

# MANDATORY DISCLOSURES

## 16.1 ENGINEERING/TECHNOLOGY/PHARMACY PROGRAMMES

The following information is to be given in the Information Brochure besides being hosted on the Institution's official Website.

**"The information has been provided by the concerned institution and the onus of authenticity lies with the institution and not on AICTE."**

### I. NAME OF THE INSTITUTION

- **Address including telephone, Fax, e-mail.** Visveshvaraya Technological University, "Jnana Sanagama", P G Centre, Belgaum-590014.  
Phone No: 0831-2405472/ 2405468  
Fax No: 0831-2405467

### II. NAME & ADDRESS OF THE DIRECTOR

- **Address including telephone, Fax, e-mail.** Dr. K.V.A Balaji, Registrar, Visvesvaraya Technological University, "Jnana Sanagama", Santebastwad Road, Machhe, Belgaum-590 014.  
Phone No: 0831-2405468  
Fax No: 0831-2405467  
E-Mail- registrar@vtu.ac.in

### III. NAME OF THE AFFILIATING UNIVERSITY:

**Visvesvaraya Technological University,  
Belgaum-18.**

#### IV. GOVERNANCE

❖ Members of the Board and their brief background :

1. Prof. H. P. Khincha Vice Chancellor, VTU, BELGAUM.	2. Sri C. S. Suranjan, IAS, Principal Secretary to Government, Dept. of Education (Higher Edn.), 5 <sup>th</sup> Floor, M. S. Building, Dr. Ambedkar Veedhi, BANGALORE – 560 001.
3. Dr.(Ms.) P. Selvie Das, Ex-Member, Rajya Sabha, No.299, 14 <sup>th</sup> Main Road, Rajmahal Vilas Extension, BANGALORE – 560 080.	4. Prof. D. Thukaram, Dept. of Electrical Engineering, Indian Institute of Science, BANGALORE – 560 012.
5. Sri Aga Sultan Murthuza, No.638, 1 <sup>st</sup> Main, 1 <sup>st</sup> Stage, Indiranagar, BANGALORE – 560 038.	6. Sri Mohan Das Pai, Member of Board of Directors, Human Resources, Infosys Technologies Ltd., Electronics City, Hosur Road, BANGALORE – 560 100.
7. Dr. Gopal K. Kadekodi, Former Director, Institute for Social and Economic Change(ISEC), Chetana Building , 1 <sup>st</sup> Main, 4 <sup>th</sup> Cross, Srinagar, DHARWAD – 580 003.	8. Director of Technical Education, Govt. of Karnataka, Palace Road, BANGALORE – 560 001.
9. Dr. Ashok S Shettar, Principal, BVB College of Engg. & Tech., Vidyanagar, HUBLI – 580 031.	10. Dr. D. H. Rao, Principal, Gogte Institute of Technology, Udyambag, BELGAUM – 590 008.
11. Dr. Syed Shakeeb-Ur-Rehman Dean Faculty of Engineering, VTU, Prof. of Civil Engineering, Sri Jayachamarajendra College of Engineering, MYSORE- 570 006.	12. Dr. G. Raghavendra Rao, Vice Principal, National Institute of Engineering, Mananthodi Road, MYSORE – 570 008.
13. Dr. C. K. Subbaraya, Principal, Adichunchanagiri Institute of Tech., CHIKMAGALUR-577 102.	14. Dr. S. C. Sharma, Principal, R. V. College of Engineering, BANGALORE – 560 059.
15. Sri G. B. Mahadevappa No.192, 3 <sup>rd</sup> 'A' Main road, R.H.C.S. Layout, I Stage, Annapoorneswari Nagar, BANGALORE – 560 091.	16. Dr. D. L. Prabhakara, Principal & Director, Sahyadri Institute of Tech., Adyar, MANGALORE.
17. Prof. B. S. Sonde, Former Vice Chancellor, Goa University, 274, Shree Ananth Nagar, Electronics City PO, Hosur road, BANGALORE – 561 229.	18. Prof. Sirohi, President, ISOI, Amity University, Rajasthan City Office, 14, Gopal Bari, Ajmeer Road, JAIPUR – 302 001.

❖ Members of Academic Advisory Body:

**List of 3<sup>rd</sup> Academic Senate Members 8-4-2007 7-4-2010**

1. Prof. H. P. Khincha, Vice Chancellor Visvesvaraya Technological University, BELGAUM.	2. Mr. C. S. Suranjan, IAS, Principal Secretary to Government, Dept. of Education (Higher Edn.), 5 <sup>th</sup> Floor, M. S. Building, Dr. Ambedkar Veedhi, BANGALORE – 560 001.
3. Director of Technical Education, Govt. of Karnataka, Palace Road, BANGALORE – 560 001.	4. Dr. Syed Shakeeb-Ur-Rehman Prof. of Civil Engineering, Sri Jayachamarajendra College of Engineering, MYSORE – 570 006.
5. Dr. V. K. Aatre, ISSS, IISc., 139, III Main, 7 <sup>th</sup> Cross, RMV II Stage, Block I, BANGALORE – 560 094	6. Dr. A. R. Upadhya, Director, National Aerospace Laboratories, P. B. No.1779, Airport Road, BANGALORE.
7. Dr. R. N. Herkal, Member of the Academic Senate, VTU, Principal, Basaveswara Engg. College, BAGALKOT – 587 102.	8. Dr. Shashidhar S. Ramtal, Member of the Academic Senate, VTU, Principal, Govt. SKSJ Technological Inst., BANGALORE – 560 001.
9. Dr. G. Raghavendra Rao, Member of the Academic Senate, VTU, Principal, National Inst. of Engg., MYSORE – 570 008.	10. Dr. M. K. Venkatesha, Member of the Academic Senate, VTU, Principal, BMS College of Engg., BANGALORE – 560 019.
11. Dr. Martin Jebraj, Member of the Academic Senate, VTU, Principal, Dr. Ambedkar Inst. of Tech., BANGALORE – 560 056.	12. Dr. M. V. Chaitanya Kumar, Member of the Academic Senate, VTU, Principal, East Point College of Engg., BANGALORE – 560 043.
13. Dr. Puttaraju, Member of the Academic Senate, VTU, Principal, SJB Inst. of Tech., BANGALORE – 560 060.	14. Dr. S. Y. Kulkarni, Member of the Academic Senate, VTU, Principal, NMAM Inst. of Tech., NITTE – 574110.
15. Dr. H. Maheshappa, Member of the Academic Senate, VTU, Principal, Reva Inst. of Engg. & Tech. Studies, BANGALORE – 560 064.	16. Dr. S. C. Pilli, Member of the Academic Senate, VTU, Principal, KLE'S College of Engg. & Tech., BELGAUM – 590 008.
17. Dr. P. J. Satturkar,	18. Dr. K. Rajanikanth,

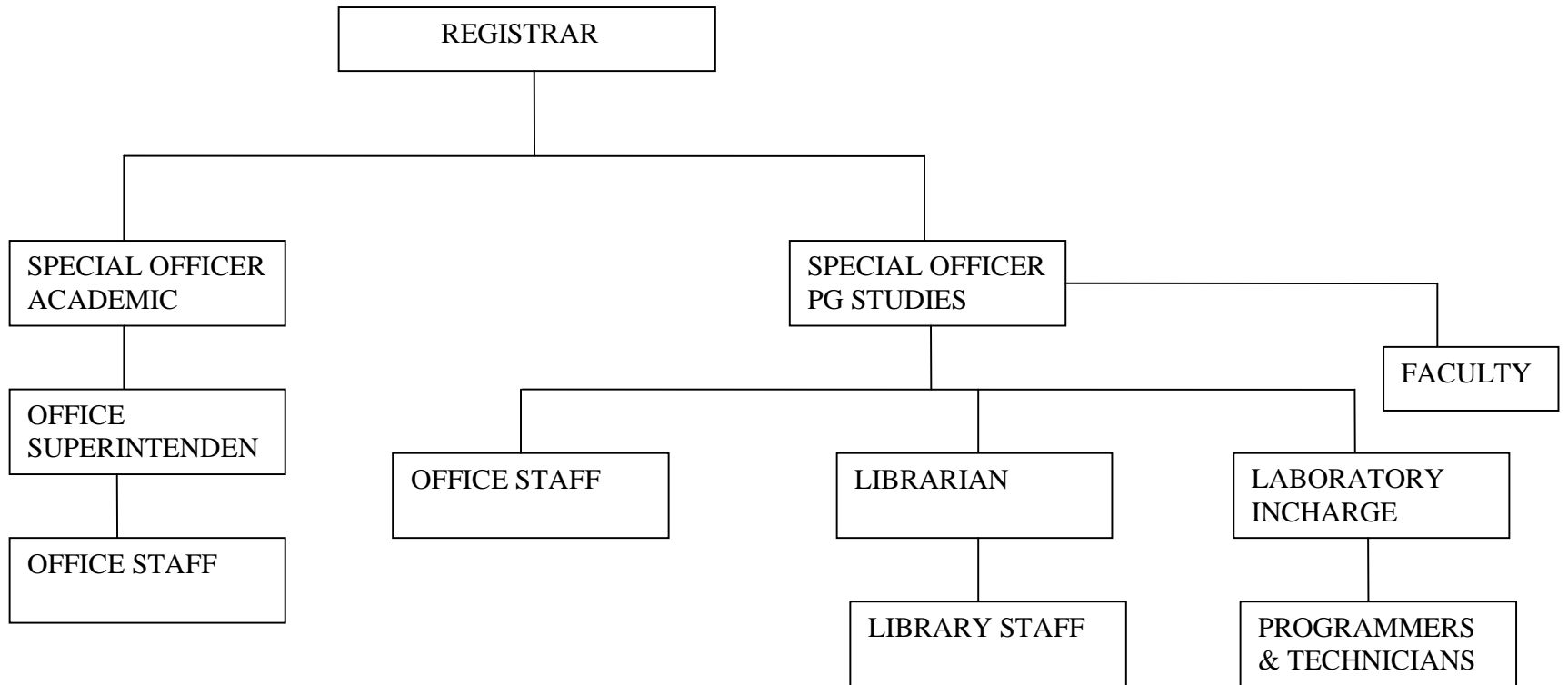
Member of the Academic Senate, VTU, Prof. of Civil Engineering, PDA College of Engg., GULBARGA – 585 102.	Member of the Academic Senate, VTU, Prof. of Computer Science, M.S. Ramaiah Inst. of Tech., BANGALORE – 560 054.
19. Dr. D. V. Girish, Member of the Academic Senate, VTU, Prof. of Mechanical Engineering, Malnad College of Engg., HASSAN – 573 201.	20. Dr. C. R. Venugopal, Member of the Academic Senate, VTU, Prof. of Electronics & Communication Sri Jayachamarajendra College of Engineering, MYSORE – 570 006.
21. Sri K. Shivashankar, Retd. Engineer-in-chief, Plot. No.10, I Main, II Stage, Hanuman Nagar, BELGAUM.	22. Sri. B. N. Thyagaraja, No.17, Sanky Road, BANGALORE - 560 020
23. Sri Rajendra Pukhraj Khataria 'PUSHKAR', 395, Veer Savarkar Road, Tilakwadi, BELGAUM – 590 006.	24. The Registrar, Visvesvaraya Technological University, BELGAUM.

❖ Frequency of the Board Meetings and Academic Advisory Body: **Monthly & Quarterly respectively.**

❖ Organizational chart and processes:

**ENCLOSURE-4**

**ORGANIZATIONAL CHART**



❖ Nature and Extent of involvement of faculty and students in academic affairs/improvements:  
**Course curriculum is governed by Visvesvaraya Technological university, Belgaum**

## **V. PROGRAMMES**

- ❖ Name of the Programmes approved by the AICTE: **MBA/M.Tech.,**
- ❖ Name of the Programmes accredited by the AICTE : **Nil: courses started in 2002**
- ❖ For each Programme the following details are to be given:
  - Name: **MBA/M.Tech.**
  - Number of seats : **Admitted for the Year 2008-2007 MBA-129/M.Tech-74**
  - Duration : **Two Years**
  - Cut off mark/rank for admission during the last three years : **Through CET & Government of Karnataka**
  - Fee : **Tuition fees for MBA -50,000/M.Tech-60,000**
  - Placement Facilities : **Yes**
  - Campus placement in last three years with minimum salary, maximum salary and average salary:
- ❖ Name and duration of programme (s) having affiliation/collaboration with Foreign University(s)/Institution(s) and being run in the same Campus along with status of their AICTE approval. If there is foreign collaboration, give the following details: **NIL**

**Details of the Foreign Institution/University: --Not Applicable--**

- Name of the University/Institution
- Address
- Website
- Is the Institution/University Accredited in its Home Country
- Ranking of the Institution/University in the Home Country
- Whether the degree offered is equivalent to an Indian Degree? If yes, the name of the agency which has approved equivalence. If no, implications for students in terms of pursuit of higher studies in India and abroad and job both within and outside the country.
- Nature of Collaboration
- Conditions of Collaboration
- Complete details of payment a student has to make to get the full benefit of collaboration.

❖ **For each Collaborative/affiliated Programme give the following: --NA--**

- Programme Focus
- Number of seats
- Admission Procedure
- Fee
- Placement Facility
- Placement Records for last three years with minimum salary, maximum salary and average salary

❖ **Whether the Collaborative Programme is approved by AICTE? If not whether the Domestic/Foreign Institution has applied to AICTE for approval as required under notification no. 37-3/Legal/2005 dated 16th May, 2005. –NA--**

**VI.FACULTY**

- Branch wise list faculty members:
- Permanent Faculty -- NA—
- Visiting Faculty :

<b>MBA Staff</b>	<b>M.Tech Staff</b>
Dr. A B Kalkundrukar	Prof. V.T Desai
Prof. A B N Kulkarni	Prof G P Kadam
Dr. Deepak Nath	Smt Nandini S Sidnal
Prof P R Kadakol	Dr. V R Udupi
Deepti S C	Prof.S B Kulkarni
Dr. S G Kulkarno	Prof. R H Goudar
Dr. R V Diwan	Prof. Hansaraj Guhilot
Dr. J G Naik	Prof. K Prabhushetty
Mr. N Malekar	Ms. Ashwini Desai
Mr. S V belgaumkar	Sri. Praveen Chitti
Prof. Anand Nayak	Smt. K R Rasane
Col. A R Patil	Dr. S C Pilli
Mr. C S Mujawar	Prof. M D Deshapnde
Prof. D G Kulkarni	Prof. R P Bhat
Smt S G Joshi	
Prof P M Kapileshware	
Prof. Rajshekhar Patil	
Prof V L Deshapande	
Prof. Murlidhar KY	
Yogendra Watawe	
Prof. Arvind Kulkarni	
Prof. Shivakumar	
Smt. Anupama Joshi	
Smt. Gouri nayak	
Prof. Ambekar	

Prof. Chate U N	
Prof. K S Keralikar	
Dr. U M Bhushi	
Ms. Gangambika D	
Mr. Shrikant Zanwar	
Smt. S G Joshi	
Prof. Nityanad M	
Prof. Chandrashekar	
Smt. Nirmala G	

- Adjunct Faculty --NA—
- Guest Faculty --NA—
- Permanent Faculty: Student Ratio --NA--

## **VII. PROFILE OF DIRECTOR/PRINCIPAL WITH QUALIFICATIONS, TOTAL EXPERIENCE, AGE AND DURATION OF EMPLOYMENT AT THE INSTITUTE CONCERNED**

For each Faculty give a page covering :

1. Name : Dr. K.V.A Balaji

2. Date of Birth : 3-9-1957

3. Educational Qualification :

- B.E in Mechanical Engineering with Heat Power Specialization from Jayachmarajendra College of Engineering, Mysore
- M.B.A with Marketing Specialization Manas Gangotri
- M.Tech in Industrial management with Industrial relations & Advertising, Specialization, from IIT, Chennai
- Ph.D in Organizational Behaviour, from IIT, Chennai

4. Professional Experience :

- 1980 : Joined as a Lecturer in the Mechanical Department of Sri Jayachamarajendra College of Engineering, mysore
- 1995: Promoted as an Assistant Professor
- 2006: Assumed the charges of Registrar (Evaluation) at Visvesvaraya Technological University, Belgaum on deputation from SJCE, Mysore
- March 31<sup>st</sup> 2008: Appointed as the Registrar of Visvesvaraya Technological University Belgaum
- Guided one Ph.D candidate and guiding wo Ph.D candidates
- Publised number of publications in National as well as International Journals

Area of Interest in Research:

- Organizational Behavior

- Organizational Development
- Professional and Business communication
- Carrer Development and Training.

## VIII. FEE

- ❖ Details of fee, as approved by State fee Committee, for the Institution.

**MBA: 50,000/- per year**

**M.Tech: 60,000/- per year**

- ❖ Time schedule for payment of fee for the entire programme. : **Two installments.**

- ❖ No. of Fee waivers granted with amount and name of students: --

- ❖ Number of scholarship offered by the institute, duration and amount :

**One, per year and**

**(Tuition fees and other fees)**

- ❖ Criteria for fee waivers/scholarship :

**SC/ST and OBC**

- ❖ Estimated cost of Boarding and Lodging in Hostels :

**10,000/- per year**

## IX. ADMISSION

- ❖ Number of seats sanctioned with the year of approval. For the year 2005-2006

Sl. No	Year	Course/Seat Sanctioned with approval	Admitted
1	2005-2006	MBA-60	70
2	2005-2006	M.Tech in VLSI-18	15
3	2005-2006	M.Tech in CNE-18	12
4	2005-2006	M.Tech in VLSI PT	03
5	2005-2006	M.Tech in PDM PT	07
		Total	107

- ❖ Number of students admitted under various categories each year in the last three years.

SI No	Course	Year	SC	ST	Cat-I	OBC	GM	Total
1	MBA	2005-06	11	02	03	19	35	70
2	M.Tech in VLSI	---do---	-	01	-	03	08	12
3	M.Tech in CNE	---do---	03	-	-01	-	11	15
4	M.Tech in VLSI PT	---do---	-	-	-	01	02	03
5	M.Tech in PDM PT	---do---	-	-	01	01	05	07
1	MBA	2004-05	10	02	03	15	29	59
2	M.Tech in VLSI	---do---	05	--	--	03	12	20
3	M.Tech in CNE	---do---	06	01	01	--	09	17
1	MBA	2003-04	02	01	--	11	44	58
2	M.Tech in VLSI	---do---	02	--	--	03	20	25
3	M.Tech in CNE	---do---	02	--	--	03	18	23
4	M.Tech. in PDM	---do---	--	--	--	01	05	06

- ❖ Number of applications received during last two years for admission under Management Quota and number admitted. -NA--

## X. ADMISSION PROCEDURE

- ❖ Mention the admission test being followed: **PG,CET-2005 of Govt. of Kanrnataka** name and address of the Test Agency :**Central Post Graduation Administrative Committee.** and its URL (website) : **www.vtu.ac.in**
- ❖ Number of seats allotted to different Test Qualified candidates separately [AIEEE/CET (State conducted test/University tests)/Association conducted test]-NA-
- ❖ Calendar for admission against management/vacant seats:
- Last date for request for applications.
  - Last date for submission of application.

Dates for announcing final results.

- Release of admission list (main list and waiting list should be announced on the same day)
- Date for acceptance by the candidate (time given should in no case be less than 15 days)
- Last date for closing of admission.

- Starting of the Academic session.
- The waiting list should be activated only on the expiry of date of main list.
- The policy of refund of the fee, in case of withdrawal, should be clearly notified.

## **XI. CRITERIA AND WEIGHTAGES FOR ADMISSION**

- ❖ Describe each criteria with its respective weightages i.e. Admission Test, marks in qualifying examination etc.
- ❖ Mention the minimum level of acceptance, if any.
- ❖ Mention the cut-off levels of percentage & percentile scores of the candidates in the admission test for the last three years.
- ❖ Display marks scored in Test etc. and in aggregate for all candidates who were admitted.

### **MBA Eligibility Criteria:**

#### **(i) Full-Time MBA Course:**

Admission to Master of Business Administration course shall be open for the candidates who have passed the Bachelor Degree Examination with not less than fifty percent (50%) of the marks in the aggregate of all the years of the degree examinations. However, in the case of candidate from Karnataka belonging to SC/ST and Category-I, the aggregate percentage of marks of all the years of the qualifying examinations shall not be less than forty-five percent.

#### **(ii) Part-Time MBA Course:**

The Candidates applying for part-time MBA course, in addition to satisfying the academic eligibility criteria specified for Full-Time MBA Course, must have worked for not less than three years in an establishment and must be working in an organization situated within a radial distance of 40 KMS from the institution in which the candidate seeks admission.

### **M.Tech Eligibility Criteria :**

(I) Admission to M.E/M.Tech. Course (Full-Time) : Course shall be open for candidates who have passed the prescribed qualifying Examinations as specified in Annexure-5 with not less than 50% of the marks in the aggregate of all the years of the degree examination (cumulative sum of secured marks of all the semesters/years divided by the sum of the maximum marks). However, in the case of candidates belonging to SC/ST and CAT-1, marks shall not be less than 45%.

(II) Admission to M.E/M.Tech. Course (Part-Time) For admission to M.E/M.Tech. Part-

Time Course, the candidate must have worked for not less than three years in an establishment and must be working in an organization situated within a radial distance of 40 km. from the institution in which the candidate seeks admission.

### **Reservation of Seats:**

- (i) Seats shall be reserved in favour of the following categories of candidates to the extent specified by the Government and AICTE from time to time.
  - (a) Candidates belonging to the Scheduled Caste, the Scheduled Tribes and Other Backward Classes of citizens under categories I, II-A, IIB, IIIB, in accordance with G.O. No: SWL 251 BCA 94, dated: 31-01-1995.
  - (b) Candidates who are Physically Disabled.
- (ii) In the case of M.E/M.Tech. (Full Time) Course, the general category seats remaining vacant after allotment to GATE candidates, 90% of the seats are reserved for Karnataka candidates and the remaining 10% for Non-Karnataka candidates.
- (iii) Inter-se merit shall be basics for selection under this rule.
- (iv) SC/ST & OBC candidates who are allotted seats by merit in general category will not be counted against the seats reserved for them and such candidates will go into the list of general category seats, however they are eligible for benefits of reservation.

### **GATE-STIPEND:**

- (i) Preference will be given to GATE qualified candidates for admission to both Full-Time  
When GATE qualified candidates are not available, admission will be made based on the merit list of PG CET-2005. For receiving GATE Scholarship, a candidate must have qualified in GATE. However, a GATE qualified candidate does not automatically become eligible to receive a scholarship.

### **Scholarship to a GATE**

- qualified candidate will depend on availability of the same in an Institution.** Due to financial constraints, as a policy, AICTE does not approve any further scholarships to the Institutions. In fact, the AICTE has reduced the number of scholarships to 70% of the existing level in the AICTE funded Institutions. When the number of Scholarships is less than the number of GATE qualified candidates admitted, the distribution of scholarships shall be on merit in respective category (i.e General & SC/ST) among the GATE qualified candidates.
- (ii) Candidates with valid GATE Score, opting seats under Sponsored Quota, are not entitled for GATE Stipend.
- (iii) SC/ST/OBC candidate with valid GATE Score claiming any other Scholarship from

Government of Karnataka/India are not entitled for GATE Scholarship.

(iv) Candidates with valid GATE Score opting for seat under Part-Time M.E/M.Tech.

Program are not entitled for GATE Stipend.

**Item No I - XI must be given in information brochure and must be hosted as fixed content in the website of the Institution. The Website must be dynamically updated with regard to XII-XV.**

## **XII. APPLICATION FORM**

- ❖ Downloadable application form, with online submission possibilities : **Yes**

## **XIII. LIST OF APPLICANTS**

- ❖ List of candidates whose applications have been received along with percentile/percentage score for each of the qualifying examination in separate categories for open seats. List of candidates who have applied along with percentage and percentile score for Management quota seats. All the admission from the CPAC.

## **XIV. RESULTS OF ADMISSION UNDER MANAGEMENT SEATS/VACANT SEATS:**

**Not Applicable**

- ❖ Composition of selection team for admission under Management Quota with the brief profiles of members  
(This information be made available in the public domain after the admission process is over)
- ❖ Score of the individual candidates admitted arranged in order of merit.
- ❖ List of candidates who have been offered admission.
- ❖ Waiting list of the candidates in order of merit to be operative from the last date of joining of the first list candidates.
- ❖ List of the candidates who joined within the date, vacancy position in each category before operation of waiting list.

## **XV. INFORMATION ON INFRASTRUCTURE AND OTHER RESOURCES AVAILABLE**

### **LIBRARY:**

- Number of Library books/Titles/Journals available (programme-wise)

<b>Sl No:</b>	<b>Course</b>	<b>Number of titles of the books</b>	<b>Number of Volumes</b>
2	M.Tech in VLSI	323	1208
3	M.Tech in CNE	318	1402
4	M.Tech in PDM	40	120

- List of online National/International Journals subscribed.

Sl No:	Course	Journals	
		National	International
2	M.Tech in VLSI	04	--
3	M.Tech in CNE	09	23 IEEE
4	M.Tech in PDM	03	12

➤ E-Library facilities : WiFi Campus

## LABORATORY:

### For each Laboratory

➤ List of Major Equipment/Facilities :

#### 1) Microsoft LAB:

1) Pentium – IV 2.6 GHZ/3.0GHZ/2.8GHZ

256/512/ 1 GB RAM 40 GB/80GB/120 GB HDD

Combo five (C D R W/ D U D R) FDD

865/845 Chipset M/B Sound/Internet/ Graphics on board K/B, Mouse

2) 4 Compaq reliant servers with 1GB RAM & 36.4 GBHD x 4 Nos

3) 25 HCL Busy bee Systems with KB RAM 40 GB HDD

4) All Microsoft Software's:

1) MS Windows 2003 Server

2) MS xp Professional

3) MS office 2003

4) MS project 2003

5) MS Visio 2003

6) MS Visual Studio. Net

7) MS SQKL Server 2000

5) Digital Board, projector (Sony) Samsung Camera

#### 2) UGS LAB for Mechanical /Automobile/Civil/

1) 25+2 MP workstations x U4200 with IGB RAM & 40 GB HDD

2) MTAB X2 Mill & X2 Turn Machines

3) NX 3.0, Solid edge 17.0, Femap 8.0 Software's.

4) Digital Board/ Projector, Samsung Camera

3) **Regular lab:**

1) 60 HCL Systems with 256 **RAM** 80 GB HDD

2) Software all 1) MS Products

2) Lab view software 8.0

3) Solid edge

4) **Solaris Lab** for VLSI /Electronics

1) 24 Sun work stations with Solaris 9.0 installed 1. GB RAM. 80 GB HDD

2) 2 Sun edge servers.

3) 1 NAC Box with sun Solaris 9.0

4) Cadence tools software installed

➤ List of Experimental Setup :

➤ Status and facilities in Studio/Designing and Art appreciation and other related disciplines / specializations.

**COMPUTING FACILITIES:**

➤ Number and Configuration of Systems : 220 Systems Approximate

➤ Total number of systems connected by LAN : 220

➤ Total number of systems connected to WAN **oval** : 220 **22:: : 220**

➤ Internet bandwidth : 2 MBPS

➤ Major software packages available : An Microsoft Products

M S Software:- MS windows 2003 Server

MS Office 2003

MS Visual 2003

MS Project 2003

MS XP Prof,

MS Visual Studio .Net

MS SQL Server 2000

UGS Software: Solid Edge -17.0

Femap 8.X

NX 3.X

Cadence Software Stools

Lab view Software

Solaris 75 9.0

Linux 075 9.0/ F case -3.4.etc

➤ Special purpose facilities available : **-NA-**

### **WORKSHOP:**

➤ List of facilities available. : WiFi network

Games and Sports Facilities : Gym, Golf Facility, Badminton, Carom

Extra Curriculum Activities :

Soft Skill Development Facilities :

Number of Classrooms and size of each : **07**

**Ground Floor: Class Room Size 1) 8.7X10.82 2) 8.7X10.46**

**Ist Floor : Class Room Size 1) 11.77X8.7 2) 8.7X10.77 3) 8.7X5.77 4) 8.7X5.88  
5) 8.7X11.77**

Number of Tutorial rooms and size of each: **-NA-**

Number of laboratories and size of each : **03**

**Microsoft Lab: 8.77X14.77**

**UGS Lab : 11.77X9  
7.7X5.77**

**Computer Lab: 8.17X29.77**

Number of drawing halls and size of each : **-NA-**

Number of Computer Centers with capacity of each: 4 Capacity 30 each.

Central Examination Facility, Number of rooms and capacity of each.

### **Teaching Learning process**

➤ Curricula and syllabi for each of the programmes as approved by the University.

➤ Academic Time Table (Enclosed as Enclosure- 1 )

ii. Curricula and Syllabi:

SCHEME OF TEACHING AND EXAMINATION  
M.TECH. - VLSI DESIGN & EMBEDDED SYSTEMS

**I SEMESTER**

Course Code	Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
			Lecture	Practical / Field Work / Assignment		I.A.	Exam	
08LVS11	08EC021	CMOS VLSI Design	4	2	3	50	100	150
08LVS12	08EC082	VLSI Systems & Architecture	4	2	3	50	100	150
08LVS13	08EC037	Embedded Systems Design	4	2	3	50	100	150
08LVS14	08EC046	Linear Algebra	4	2	3	50	100	150
08LVS15	08ECxxx	Elective-I	4	2	3	50	100	150
08LVS16		Seminar	--	3	--	50	--	50
<b>Total</b>			<b>20</b>	<b>13</b>	<b>15</b>	<b>300</b>	<b>500</b>	<b>800</b>

**ELECTIVE – I**

08LVS151	08EC083	VLSI Technology
08LVS152	08EC012	ASIC Design

08LVS153	08EC032	Digital System Design Using VHDL

1

SCHEME OF TEACHING AND EXAMINATION  
M.TECH. - VLSI DESIGN & EMBEDDED SYSTEMS

**II SEMESTER**

Course Code	Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
			Lecture	Practical / Field Work / Assignment		I.A.	Exam	
08LVS21	08EC025	Design of analog & mixed mode VLSI Circuits	4	2	3	50	100	150
08LVS22	08EC070	Real Time Embedded Systems	4	2	3	50	100	150
08LVS23	08EC047	Low Power VLSI Design	4	2	3	50	100	150
08LVS24	08EC078	Testing & Verification of VLSI Circuits	4	2	3	50	100	150
08LVS25	08ECxxx	Elective-II	4	2	3	50	100	150
		*Project Phase-I (6 week Duration)						
08LVS26		Seminar	--	3	--	50	--	50
<b>Total</b>			<b>20</b>	<b>13</b>	<b>15</b>	<b>300</b>	<b>500</b>	<b>800</b>

**ELECTIVE – II**

08LVS251	08EC027	Design of VLSI system	08LVS253	08EC007	Advanced Embedded System Design
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08LVS252	08EC010	Algorithms for VLSI Design Automation			
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\* Between the II Semester and III Semester. After availing a vocation of 2 weeks.

2

SCHEME OF TEACHING AND EXAMINATION  
M.TECH. - VLSI DESIGN & EMBEDDED SYSTEMS

III SEMESTER

Course Code	Subject Code	Subject	No. Of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
			Lecture	Practical / Field Work		I.A.	Exam	
08LVS31	08EC020	CMOS RF Circuit Design	4	2	3	50	100	150
08LVS32	08ECxxx	Elective-III	4	2	3	50	100	150
08LVS33	08ECxxx	Elective-IV	4	2	3	50	100	150
		Project Phase-II		*				
08LVS34		Evaluation of Project Phase – I	–	3	–	50	–	50
<b>Total</b>			<b>12</b>	<b>09</b>	<b>09</b>	<b>200</b>	<b>300</b>	<b>500</b>

ELECTIVE – III

08LVS311	08EC041	Hardware-Software Co-design
08LVS312	08EC077	Synthesis & Optimization of Digital Circuits
08LVS313	08EC019	CAD Tools for VLSI Design

ELECTIVE – IV

08LVS321	08EC009	Advances in VLSI Design
08LVS322	08EC071	RF & Microwave Circuit Design
08LVS323	08EC081	VLSI Sub-System Design

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SCHEME OF TEACHING AND EXAMINATION  
M.TECH. - VLSI DESIGN & EMBEDDED SYSTEMS

IV SEMESTER

Course Code	Subject Code	Subject	No. Of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
			Lecture	Practical / Field Work		I.A.	Exam	
08LVS41		Evaluation of Project Phase – II	-	3	-	50	-	50
08LVS42		Evaluation of Project work	-	3	-	50	-	50
08LVS43		Project Work Evaluation & Viva-Voce	-	-	3	–	200	200
<b>Total</b>			<b>-</b>	<b>06</b>	<b>03</b>	<b>100</b>	<b>200</b>	<b>300</b>
<b>Grand Total (I to IV Sem.) : 2400</b>								

Note: Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

I – SEMESTER  
**CMOS VLSI DESIGN**

Subject Code	: 08EC021	IA Marks	: 50
No. of Lecture Hours /week	: 04	Exam Hours	: 03
Total no. of Lecture Hours	: 52	Exam Marks	: 100

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**MOS Transistor Theory:** n MOS / p MOS transistor, threshold voltage equation, body effect, MOS device design equation, sub threshold region, Channel length modulation. mobility variation, Tunneling, punch through, hot electron effect MOS models, small signal AC Characteristics, CMOS inverter,  $\beta_n / \beta_p$  ratio, noise margin, static load MOS inverters, differential inverter, transmission gate, tristate inverter, BiCMOS inverter.

**CMOS Process Technology:** Lambda Based Design rules, scaling factor, semiconductor Technology overview, basic CMOS technology, p well / n well / twin well process. Current CMOS enhancement (oxide isolation, LDD. refractory gate, multilayer inter connect) , Circuit elements, resistor , capacitor, interconnects, sheet resistance & standard unit capacitance concepts delay unit time, inverter delays , driving capacitive loads, propagate delays, MOS mask layer, stick diagram, design rules and layout, symbolic diagram, mask feints, scaling of MOS circuits.

**Basics of Digital CMOS Design:** Combinational MOS Logic circuits- Introduction, CMOS logic circuits with a MOS load, CMOS logic circuits, complex logic circuits, Transmission Gate. Sequential MOS logic Circuits - Introduction, Behavior of hi stable elements, SR latch Circuit, clocked latch and Flip Flop Circuits, CMOS D latch and triggered Flip Flop. Dynamic Logic Circuits - Introduction, principles of pass transistor circuits, Voltage boot strapping synchronous dynamic circuits techniques, Dynamic CMOS circuit techniques

**CMOS Analog Design:** Introduction, Single Amplifier. Differential Amplifier, Current mirrors, Band gap references, basis of cross operational amplifier.

**Dynamic CMOS and clocking:** Introduction, advantages of CMOS over NMOS, CMOS\SOS technology, CMOS\bulk technology, latch up in bulk CMOS., static CMOS design, Domino CMOS structure and design, Charge sharing, Clocking- clock generation, clock distribution, clocked storage elements.

I SEMESTER  
**ADVANCED DIGITAL COMMUNICATION**

Subject Code	: 08SCN11	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**Digital Transmission Fundamentals**

Digital Representation of Information: Block-Oriented Information, Stream Information; Why Digital Communications? Comparison of Analog and Digital Transmission, Basic properties of Digital Transmission Systems; Digital Representation of Analog Signals: Bandwidth of Analog Signals, Sampling of an Analog Signal, Digital Transmission of Analog Signals; Characterization of Communication Channels: Frequency Domain Characterization, Time Domain Characterization; Fundamental Limits in Digital Transmission: The Nyquist Signaling Rate, The Shannon Channel Capacity; Line Coding; Modems and Digital Modulation: Binary Phase Modulation, QAM and Signal Constellations, Telephone Modem Standards; Properties of Media and Digital Transmission Systems: Twisted Pair, Coaxial Cable, Optical Fiber, Radio Transmission, Infrared Light; Error Detection and Correction: Error Detection, Two Dimensional Parity Checks, Internet Checksum, Polynomial Codes, Standardized Polynomial Codes, Error Detecting Capability of a Polynomial Code.

**Brief Review of digital communication systems**

Elements of Digital communication systems; Communication channels and their characteristics; Historical perspective in the development of digital communication; Review of the features of a decreases memo less channel and the channel capacity theorem.

**Wave form Coding Techniques**

PCM, Channel. Noise and error probability, DPCM, DM, coding speech at low bit rates, Applications.

**Base band Shaping for data transmission**

Discrete PAM signals, Inter-symbol interference (ISI) Nyquist criterion for distortion-less Base band binary transmission, correlative coding, Eypattern, transmission, correlative coding, Eypatterns Based and M-ary PAM system, Adoptive Equalization. The zero forcing algorithm, The LMA algorithm.

**TEXT BOOKS:**

1. Alberto Leon – Garcia and Indra Widjaja: “**Communication Networks - Fundamental Concepts and Key architectures**”, 2<sup>nd</sup> edition Tata McGraw-Hill,200.
2. Simon Haykin: “**Digital Communication**”, John Wiley and Sons, 200

**REFERENCE BOOKS AND JOURNALS:**

1. John G Proakis: “**Digital Communications**, 3<sup>rd</sup> Edition, McGraw Hill,200
2. Leon W Couch: “**Analog / Digital Communication**”, 5<sup>th</sup> Edition, PHI,200 IEEE Transactions on Digital Communication.

**COMPUTER NETWORKS**

Subject Code	: 08SCN12	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**Foundation**

Building a Network; Applications; Requirements; Network Architecture; Implementing Network software; Performance.

**Direct Link Networks**

Physically connecting hosts; Hardware building blocks; Encoding; Framing; Error detection; Reliable transmission; Ethernet (802.3); Ring; (802.5, FDDI, 802.17); Wireless (802.15.1, 802.11, 802.16, Cell Phone Technologies).

**Packet Switching**

Switching and forwarding; Bridges and LAN Switches; Cell Switching; Implementation and Performance.

## **Internetworking**

Simple internetworking (IP); Routing; Global Internet; Multicast; MPLS.

## **End –to-End Protocols** (TCP).

Simple demultiplexer (UDP); Reliable byte stream

## **Congestion Control and Resource Allocation**

Issues in resource allocation; Queuing discipline; TCP Congestion Control; Congestion-Avoidance mechanisms; Quality of Service.

## **Applications**

Traditional applications; Web services; Multimedia applications; Overlay Networks.

## **TEXT BOOKS:**

1. Larry L. Peterson and Bruce S. David: “**Computer Networks – A Systems Approach**”, 4<sup>th</sup> Edition, Elsevier, 2007.

## **REFERENCE BOOKS:**

1. Behrouz A. Forouzan: “**Data Communications and Networking**”, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2006.
2. William Stallings: “**Data and Computer Communication**”, 8<sup>th</sup> Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: “**Communication Networks -Fundamental Concepts and Key architectures**”, 2<sup>nd</sup> Edition Tata McGraw-Hill, 2004.

## **UNIX NETWORK PROGRAMMING**

Subject Code	: 08SCN13	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **Introduction**

OSI model, Processes, simplified model, client server model, history of Unix Networking.

### **Communication Protocols**

Introduction, TCP/IP, XNS, UUCP.

### **Sockets**

Introduction, Unix domain protocols, socket addresses, elementary socket system calls, advanced socket system calls, reserved ports, stream pipes, passing file descriptions, socket options, asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, sockets and signals, Internet superservers, socket implementation.

### **TFTP Protocol**

Introduction, protocol, security, data formats, connections, client user interface, UDP implementation, TCP implementation.

### **Remote Command Execution**

Introduction, Security issues, rcmd function and rshd server, rexec function and rexecd server.

### **Remote Login**

Introduction, Terminal line disciplines, pseudo terminal, terminal modes, control terminals rlogin overview, rlogin client, rlogin server.

### **Application Protocols**

Application protocols with example implementation SMTP, HTTP, FTP.

## **TEXT BOOKS:**

1. W. Richard Stevens: “**Unix Network Programming**”, PHI, 2001.

## **REFERENCE BOOKS:**

1. W. Richard Stevens: “**Unix Network Programming**”, Vol. 1, PHI, 1997.

## COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Subject Code	: 08SCN14	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### Introduction

The art of Performance Evaluation; Common mistakes in Performance Evaluation; A systematic approach to Performance Evaluation; Selecting an evaluation technique; Selecting performance metrics; Commonly used performance metrics; Utility classification of performance metrics; Setting performance requirements.

### Workloads, Workload Selection and Characterization

Types of work loads: addition instructions; Instruction mixes; Kernels; Synthetic programs; Application benchmarks; Popular benchmarks.

Work load selection: Services exercised; Level of detail; Representativeness; Timeliness; Other considerations in workload selection.

Work load characterization techniques: Terminology; Averaging; Specifying dispersion; Single-parameter histograms; Multi-parameter histograms; Principle-component analysis; Markov models; Clustering.

### Monitors, Program Execution Monitors, and Accounting Logs

Monitors: Terminology and classification; Software and hardware monitors; Software versus hardware monitors; Firmware and hybrid monitors; Distributed system monitors.

Program execution monitors and accounting logs: Program execution monitors; Techniques for improving program performance; Accounting logs; Analysis and interpretation of accounting log data; Using accounting logs to answer commonly asked questions.

### Capacity Planning and Benchmarking

Steps in capacity planning and management; Problems in capacity planning; Common mistakes in benchmarking; Benchmarking games; Load drivers; Remote-terminal emulation; Components of an RTE; Limitations of RTEs.

### Experimental Design and Analysis

Introduction: Terminology; Common mistakes in experiments; Types of experimental designs.

$2^k$  Factorial Designs: Concepts; Computation of effects; Sign table method for computing effects; Allocation of variance; General  $2^k$  Factorial Designs.

General full factorial designs with k factors: Model; Analysis of a general design; Informal methods.

### Queuing Models

Introduction: Queuing notation; Rules for all Queues; Little's law; Types of stochastic processes.

Analysis of Single Queue: Birth-Death processes; M / M / 1 Queue; M / M / m Queue; M / M / m / B Queue with finite buffers; Results for other M / M / 1 Queuing Systems.

Queuing Networks: Open and closed Queuing Networks; Product form networks; Queuing Network models of Computer Systems.

Operational Laws: Utilization law; Forced flow law; Little's law; General response time law; Interactive response time law; Bottleneck analysis.

Mean Value analysis and related techniques: Analysis of open queuing networks; Mean value analysis; Approximate MVA; Balanced job bounds.

