 Solution of Two person zero sum games, by i) minimax and maximin principle, ii) Saddle point approach iii) Dominance property

4.3 Games without saddle points (Mixed strategies): i) 2X2 games without saddle point ii) Graphical solution of 2xn and nx2 games iii) solution of a game by linear programming approach.

Practical

Part A: Manual Calculation

1. Formulation of L.P.P
2. Solving L.P.P by Graphical method
3. Solving L.P.P by simplex Method
4. Estimation of Initial Basic Feasible Solution for T.P
5. Testing of optimality of T. P
6. Solving Assignment Problems
7. Problems of Game Theory

Reference Books

1. Gass E.: Linear Programming Method and Applications, Narosa Publishing House, New Delhi.
2. Taha, R. A.: Operation Research – An Introduction, Fifth Edition, Prentice Hall of India, New Delhi.
3. Saceini Yaspan, Friedman: Operation Research Method and Problems, Wiley International Edition.
4. Shrinath L.S.: Linear Programming, AffiliatedEast-West Press Pvt. Ltd. New Delhi.
5. Phillips, D.T., Ravindra, A., Solberg, J. : Operations Research Principles and Practice, John Wiley and Sons Inc.
6. Sharma J. K.: Mathematical Models in Operations Research, Tata McGraw Hill Publishing Company Ltd., New Delhi.
7. Kapoor, V. K.: Operation Research, Sultan Chand and Sons, New Delhi.
8. Gupta, P. K. and Hira, D.S.: Operations Research, S. Chand and company Ltd., New Delhi.
9. Shrinath, L.S.: PERT-CPM Principles and Applications Affiliated East-West Press Pvt. Ltd., New Delhi.
10. S.D.Sharma: Operations Research, Kedar Nath Ram Nath & Co. Meerut.
11. B.S Goel and S.K. Mittal, Pragati Prakashan Meerut.
12. Kantiswaroop, Man Mohan and P.K Gupta (2003): Operations Research- Sultan Chand & Co.
13. Churchman C.W, Ackoff R.L and Arnoff E.L (1957): Introduction to Operations Research- John Wiley.
14. Shenoy,G.V.,Srivatsava,U.K and Sharma,S.C.: Operations Research for Management,New Age International.
10. www.math.uah.edu/stat (Virtual laboratories in Statistics)
11. www.amstat.org/publications/stats (STATS: the magazine for students of Statistics)

MODEL QUESTION PAPER FOR SEMESTER EXAMINATION
B.Sc Statistics: Title of the paper

Time: 3 hours **Max. Marks: 70**

SECTION – A

I. Choose the correct answer for the following each carry 1 mark 1 X 10 = 10

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

SECTION – B

II. Answer any four of the following, each carry 5 marks 4 x 5 = 20

11.
12.
13.
14.
15.
16.

SECTION – C

III. Answer any four of the following each carry 10 marks 4 x 10 = 40

17.
18.
19.
20.
21.
22.

Xxxxxxxxxxxxxxxxxxxx END xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx