

B.E. /B. Tech in Computer Science & Business Systems

Semester 8

TCS

Computer Science & Business Systems

Semester 8 Curriculum



Semester 8

Services Science & Service Ops Management

Course Pre Requisite(s):

Fundamentals of Management, Operations Research

Course Outcome(s):

Students will be able to

- Understand concepts about Services and distinguish it from Goods
- Able to identify characteristics and nature of Services
- Comprehend ways to design Services and evaluate them using Service qualities
- Understand how various methods can be used to operate and manage Service businesses
- Understand how innovation can be approached from Services point of view

Topics to Be Covered:

UNIT – I

Introduction: Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector

Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters

Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co-creation

UNIT – II

Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis

New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design

Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools

UNIT – III

Service Guarantee & Service Recovery: How to provide Service guarantee? How to recover from Service failure?



Semester 8

UNIT – IV

Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.

Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.

Managing Facilitating Goods: Review of inventory models, Role of inventory in services

Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service

Vehicle Routing Problem: Managing after sales service, Understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes

UNIT – V

Service Innovation: Services Productivity, Need for Services Innovation

Student Project:

Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

Text Books:

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition)

Reference Books:

- 1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Services marketing: Integrating customer focus across the firm. McGraw Hill.
- 2. Lovelock, C. (2011). Services Marketing, 7/e. Pearson Education India
- 3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India,
- 4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.



Semester 8

Reference Papers:

- Karmarkar, U. (2004). Will you survive the services revolution? Harvard Business Review, 100-107.
- 2. Vargo, S. L., & Lusch, R. F. (2008). From goods to service (s): Divergences and convergences of logics. Industrial marketing management, 37(3), 254-259.
- 3. Vargo, S. L., & Lusch, R. F. (2008). "Service-Dominant Logic: Continuing the Evolution," Journal of the Academy of Marketing Science (36:1), pp. 1-10
- 4. Silvestro, R., Fitzgerald, L., Johnston, R., & Voss, C. (1992). Towards a classification of service processes. International journal of service industry management, 3(3), 62-75.
- 5. Vargo, S. L., Maglio, P. P., & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. European management journal, 26(3), 145-152.
- 6. Shostack, G.L., (1984), "Designing Services That Deliver," Harvard Business Review, January-February 1984, pp. 132-139
- 7. Evenson, S., & Dubberly, H. (2010). Designing for service: Creating an experience advantage. Introduction to service engineering, 403-413.
- 8. Edvardsson, B., & Olsson, J. (1996). Key concepts for new service development. Service Industries Journal, 16(2), 140-164.
- 9. Goldstein, S. M., Johnston, R., Duffy, J., & Rao, J. (2002). The service concept: the missing link in service design research? Journal of Operations management, 20(2), 121-134.
- Kumar, A., Zope, N. R., & Lokku, D. S. (2014, April). An approach for services design by understanding value requirements, identifying value carriers, developing value proposition, and subsequently realizing value. In Global Conference (SRII), 2014 Annual SRII (pp. 298-304). IEEE.
- 11. Parasuraman, A., Zeithaml, V.A., and Berry, L.L., (1985), "A Conceptual Model of Service Quality and Its Implications for Future Research," The Journal of marketing, Vol. 49, No. 4, pp. 41-50
- 12. Cronin, J.J., and Taylor, S.A., (1992), "Measuring Service Quality: A Reexamination and Extension," The Journal of Marketing, Vol. 56, No. 3, pp. 55-68
- 13. Van Ree, H. J., (2009), Service Quality Indicators for Business Support Services, Ph.D. Thesis, University College London, London.
- 14. Zope, N. R., Anand, K., & Lokku, D. S. (2014, April). Reviewing Service Quality for IT Services Offerings: Observations in the Light of Service Quality Models & Determinants. In Global Conference (SRII), 2014 Annual SRII (pp. 43-49). IEEE.
- Heskett, J.L., Jones, T.O., Loveman, G.W., Sasser, W.E., and Schlesinger, L.A., (2008), "Putting the Service-Profit Chain to Work," Best of HBR, Harvard Business Review, July-August 2008, pp. 118-128
- 16. Clatworthy, S. (2011). Service innovation through touch-points: Development of an innovation toolkit for the first stages of new service development. International Journal of Design, 5(2).
- 17. Barras, R. (1986). "Towards a Theory of Innovation in Services," Research Policy (15), pp. 161-173.



Semester 8

- 18. Gustafsson, A., and Johnson, M. (2003). Competing in a Service Economy: How to Create a Competitive Advantage Through Service Development and Innovation, San Francisco: Jossey-Bass.
- 19. Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L. (2015). "Service innovation in the digital age: key contributions and future directions". Mis Quarterly, 39(1), 135-154.
- 20. Lusch, R. F., and Nambisan, S. (2015). "Service Innovation; A Service-Dominant Logic Perspective," MIS Quarterly (39:1), pp.155-175



Semester 8

IT Project Management (includes Agile / DevOps)

Course Outcome(s):

After completion of this course, students will learn the techniques to effectively plan, manage, execute, and control projects within time and cost targets with a focus on Information Technology and Service Sector. Students will also learn agile project management techniques such as Scrum and DevOps.

Topics to Be Covered:

UNIT – I

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

UNIT – II

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

UNIT – III

Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling

$\mathbf{UNIT} - \mathbf{IV}$

Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination

$\mathbf{UNIT} - \mathbf{V}$

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

$\mathbf{UNIT}-\mathbf{VI}$

Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

UNIT – VII



Semester 8

DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring.

UNIT – VIII

Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

Workshop:

Workshops will be conducted as a part of this course which is mandatory for students to attend. The primary objective of the workshops is to teach the students the agile project management including Scrum and DevOps through group activities.

Home Assignment:

Case studies will be distributed to students beforehand and students should prepare and try to solve these cases before coming to class. Students will be asked submit and present their understanding of the cases and solutions before the class.

Text Books:

- 1. Mike Cohn, Succeeding with Agile: Software Development Using Scrum
- 2. Notes to be distributed by the course instructor on various topics

Reference Books:

- 1. Roman Pichler, Agile Product Management with Scrum
- 2. Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional)



Semester 8

Advance Finance (Elective IV)

Course Outcome(s):

This course will help students to develop in-depth knowledge about the financial techniques and instruments. The students will learn to

- Imbibe knowledge about the decisions and decision variables involved with financial activities of the firm.
- Develop skills for interpretation business information and application of financial theory in corporate investment decisions, with special emphasis on working capital management.
- Familiarizing the students with the corporate and financial restructuring.

Topics to Be Covered:

UNIT – I

Sources of Funds (including regulatory framework)

- Types of securities
- Issuing the capital in market
- Pricing of issue
- Valuation of Stocks and bonds

UNIT – II

Dividend Decisions: Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split

UNIT – III

Evaluation of Lease Contracts

UNIT – IV

Corporate Restructuring

- Mergers and Acquisitions- Types of Mergers, Evaluation of Merger Proposal
- Take-over
- Amalgamation
- Leverage buy-out





Semester 8

- Management buy-out
- Corporate Failure and Liquidation

UNIT – V

Financial Restructuring

- Share Split
- Consolidation
- Cancellation of Paid-up Capital
- Other Mechanisms

UNIT – VI

Working Capital Management:

- Working Capital Planning
- Monitoring and Control of Working Capital
- Working Capital Financing
- Managing the Components of Working Capital
 - o Cash Management
 - o Receivable Management
 - o Inventory Management

UNIT – VII

Introduction to derivatives

- Basics of Futures, Forwards, Options, Swaps
- Interest rate Payoff Diagrams, Pricing of Futures, Put Call Parity, Option Pricing using Binomial Model and Black Scholes Model
- Use of Derivatives for Risk-Return Management- Credit Default Swaps

Home Assignment:

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.



Semester 8

Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

- 1. Topic: Historical perspectives of markets like major boom and busts, bull and bear cycles, major market crashes, bubbles
- 2. Topic: Major scams in the market, e.g. Satyam case

Text Books:

1. Brealey, Myers and Allen, Principles of Corporate Finance

Case Study Materials: To be distributed for class discussion



Semester 8

Marketing Research & Marketing Management

Course Outcome(s):

Students will be able to

- Understand basic marketing concepts
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research

Topics to Be Covered:

UNIT – I

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social

Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT – II

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

UNIT – III

Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

UNIT – IV

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations



Semester 8

Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT – V

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

UNIT – VI

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

- 1. Written Analyses of Cases Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. "Marketing Myopia"
- 2. Field visit & live project covering steps involved in formulating Market Research Project
- 3. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

Text Books:

- 1. Marketing Management (Analysis, Planning, Implementation & Control) Philip Kotler
- 2. Fundamentals of Marketing William J. Stanton & Others
- 3. Marketing Management V.S. Ramaswamy and S. Namakumari
- 4. Marketing Research Rajendra Nargundkar
- 5. Market Research G.C. Beri
- 6. Market Research, Concepts, & Cases Cooper Schindler

Reference Books:

- 5. Marketing Management Rajan Saxena
- 6. Marketing Management S.A. Sherlekar



Semester 8

- 7. Service Marketing S.M. Zha
- 8. Journals The IUP Journal of Marketing Management, Harvard Business Review
- 9. Research for Marketing Decisions by Paul Green, Donald, Tull
- 10. Business Statistics, A First Course, David M Levine at al, Pearson Publication



Semester 8

Behavioral Economics + Lab

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 4 Hrs/Week	Semester Examination: 60 marks	4
Tutorials: Nil	Continuous Assessment: 40 marks	
Lab: Nil	Term Work: Nil	
Pahavianal Factoria (Flasting II)		

Behavioral Economics (Elective – II)

Course Objective: To impart knowledge on current ideas and concepts regarding decision making in Economics, particularly from a behavioral science perspective, which can affect choices and behavior of firms, households and other economics entities

Course Outcome: Students will be able to understand and apply various concepts in traditional and modern Microeconomics, focusing on decision making, and develop a holistic understanding of these concepts and their interconnections

<u>Unit I</u>

I. Introduction

The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications – gains and losses, money illusion, charitable donation.

<u>Unit II</u>

II. Basics of choice theory

Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis – consumption and addiction, environmental protection, retail therapy; applications – pricing, valuation, public goods, choice anomalies



Semester 8

<u>Unit III</u>

III. Beliefs, heuristics and biases

Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; selfevaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade in memorabilia

Unit IV

IV. Choice under uncertainty

Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications – ownership and trade, income and consumption, performance in sports.

<u>Unit V</u>

V. Intertemporal choice

Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings, clubs and membership, consumption planning

<u>Unit VI</u>

VI. Strategic choice



1. Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry

2. Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion; policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design

Text Book: An Introduction to Behavioral Economics, by N. Wilkinson and M. Klaes



Semester 8

Computational Finance & Modeling (Elective – II)

Course Objective:

Post successful completion of this course, students will be able to:

- 1. Understand existing financial models in a quantitative and mathematical way.
- 2. Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
- 3. Explain the approaches required to calculate the price of options.
- 4. Identify the methods required to analyse information from financial data and trading systems.

Topics to Be Covered:

UNIT – I

Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance: examples of exact solutions including Black Scholes and its relatives, finite difference methods including algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, early exercise, and the corresponding free boundary problems, and a brief introduction to numerical methods for solving multi-factor models.

UNIT – II

Black-Scholes framework: Black-Scholes PDE: simple European calls and puts; put-call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega & rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts; optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.

Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linear congruential generator, Mersenne twister RNG. The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current



Semester 8

finance literature. The technical topics addressed include importance sampling, Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the "Greeks."

UNIT – III

Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.

$\mathbf{UNIT} - \mathbf{IV}$

Application areas include the pricing of American options, pricing interest rate dependent claims, and credit risk. The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options.

$\mathbf{UNIT} - \mathbf{V}$

Statistical Analysis of Financial Returns: Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data.

$\mathbf{UNIT} - \mathbf{VI}$

Copulas, Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High-dimensional covariance matrices, Extreme value theory, Statistical Arbitrage.