Convolution Algorithm: Distribution of jobs in a system; Convolution algorithm for computing G(N); Computing performance using G(N); Timesharing systems.

Hierarchical decomposition of Large Queuing Networks: Load-dependent service centers; Hierarchical decomposition; Limitations of Queuing Theory.

### TEXT BOOKS:

1. Raj Jain: "The Art of Computer Systems Performance Analysis", John Wiley and Sons, 1991.

### REFERENCE BOOKS:

1. Paul J. Fortier, Howard E. Michel: "Computer Systems Performance Evaluation and Prediction", Elsevier, 2003.
2. Trivedi, KS, "Probability and Statistics with Reliability, Queueing and computer science Applications", Prentice Hall of India Reprinted in 1990

ELECTIVE-I  
C# AND .NET

Subject Code : 08SCN151 IA Marks : 50

No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **The Philosophy of .NET**

Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries ( aka Assemblies ), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Language Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

### **Building C# Applications**

The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class.

### **C# Language Fundamentals.**

The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

### **Object- Oriented Programming with C#**

Forms Defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The “ Protected” Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between .

### **Exceptions and Object Lifetime.**

Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application-Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of ‘new’, The Basics of Garbage Collection., Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

### **Interfaces and Collections**

Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects ( ICloneable), Building Comparable Objects ( I Comparable ), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type).

### **Callback Interfaces, Delegates, and Events, Advanced Techniques**

Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, , Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events.The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer . Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

### **Understanding .NET Assemblies.**

Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary’s, Manifest, Exploring the CarLibrary’s Types, Building the Multifile Assembly ,Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies ( The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly.

## TEXT BOOKS:

1. Andrew Troelsen: “**Prog. C# with .NET 3.0, Special Edition**”, Dream tech Press, India, 2007.
2. E. Balagurusamy: “**Programming in C#**”, 5<sup>th</sup> Reprint, Tata McGraw Hill, 2004.

## REFERENCE BOOKS:

1. Tom Archer: “**Inside C#**”, WP Publishers, 2001.
2. Herbert Schildt: “**C# The Complete Reference**”, Tata McGraw Hill, 2004.

## STOCHASTIC MODELS AND APPLICATIONS

Subject Code	: 08SCN152	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### Introduction

A Speech Recognition System, A Radar System, A Communication Network

### Introduction to Probability Theory

Experiments, Sample Spaces, and Events, Axioms of Probability, Assigning Probabilities, Joint and Conditional Probabilities, Bayes’ Theorem, Independence, Discrete random Variables, Engineering Application: An Optimal Communication System

### Random variables, Distributions, and Density Functions

The Cumulative Distribution Function, The Probability Density Function, The Gaussian Random Variable, Other Important Random Variables, Conditional Distribution and Density Functions, Engineering Application: Reliability and Failure Rates

### Random Processes

Definition and Classification of Processes, Mathematical Tools for Studying Random Processes, Stationary and Ergodic Random Processes, Properties of the Autocorrelation Function, Gaussian random Processes, Poisson Processes, Engineering Application: Shot Noise in a  $p$ - $n$  Junction Diode

### Markov Processes

Definition and Examples of Markov Processes, Calculating Transition and State Probabilities in Markov Chains, Characterization of Markov Chains, Continuous Time Markov Processes, Engineering Application: A Telephone Exchange

### Poisson Processes, Queuing Theory

The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times.

Queuing Theory: Introduction; Preliminaries; Exponential models; Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

### Simulation Techniques

Computer Generation of Random Variables, Generation of Random Processes, Simulation of Rare Events, Engineering Application: Simulation of a Coded Digital Communication System

## TEXT BOOKS:

1. Scott L. Miller, Donald G. Childers: “**Probability and Random Processes With Applications to Signal Processing and Communications**”, Elsevier, 2004.
2. Sheldon M. Ross: “**Probability Models for Computer Science**”, Elsevier, 2002.

## REFERENCE BOOKS:

1. R. W. Wolff: “**Stochastic Modeling and Queuing Theory**”, Prentice Hall, 1989.
2. B. R. Bhat: “**Stochastic Models Analysis and Applications**”, New Age International, 2000.

## SYSTEM MODELING & SIMULATION

Subject Code	: 08SCN153	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3

**Introduction**

When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

Simulation examples: Simulation of queuing systems; Simulation of inventory systems; Other examples of simulation.

**General Principles, Simulation Software**

Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing.

Simulation in Java; Simulation in GPSS.

**Statistical Models in Simulation**

Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

**Queuing Models**

Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

**Random-Number Generation, Random-Variate Generation**

Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers.

Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

**Input Modeling**

Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

**Output Analysis for a Single Model**

Types of simulations with respect to output analysis; Stochastic nature of output data; Measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

**Variance Reduction, Verification and Validation, Optimization**

Variance reduction techniques; Model building, verification and validation; Verification of simulation models; Calibration and validation of models. Optimization via Simulation.

**TEXT BOOKS:**

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: “**Discrete-Event System Simulation**”, 4<sup>th</sup> Edition, Pearson Education, 2007.

**REFERENCE BOOKS:**

1. Lawrence M. Leemis, Stephen K. Park: “**Discrete – Event Simulation: A First Course**”, Pearson / Prentice-Hall, 2006.
2. Averill M. “**Law: Simulation Modeling and Analysis, 4th Edition**”, Tata McGraw-Hill, 2007.

II-SEMESTER  
**WIRELESS & MOBILE NETWORKS**

Subject Code	: <b>08SCN21</b>	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction to Wireless Communication Systems**

Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems.

## **Modern Wireless Communications Systems**

Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

## **The Cellular Concept**

System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference.

## **Mobile Radio Propagation**

Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.

## **Modulation Techniques for Mobile Radio**

Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).

## **Multiple Access Techniques for Wireless Communications**

Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols, Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems.

## **Wireless Networking**

Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

## **TEXT BOOKS:**

1. **“Wireless Communications, Principles and Practice, second edition”**, Theodore S Rappaport, Pearson Education Asia, 2002.

## **REFERENCE BOOKS:**

1. **“Mobile Communications Engineering Theory and Applications, Second Edition”**, William C Y Lee McGraw Hill Telecommunications 1998.
2. **“Wireless Communications and Networks”**, William Stallings Pearson Education Asia, 2002.

## **INFORMATION AND NETWORK SECURITY**

Subject Code	: 08SCN22	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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## **Introduction to Information Security**

Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.

## **Planning for Security**

Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.

## **Security Technology**

Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections.

Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.

## **Information Security maintenance**

Introduction; Security Management Models; The Maintenance Model.

## **Introduction to Network Security**

Attacks , Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs.

## **Cryptography**

Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.

## **Authentication Applications**

Kerberos, X.509 Directory Authentication Service

## **Electronic Mail Security**

Pretty Good Privacy (PGP), S/MIME

## **IP Security**

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.

## **Web Security**

Web security requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)

## **Network Management Security**

Basic concepts of SNMP, SNMPv1 community facility, SNMPv3

## **TEXT BOOKS:**

1. Michael E. Whitman and Herbert J. Mattord: “**Principles of Information Security, 2<sup>nd</sup> Edition**”, Thomson, 2005.
2. William Stallings: “**Network Security Essentials Applications and Standards**”, Person Education, 2000.

## **REFERENCE BOOKS:**

1. Behrouz A. Forouzan: “**Cryptography and Network Security**”, Tata McGraw-Hill, 2007.

## **OPTICAL NETWORKS**

Subject Code	: <b>08SCN23</b>	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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## **Introduction**

Three generations of Digital Transport Networks; A brief introduction to WDM and TDM; The Optical Marketplace; Wireless Optical Systems; Key Optical Nodes; Other Key Terms; Evolution of Optical Systems; Key attributes of Optical Fiber.

## **Telecommunications Infrastructure**

The Local Connections; The Backbone Connections; The Digital Multiplexing Hierarchy; The Digital Signaling Hierarchies; T1 / DS1 and T3 / DS3; The Layered Protocol Model in the Transport Network; considerations for Interworking Layer1, Layer 2, and Layer 3 Networks.

## **Characteristics of Optical Fiber**

The Basics; The Wavelength; The Basic Components; Structure of the Fiber; Fiber Types; Key Performance Properties of Fiber; Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion; Lasers.

### **Timing and Synchronization**

Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and SDH; Timing Downstream Devices; Building Integrated Timing Supply; Synchronization Status Messages and Timing Loops.

### **SONET and SDH**

Introduction; The SONET Multiplexing Hierarchy; SONET and SDH Multiplexing Structure; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; Virtual Tributaries in more detail; Virtual Tributaries in Virtual Containers; The Overhead Bytes; SONET and SDH Concatenation.

### **Architecture of Optical Transport Networks**

The Digital Wrapper; Control Planes; In-Band and Out-Band Control Signaling; Importance of Multiplexing and Multiplexing Hierarchies; Current Digital Transport Hierarchy; SONET Multiplexing Hierarchy; SDH Multiplexing Hierarchy; Key Indexes and Other Terms; The New Optical Transport and Digital Transport Hierarchy; The OTN Layered Model; Encapsulation and Decapsulation Operations; Generic Framing Procedure.

### **WDM**

The WDM Operation; DWDM, TDM and WDM Topologies; Relationship of WDM to SONET / SDH; EDF; WDM Amplifiers; Add-Drop Multiplexers; WDM Cross-Connects; Wavelength Continuity Property; Examples of DWDM Wavelength Plan; Higher Dispersion for DWDM; Tunable DWDM Lasers.

### **Network Topologies and Protection Schemes**

The Non-Negotiable Requirement Robust Networks; Diversity in the Network; Line and Path Protection Switching; Types of Topologies; Working and Protection Fibers; Point-to-Point Topology; BLSR; Protection Switching on Four-Fiber BLSR; Meshed Topologies; PONs; Ethernet in the Wide Area Backbone? Metro Optical Networking.

### **MPLS and Optical Networks**

Label Switching; FEC; Types of MPLS Nodes; Label Distribution and Binding; Label Switching and Traffic Forwarding; MPLS Support of VPNs; MPLS Traffic Engineering; Multiprotocol Lambda Switching; MPLS and Optical TE Similarities; Possibilities for the MPIS Network; Control and Data Planes Interworking.

### **Architecture of IP and MPLS-Based OTNs**

IP, MPLS, and Optical Control Planes; Interworking the three Control Planes; Management of the Planes; A Framework for the IP over Optical Networks; An Opposing View; Generalized MPLS use in Optical Networks; Bi-Directional LSPs in Optical Networks; GMPLS Extensions for G.709; GMPLS with SONET and SDH.

### **The Link Management Protocol**

Keep the Optical Link up and running; What is managed? Data-bearing Links; Clarification of terms; Basic functions of LMP; Control Channel Management; Link Property Correlation; Fault Management; Extending LMP operations for Optical Link Systems.

### **Optical Routers**

Optical Switching; Implementation Preferences; Key Terms; Evolution of Switching Networks; Optical Router; Optical Switching Technologies; Optical Resources; Protecting the Label Switched Paths; Protection of the OSP; Wavelength OSP and MPLS LSP; Nesting the LSPs and OSPs; Topologies for a Node Failure; Plane Coupling and De-Coupling; Some End-to-End Wavelengths and Node-to-Node Wavelengths; Granularity of Labels versus Wavelength Support; Approach to the Problem of LSP and OSP Interworking; MEMS and Optical Switching; Thermo-Optic Switches.

### **ASON Operation at the UNI and NNI**

Objectives of ASON; UNI and NNI; Managing the Optical Bandwidth in the ASON; General approach to Optical Bandwidth Management; IETF Optical Carrier Framework for the UNI; Types of Connections; NNI; UNI and NNI Signaling Services.

### **ATM versus IP in Optical Internets**

IP over ATM over SONET; The OSI and Internet Layered Models; ATM in the SONET / SDH Payload Envelope; PPP in the SONET Payload Envelope; Encapsulation / Framing Rules; The PPP Packet; The ATM versus IP; Overhead of IP and ATM; Three encapsulation methods.

### **Evolving to 3G Architecture**

Migration of IP Optical Networking; IP and the Optical Backbones; Placing MPLS into the Picture; Putting it together.

### **TEXT BOOKS:**

1. “Uyless Black: Optical Networks”, Pearson Education Asia, 2002.

#### REFERENCE BOOKS:

1. Rajiv Ramaswami and Kumar N.Sivaranjan: “Optical Networks - A Practical Perspective”, Morgan Kaufmann, 2000.
2. Paul E.Green Jr.,: “Fiber Optic Network”, Prentice Hall, 1993.
3. Jeff Hecht: “Understanding Fiber Optics”, 4<sup>th</sup> Edition, PHI 1999.

#### SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATION

Subject Code	: 08SCN24	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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#### Introduction

Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks.

#### Why Digital?

Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

#### Switching

Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

#### Electronic Space Division Switching

Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks.

#### Digital Transmission and Multiplexing

Sampling, Quantisation and Binary Coding, Quantisation Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexy.

#### Time Division Switching

Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

#### Traffic Engineering

Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

#### TEXT BOOKS:

1. Thiagarajan Viswanathan: “Telecommunication Switching Systems and Networks”, Prentice-Hall of India Pvt. Ltd., 1992.
2. John.C.Bellamy: Digital Telephony, 3<sup>rd</sup> Edition, John Wiley and Sons Inc., 2002.

#### ELEVATIVE-II

#### DISTRIBUTED SYSTEMS

Subject Code	: 08SCN251	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3

**Characterization of Distributed Systems and System Models**

Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges, Architectural models, Fundamental models.

**Networking and Internetworking**

Types of Networks, Networks principles, Internet protocols, Network case studies(Ethernet, wireless LAN and ATM).

**Interprocess Communication**

Introduction, The API for the Internet protocols, External data representation and marshalling, Client -Server communication, Group communication, Case study: Interprocess communication in UNIX

**Distributed Objects and Remote Invocation**

Communication between distributed objects, Remote procedure call, events and notifications, JAVA RMI case study.

**Operating System Support and Security**

The Operating system layer, protection, processes and threads, communication and invocation , operating system architecture, overview of security techniques, cryptographic algorithms, digital signatures, cryptography pragmatics, case studies: Needham-Schroeder, Kerberos, SSL and Millicent.

**Distributed File Systems**

File service architecture, Sun Network file system, Andrew file system, Recent advances

**Transactions and Concurrency Control**

Transactions, nested transactions, locks, optimistic concurrency control, timestamp ordering, comparison of methods for concurrency control

**Distributed Transactions**

Flat and nested distributed transactions, atomic commit protocols, concurrency control in distributed transactions, distributed deadlocks, transaction recovery.

**Distributed Shared Memory**

Design and Implementation issues, sequential consistency and Ivy, Release consistency and Munin, other consistency models

**CASE Studies**

CORBA , Mach

**TEXT BOOKS:**

1. George Coulouris, Jean Dollimore, Tim Kindberg: “**Distributed Systems, Concept and Design**”, 3<sup>rd</sup> edition, Pearson Education, 2005.

**CLIENT-SERVER PROGRAMMING**

Subject Code	: 08SCN252	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**The Client Server Model and Software Design**

Introduction, Motivation, Terminology and Concepts.

**Concurrent Processing in Client-Server software**

Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O.

**Program Interface to Protocols**

Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.

**The Socket Interface**

Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters.

### **Algorithms and Issues in Client Software Design**

Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

### **Example Client Software**

Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

### **Algorithms and Issues in Server Software Design**

Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR\_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

#### **Iterative, Connectionless Servers (UDP)**

Introduction, Creating a Passive Socket, Process Structure, An example TIME Server.

#### **Iterative, Connection-Oriented Servers (TCP)**

Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

#### **Concurrent, Connection-Oriented Servers (TCP)**

Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

#### **TEXT BOOK:**

1. Douglas E.Comer & David L. Stevens: “**Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications**”, BSD Socket Version with ANSI C, 2<sup>nd</sup> Edition, Pearson Education Asia, 2001.

## **E-COMMERCE**

Subject Code	: 08SCN253	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **Introduction**

Electronic Commerce Frame work, Electronic Commerce and Media Convergence, The anatomy of E-Commerce Application.

### **Electronic Commerce and Word Wide Web**

Architectural Framework for Electronic Commerce, World Wide Web (WWW) as the Architecture, Web Background Hypertext Publishing, Technology behind the Web, Security and the Web.

### **Consumer-Oriented Electronic Commerce**

Consumer – Oriented Applications, Mercantile Process Models, Mercantile Models from the Consumer’s Perspective, Merchant’s Models from the Merchant’s Perspective.

### **Electronic Payment Systems**

Types of Electronic Payment Systems, Digital Token-Based Electronic Payment Systems, Smart Cards and Electronic Payment Systems, Credit Card-Based Electronic Payment Systems, Designing Electronic Payment Systems.

### **Inter organizational Commerce and EDI**

Electronic Data Interchange, EDI Applications in Business, EDI: Legal, Security, and Privacy Issues, EDI and Electronic Commerce.

### **EDI Implementation, MIME, and Value-Added Networks**

Standardization and EDI, EDI Software Implementation, EDI Envelope for Message Transport, Value-Added Networks (VANs), Internet-Based EDI.

### **Intraorganizational Electronic Commerce**

Internal Information Systems, Macro forces and Internal Commerce, Work-Flow Automation and Coordination, Customization and Internal Commerce, Supply Chain Management.

### **The Corporate Digital Library**

Dimensions of Internal Electronic Commerce Systems, Making a Business Case for a Document Library, Types of Digital Documents, Issues behind Document Infrastructure, Corporate Data Warehouses.

### **Advertising and Marketing on the Internet**

The New Age of Information – Based Marketing, Advertising on the Internet, Charting the On-Line Marketing Process, Market Research.

### **On-Demand Education and Digital Copyrights**

Computer-Based Education and Training, Technological Components of Education On-Demand, Digital Copyrights and Electronic Commerce.

### **TEXT BOOK:**

1. Ravi Kalakota, Andrew B Winston: “**Frontiers of Electronic Commerce**”, Addison Wesley, 1996.

### **REFERENCE BOOKS**

1. Daniel Lynch and Lesllie Lundquist: “**Digital Money**”, The New Era of Internet Commerce, John Wiley, 1996.
2. Daniel Minoli, Emma Minoli: “**Web Commerce Technology Handbook**”, Tata McGrawHill, 1998.

## **III SEMESTER NETWORK MANAGEMENT**

Subject Code	: 08SCN31	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **Introduction**

Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

### **Basic Foundations: Standards, Models, and Language**

*Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.*

### **SNMPv1 Network Management**

Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview.

The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base.

The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model.

### **SNMP Management – RMON**

Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications; ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

### **Broadband Network Management: ATM Networks**

Broadband Networks and Services, ATM Technology – Virtual Path-Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation, ATM Digital Exchange Interface Management.

### **Broadband Network Management**

Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

### **Network Management Applications**

Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

### **TEXT BOOKS:**

1. Mani Subramanian: “**Network Management- Principles and Practice**”, Pearson Education, 2003.

### **REFERENCE BOOKS:**

1. J. Richard Burke: “**Network management Concepts and Practices**”: a Hands-On Approach, PHI, 2008.

### **ELEVATIVE-III PROTOCOL ENGINEERING**

Subject Code	: <b>08SCN321</b>	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **Introduction**

Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases

### **Error Control, Flow Control**

Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance.

### **Network Reference Model**

Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.

### **Protocol Specification**

Components of specification, Service specification, Communication Service Specification

Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.

### **Protocol Specification Language (SDL)**

Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP

Multi Protocol Label Switching SDL components.

### **Protocol Verification / Validation**

Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Nonexecutable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol Validation: ABP Validation.

### **Protocol Conformance and Performance Testing**

Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing Multimedia Systems, quality of service test architecture(QoS), Performance Test methods, SDL Based Performance Testing of TCP, OSPF, Interoperability testing, Scalability testing protocol synthesis problem

### **Protocol Synthesis and Implementation**

Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis, Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS.

### **TEXT BOOKS:**

1. Pallapa Venkataram and Sunilkumar S. Manvi, “**Communiation Protocol Engineering**”, Prentice Hall Private Limited, 2004.

### **REFERENCE BOOKS:**

1. Mohammed G. Gouda, “**Elements of Protocol Design**”, Wiley Student Edition, 2004.

## **MULTIMEDIA NETWORKS**

Subject Code	: 08SCN322	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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### **Multimedia Communications**

Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS application QoS.

### **Multimedia Information Representation**

Introduction, digital principles, text, images, audio, video.

#### **Compression**

Text and image compression: introduction, compression principles, text compression, image compression.

Audio and video compression: introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, MPEG-4 and MPEG-7.

### **Multimedia Information Networks**

Introduction, network performance parameters, throughput, networking delay, delay variance, error rate, quality of service.

QoS perspectives, QoS processing, multimedia transmission, requirements, transmission over WANs, Multimedia Transmission over LANs, ATM networks, Wireless LANs

### **Multimedia Transport Protocols and Management Protocols**

RTP, RTCP, H.323, SIP, SDP, SAP.

**TEXT BOOKS:**

1. Fred Halsall, Multimedia Communications: “**Applications, Networks, Protocols, and Standards**”, Pearson Education, Asia, Second Indian reprint 2002.
2. Nalin K. Sharda: “**Multimedia Information Networking**”, PHI, 2003.

**REFERENCE BOOKS:**

1. Ralf Steinmetz, Klara Narstedt: “**Multimedia Fundamentals**”: Vol 1-Media Coding and Content Processing, Pearson Education, 2004.
2. Prabhat K. Andleigh, Kiran Thakrar, “**Multimedia Systems Design**”, PHI, 2004.