References:

- 1. R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2004.
- 2. P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York, 2004.
- W. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Art of Scientific Computing, 1997. Cambridge University Press, Cambridge, UK. Available on-line at: <u>http://www.nr.com/</u>
- 4. A. Lewis: Option Valuation under Stochastic Volatility, Finance Press, Newport Beach, California, 2000.
- 5. A. Pelsser: Efficient Methods for Valuing Interest Rate Derivatives, Springer-Verlag, New York, 2000.



Semester 8

- 6. D. Ruppert, Statistics and Data Analysis for Financial Engineering
- 7. R. Carmona: Statistical Analysis of Financial Data in S-Plus
- 8. N. H. Chan, Time Series: Applications to Finance
- 9. R. S. Tsay, Analysis of Financial Time Series
- 10. J. Franke, W. K. Härdle and C. M. Hafner, Statistics of Financial Markets: An Introduction



Semester 8

INDUSTRIAL PSYCHOLOGY

Course Objective:

Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues. Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety. Using an applied approach, this course will help prepare students for their roles as employees and managers.

Course Outcome(s):

Students will be able to

- Become conversant about the major content areas of Industrial Psychology (i.e., job analysis, recruitment, selection, employment law, training, performance management, and health/well-being issues in the workplace).
- Gain further comfort with statistical concepts in the context of making personnel decisions to reinforce content learned in PSY203 or an equivalent introductory statistics course.
- Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.
- Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.
- Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

Topics to Be Covered:

UNIT – I

What is I/O Psychology? Research Methods, Statistics, and Evidence-based Practice,

Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment



Semester 8

UNIT – II

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods,

UNIT – III

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance,

$\mathbf{UNIT} - \mathbf{IV}$

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity

$\mathbf{UNIT} - \mathbf{V}$

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior

$\mathbf{UNIT} - \mathbf{VI}$

Stress Management: Demands of Life and Work

Text Book:

Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford: Blackwell Publishing



Semester 8

Enterprise Systems + Lab

Attached Separately



Semester 8

Image Processing and Pattern Recognition + Lab

Introduction: Image processing systems and its applications. Basic image file formats

Image formation: Geometric and photometric models; Digitization - sampling, quantization; Image definition and its representation, neighbourhood metrics.

Intensity transformations and spatial filtering: Enhancement, contrast stretching, histogram specification, local contrast enhancement; Smoothing, linear and order statistic filtering, sharpening, spatial convolution, Gaussian smoothing, DoG, LoG.

Segmentation: Pixel classification; Grey level thresholding, global/local thresholding; Optimum thresholding - Bayes analysis, Otsu method; Derivative based edge detection operators, edge detection/linking, Canny edge detector; Region growing, split/merge techniques, line detection, Hough transform.

Image/Object features extraction: Textural features - gray level co-occurrence matrix; Moments; Connected component analysis; Convex hull; Distance transform, medial axis transform, skeletonization/thinning, shape properties.

Registration: Mono-modal/multimodal image registration; Global/local registration; Transform and similarity measures for registration; Intensity/pixel interpolation.

Colour image processing: Fundamentals of different colour models - RGB, CMY, HSI, YCbCr, Lab; False colour; Pseudo colour; Enhancement; Segmentation.

Morphological Filtering Basics: Dilation and Erosion Operators, Top Hat Filters

Text Books:

1. Digital Image Processing. R. C. Gonzalez and R. E. Woods, Prentice Hall.

Reference Books:

- 1. *Image Processing: The Fundamentals*. Maria Petrou and Panagiota Bosdogianni, John Wiley & Sons, Ltd.
- 2. Digital Image Processing. K. R. Castleman:, Prentice Hall, Englewood Cliffs.
- 3. Visual Reconstruction. A. Blake and A. Zisserman, MIT Press, Cambridge.
- 4. Digital Pictures. A. N. Netravali and B. G. Haskell, Plenum Press.
- 5. Digital Images and Human Vision. A. B. Watson:, MIT Press, Cambridge.