**STORAGE AREA NETWORKS**

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Subject Code	: 08SCN323	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction**

Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks  
The Data Storage and Data Access problem; The Battle for size and access

**Intelligent Disk Subsystems**

Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

**I/O Techniques**

The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage

**Network Attached Storage**

The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

**File System and NAS**

Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

**Storage Virtualization**

Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network

**SAN Architecture and Hardware devices**

Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

**Software Components of SAN**

The switch’s Operating system; Device Drivers; Supporting the switch’s components; Configuration options for SANs.

**Management**

Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

**TEXT BOOKS:**

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: “**Storage Networks Explained**”, Wiley India, 2007
2. Robert Spalding: “**Storage Networks The Complete Reference**”, Tata McGraw-Hill, 2003.

**REFERENCE BOOKS:**

1. Richard Barker and Paul Massiglia: “**Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs**”, John Wiley India, 2002

ELECTIVE-IV  
**WIRELESS SENSOR NETWORKS**

Subject Code	: <b>08SCN331</b>	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction**

Unique Constraints and Challenges, Advantages of Sensor Networks, Energy advantage, Detection advantage, Sensor Network Applications, Habitat monitoring, Wildlife conservation through autonomous, non-intrusive sensing, Tracking chemical plumes, Ad hoc, just-in-time deployment mitigating disasters, Smart transportation: networked sensors making roads safer and less congested, Collaborative Processing.

**Key Definitions and The Problem**

Key Definitions of Sensor Networks, Canonical Problem: Localization and Tracking, Tracking Scenario, Problem Formulation, Sensing model, Collaborative localization, Bayesian state estimation, Distributed Representation and Inference of States, Impact of choice of representation, Design desiderata in distributed tracking, Tracking Multiple Objects, State-space decomposition, Data association, Sensor Models, Performance Comparison and Metrics.

**Networking and Protocols**

Networking Sensors, Key Assumptions, Medium Access Control, The S-MAC Protocol, IEEE 802.15.4 Standard and ZigBee, General Issues, Geographic, Energy-Aware Routing, Unicast Geographic Routing, Routing on a Curve, Energy-Minimizing Broadcast, Energy-Aware Routing to a Region, Attribute-Based Routing, Directed Diffusion, Rumor Routing, Geographic Hash Tables. Infrastructure Establishment, Topology Control, Clustering, Time Synchronization, Clocks and Communication Delays, Interval Methods, Broadcasts, Localization and Localization Services, Ranging Techniques, Range-Based Localization Algorithms, Other Localization Algorithms, Location Services. Sensor Tasking and Control, Task-Driven Sensing, Roles of Sensor Nodes and Utilities, Information-Based Sensor Tasking, Sensor selection, IDSQ: Information-driven sensor querying, Cluster leader based protocol, Sensor tasking in tracking relations, Joint Routing and Information Aggregation, Moving center of aggregation, Multi-step information-directed routing, Sensor group management, Case study: Sensing global phenomena.

**Databases**

Sensor Network Databases, Sensor Database Challenges, Querying The Physical Environment, Query Interfaces, Cougar sensor database and abstract data types, Probabilistic queries, High-level Database Organization, In-Network Aggregation, Query propagation and aggregation, TinyDB query processing, Query processing scheduling and optimization, Data-Centric Storage, Data Indices and Range Queries, One-dimensional indices, Multi-dimensional indices for orthogonal range searching, Non-orthogonal range searching, Distributed Hierarchical Aggregation, Multi-resolution, Partitioning, Fractional cascading, Locality preserving hashing, Temporal Data, Data aging, Indexing motion data.

**Platforms and Tools**

Sensor Network Platforms and Tools, Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms, Operating system: TinyOS, Imperative language: nesC, Dataflow style language: TinyGALS, Node-Level Simulators, ns-2 and its sensor network extensions, TOSSIM, Programming Beyond Individual Nodes: State-centric programming, Collaboration groups, PIECES: A state-centric design framework, Multi-target tracking problem revisited. Applications and Future Directions.

**TEXT-BOOKS:**

1. Feng Zhao, Leonidas Guibas: “**Wireless Sensor Networks – An Information Processing Approach**”, Elsevier, 2004.

**DIGITAL IMAGE PROCESSING**

Subject Code	: <b>08SCN332</b>	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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## **Fundamentals**

Basic concepts, Examples of fields that use Digital Image processing, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Basic relationships between pixels

## **Image Enhancement in Digital Spatial Domain**

Some basic gray level transformations, Histogram Processing, Enhancement using Arithmetic/Logic Operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial enhancement methods

## **Image Enhancement in the Frequency Domain**

Background, Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering, Implementation

## **Image Restoration**

A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Periodic noise reduction by frequency domain filtering, Linear, position-invariant degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error filtering, Constrained least squares filtering, Geometric mean filter, Geometric transformations

## **Image Compression**

Fundamentals, Image compression models, Elements of information theory, Error-free compression, Lossy compression and image compression standards.

## **Image Segmentation**

Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-based segmentation, Segmentation by morphological watersheds and the use of motion in segmentation.

## **Object Recognition**

Pattern and pattern classes, Recognition based on Decision-Theoretic Methods and Structural Methods.

## **TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods: “**Digital Image Processing**”, 2<sup>nd</sup> Edition, Pearson Education, 2002.

## **REFERENCE BOOKS:**

1. Anil K. Jain: “**Fundamentals of Digital Image Processing**”, Prentice-Hall of India Pvt. Ltd.,1997.
2. B. Chanda , Dutta Majumdeer: “**Digital Image Processing and Analysis**”, Prentice-Hall of India Pvt. Ltd.,2002.

## **TOPICS IN ANALYSIS OF COMPUTER NETWORKS**

Subject Code	: 08SCN333	IA Marks	: 50
No of Lecture Hrs/Week	: 4	Exam hours	: 3
Total No of Lecture Hours	: 52	Exam Marks	: 100

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## **Introduction**

Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; The importance of quantitative modeling in the Engineering of Telecommunication Networks.

## **Multiplexing**

Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

## **Stream Sessions: Deterministic Network Analysis**

Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

## **Stream Sessions: Stochastic Analysis**

Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

#### Adaptive Bandwidth Sharing for Elastic Traffic

Elastic transfers in a Network; Network parameters and performance objectives; Sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

#### TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

#### REFERENCE BOOKS:

1. M. Schwartz: "Broadband Integrated Networks", Prentice Hall PTR, 1996.
2. J. Walrand, P. Varaiya: "High Performance Communication Networks", 2<sup>nd</sup> Edition, Morgan Kaufmann, 1999.

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SCHEME OF TEACHING AND EXAMINATION  
M.TECH - PRODUCT DESIGN & MANUFACTURING

#### I SEMESTER

Subject Code	Name of the Subject	No. of hours / week		Duration of Exam in hours	Marks for		Total Marks
		Lectures	Practical/ Field work/ Assignment		I.A.	Exam	
08 MPD 11	Product Design & Development	4	2	3	50	100	150
08 MPD 12	Product Life Cycle Management	4	2	3	50	100	150
08 MPD 13	Advanced Materials Technology	4	2	3	50	100	150
08 MPD 14	Finite Element Methods	4	2	3	50	100	150
08 MPD 15	Elective – I	4	2	3	50	100	150
08 MPD 16	Seminar	-	3	-	50	-	50
<b>Total</b>		<b>20</b>	<b>13</b>	<b>15</b>	<b>300</b>	<b>500</b>	<b>800</b>

ELECTIVE – I	
08 MPD 151	Simulation and modeling of manufacturing systems
08 MPD 152	Robotics
08 MPD 153	Quality By Design

SCHEME OF TEACHING AND EXAMINATION  
M.TECH - PRODUCT DESIGN & MANUFACTURING

**II SEMESTER**

Subject Code	Name of the Subject	No. of hours / week		Duration of Exam in hours	Marks for		Total Marks
		Lectures	Practical/ Field work/ Assignment		I.A.	Exam	
08 MPD 21	Industrial Design & Ergonomics	4	2	3	50	100	150
08 MPD 22	Product Data Management	4	2	3	50	100	150
08 MPD 23	Lean Manufacturing Systems	4	2	3	50	100	150
08 MPD 24	Design for Manufacture	4	2	3	50	100	150
08 MPD 25	Elective – II	4	2	3	50	100	150
	*Project Phase – I (6 weeks duration)	-	-	-	-	-	-
08 MPD 26	Seminar	-	3	-	50	-	50
<b>Total</b>		<b>20</b>	<b>13</b>	<b>15</b>	<b>300</b>	<b>500</b>	<b>800</b>

\* Between the II Semester and III semester. After availing a vacation of Two Weeks

<b>ELECTIVE – II</b>	
08 MPD 251	Quality and Reliability Engineering
08 MPD 252	Virtual Design and Manufacturing
08 MPD 253	Rapid Proto Typing

SCHEME OF TEACHING AND EXAMINATION  
M.TECH, PRODUCT DESIGN & MANUFACTURING

**III SEMESTER**

Subject Code	Name of the Subject	Teaching hours / week		Duration of Exam in hours	Marks for		Total Marks
		Lectures	Practical/ Field work / Assignment		I.A.	Exam	
08 MPD 31	Robust Design	4	2	3	50	100	150
08 MPD32x	Elective – III	4	2	3	50	100	150
08 MPD33x	Elective – IV	4	2	3	50	100	150
	Project Phase – II ( 5 week duration)	-	*	-	-	-	-
08 MPD 34	Evaluation of project phase – I	-	3	-	50	-	50
<b>Total</b>		<b>12</b>	<b>09</b>	<b>09</b>	<b>200</b>	<b>300</b>	<b>500</b>

<b>ELECTIVE – III</b>		<b>ELECTIVE – IV</b>	
08 MPD 321	Optimization Technique for Decision Making	08 MPD 331	Product Analysis and Cost Optimization
08 MPD 322	Product Planning and Marketing	08 MPD 332	Advanced Manufacturing Practices
08 MPD 323	Agile Manufacturing	08 MPD 333	Artificial Intelligence And Expert Systems

SCHEME OF TEACHING AND EXAMINATION  
M.TECH, PRODUCT DESIGN & MANUFACTURING

**IV SEMESTER**

Subject Code	Name of the Subject	Teaching hours / week		Duration of Exam in hours	Marks for		Total Marks
		Lectures	Practical / Field work / Assignment		I.A.	Exam.	
08 MPD41	Evaluation of Project Phase-II	-	3	-	50	-	50

08 MPD42	Evaluation of Project Phase – III	-	3	-	50	-	50
08 MPD42	Project work Evaluation & Viva Voce	-	-	3		100 + 100	200
<b>Total</b>		-	<b>6</b>	<b>3</b>	<b>100</b>	<b>200</b>	<b>300</b>
<b>Grand Total ( I to IV semester):</b>							<b>2400</b>

**Note:**

1. The hours / week shown in the column of Practical / Field work / Assignment are the contact hours for students, no load to be shown to the teachers. The teachers should provide guidance.
2. The seminar Marks are to be awarded by the department committee constitute for the purpose.
3. The project evaluation and Viva-Voce will be conducted by a committee consisting of the following.
  - Head of the Department ( Chairman)
  - Guide
  - Internal and External Examiners appointed by the VTU

**I SEMESTER  
PRODUCT DESIGN AND DEVELOPMENT**

Subject Code	: 08MPD11	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

**Development Processes and Organizations:** A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.

**Product Planning:** The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

**Identifying Customer Needs:** Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

**Product Specifications:** What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

**Concept Generation:** The activity of concept generation clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process.

**Concept Selection:** Overview of methodology, concept screening, and concept scoring,

**Concept Testing:** Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.

**Product Architecture:** What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

**INDUSTRIAL DESIGN:** Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

**Design for Manufacturing:** Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

**Prototyping:** Prototyping basics, principles of prototyping, technologies, planning for prototypes.

**Product Development Economics:** Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

**Managing Projects:** Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

**TEXT BOOK:**

1. Karl.T.Ulrich, Steven D Eppinger, “**Product Design and Development**” Irwin McGrawHill-2000.

**REFERENCE BOOKS:**

1. A C Chitale and R C Gupta, PH1, “**Product Design and Manufacturing**”
2. Timjones. Butterworth Heinmann, “**New Product Development**” Oxford. UCI. 1997
3. Geoffery Boothroyd, Peter Dewhurst and Winston Knight, “**Product Design for Manufacture and Assembly**”

## PRODUCT LIFE CYCLE MANAGEMENT

Subject Code	: 08MPD12	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Product life cycle management** – Need for PLM, Components of PLM, Product Data and Product workflow, Drivers for Change, The PLM Strategy, Developing a PLM Strategy, A Five-step Process, Strategy Identification and Selection, Strategy Elements, Implications of Strategy Elements, Policies, Strategy Analysis, Communicating the Strategy

Change Management for PLM, Configuration management, cost of design changes, schemes for concurrent engineering, Design for manufacturing and assembly, robust design, failure mode and effect-analysis

Modeling, Current concepts, part design, sketching, use of datum's construction features, free ovulation, patterning, copying, and modifying features, reference standards for datum specification, Standards for Engineering data exchange

Modeling, tolerance mass property calculations, rapid prototyping and tooling, finite modeling and analysis, general procedure, analysis techniques, finite element modeling. Static and thermal analysis.

### REFERENCE BOOKS:

1. John Stark, Springer-Verlag, "**Product Lifecycle Management Paradigm for 21st century Product Realization**", London, 3rd printing (2006). 441 pp., ISBN: 1-85233-810-5,
2. Zeid, "**CAD/CAM Theory and Practice**", Mc Graw Hill., 1991
3. Mark Henderson & Philip Wolfe, "**Computer Integrated Design and Manufacturing**", Bedworth Mc Graw hill inc., 1991.
4. Engineer, "**Part modeling Users Guide**", 1998

## ADVANCED MATERIALS TECHNOLOGY

Subject Code	: 08MPD13	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Composite Materials:** Classification of composites, types of matrices and reinforcements, characteristics and selection, particulate composites, laminates; sandwich structures, fabrication technologies for laminates and sandwich structures

**Micromechanics of laminates:** Rule of mixture for evaluation of physical and elastic properties of laminates (density, thermal conductivity, elastic moduli, ultimate tensile strength), numericals

**Powder Metallurgy:** Process details and special characteristics of powder metallurgy process. Compaction techniques like CIP & HIP (Cold Isostatic and Hot Isostatic pressing) Applications of Powder metallurgy.

**High temperature alloys:** Classification of Titanium alloys, properties and applications

**Surface technology:** Coatings for specific applications, coating materials and their selection, coating technologies and their merits and demerits, coating characterization, Use of LASER for coating life enhancement, hardfacing

**Nanotechnology:** Nanopowders and nanomaterials, methods of preparation – plasma arcing, chemical vapour deposition, electrodeposition, sol-gel synthesis, ball milling, Carbon nanotubes, types of nanotubes, formation of nanotubes, advantages of nanotubes over nanopowders nanofabrication technologies, characterization of nanomaterials and nanostructured materials, AFM, STEM, XRD, FTIR for nanocharacterisation

### REFERENCE BOOKS:

1. William D. Callister Jr. "**Materials Science & Engineering**" an introduction, 4th edition. John Wiley & Sons.

2. R. A. Flinn & P. K. Trojan: "**Engg. Materials & Their Applications**". 4<sup>th</sup> edition, Jaico Publishing House.
3. Krishan K. Chawla: "**Composite Materials, Science & Engg.**", 2<sup>nd</sup> edition, Springer publication.
4. "**ASM Handbook on Metal Casting**", Vol .15, 9th edition, ASM publication
5. "**ASM Handbook on Powder Metallurgy**", Vol 17, ASM publications
6. Mick Wilson, Kamali Kannagara, "**Nanotechnology – Basic Science and Emerging Technologies**", Overseas Press India Private Limited, First Indian Edition 2005

### FINITE ELEMENT METHODS

Subject Code	: <b>08MPD14</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** Equations of equilibrium, stress-strain relations for 2-D and 3-D, Potential energy and equilibrium, Boundary conditions, Von Misses Stresses

**FEM for 1-D Problems:** General procedure for FEA, Raleigh Ritz method, Galerkin Approach, shape functions, stiffness matrix, load vectors, temperature effects, Applications of boundary conditions using elimination, penalty and multi-constraint approaches, Application problems – 1-D bar element. Trusses and beams

**FEM for 2-D Problems:** Shape functions, stiffness matrix, strain matrix, load vectors for CST Elements and application problems

**FEM for Axisymmetric Problems:** Axisymmetric formulation, triangular elements, PE approach, Body force term, Rotating flywheel, Problem modeling and boundary conditions – Disks and Cylinders

**FEM for Scalar Field Problems:** 1-D and 2-D Steady state heat transfer, torsion, potential flow and fluid flow in ducts and application problems

**Dynamic Analysis:** Equations of motion for dynamic problems --consistent and lumped mass matrices --formulation of element mass matrices free vibration and forced vibration problems formulation,

#### TEXT BOOKS:

1. "**Introduction to Finite Elements in Engineering**" (Third Edition), Tirupathi R. Chandrupatla, Ashok D Belegundu, Prentice Hall India Pvt. Ltd., New Delhi – 2003
2. Cook R.D, Malkus D.S & Plesha M.E, "**Concepts and Applications of finite Element Analysis**", John Wiley & Sons, 1989.

#### REFERENCE BOOKS:

1. Segerlind L .J "**Applied Finite Element Analysis**" John Wiley & Sons Edition, 1984.
2. Rao SS "**The Finite Element Method in Engineering**", Pergomon Press, Oxford, 2<sup>nd</sup> Edition, 1984.
3. Bathe K .J "**Finite Element Procedures in Engineering Analysis**", prentice Hall, NewJersey, 1982.
5. Shames III & Dym C L "**Energy and Finite Element Methods in Structural mechanics**", Wiley eastern ltd, 1995,

### SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

Subject Code	: <b>08MPD151</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Principles of Computer Modelling And Simulation:** Monte Carlo simulation. Nature of computer- modeling and simulation. Limitations of simulation, areas of applications.

**System and Environment:** Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.

**Discrete Event Simulation:** Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, two server queue , simulation of inventory problem.

**Statistical Models in Simulation:** Discrete distributions, continuous distributions.

**Random Number Generation:** Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smirnov test -the Chi-square test.

**Random Variable Generation:** Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.

**Empirical Discrete Distribution:** Discrete uniform -distribution poisson distribution -geometric distribution - acceptance -rejection technique for Poisson distribution gamma distribution.

**Design and Evaluation Of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.

**Simulation Software:** Selection of simulation software, simulation packages.

#### TEXT BOOKS:

1. Jerry Banks & John S Carson II, "**Discrete Event System Simulation**", Prentice Hall Inc..1984.
2. Gordan. G. "**Systems Simulation**", Prentice Hall India Ltd, 1991.

#### REFERENCE BOOKS:

1. Nusing Deo, "**System Simulation With Digital Computer**", Prentice Hall of India , 1979.
2. Francis Neelamkovil, "**Computer Simulation and Modeling**", John Wiley & Sons, 1987.
3. Rath M.Davis & Robert M O Keefe, "**Simulation Modeling with Pascal**", Prentice Hall Inc.1989.

#### ROBOTICS

Subject Code	: <b>08MPD152</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Fundamental Concepts of Robotics:** History, present status and future trends, Robotics. Robot Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator

**Robot Drives:** Power transmission systems and control Robot drive mechanisms, hydraulic-electric-pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices-Control of Actuators in Robotic Mechanisms.

**Sensors and Intelligent Robots:** Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics.

**Computer Vision for Robotics Systems:** Robot vision systems – Imaging components – Image representation – Hardware aspects-Picture coding – Object Recognition and Categorization- Visual inspection – software considerations – applications – commercial – Robotics vision systems.

**Computer Considerations for Robotic Systems:** Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot’s computer system.

**Transformations and Kinematics:** Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.

**Robot Cell Design and Control:** Specifications of Commercial Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.

**Applications of Robots:** Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

**TEXT BOOKS:**

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin “**Robotics Engineering An Integrated Approach**”, Eastern Economy Edition – Prentice Hall of India Pvt. Ltd., 1989.
2. Fu KS Gomalal R C, Lee C S G, “**Robotics: Control Sensing, Vision, Intelligence**”, McGraw Hill Book Co., 1987.

**REFERENCE BOOKS:**

1. Shuman Y. Nof, “**Handbook of Industrial Robotics**”, John Wiley & Sons, New York, 1985.
2. Deb SR “**Robotics Technology and Flexible Automation**”, McGraw Hill Book Co., 1994.

**QUALITY BY DESIGN**

Subject Code	: <b>08MPD153</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

Define customer needs - Quality Function Deployment, Concept generation as System Technique (FAST), Use brain storming and selection processes, Six Phases: Accept reduction phase. Review functional requirements, product specifications, concepts, Select candidate. Concept evaluation phase, Pugh method, and technical risks, output, Conclusions and recommendations.

Reliability design, Critical parameter management; Value engineering, Failure-analysis (FMEA). Prototype building and testing, Pre-production model and testing, Taguchi method, Statistical process control, product development cycle.

**TEXT BOOKS:**

1. “**Through design**”, McGraw- hill 1993.
2. Marcel Dekker Inc, “**Engineering Quality by Design**”, New York.

**REFERENCE BOOKS:**

1. Marcel Dekker Inc, “**Velocity Function Deployment**”, New York.
2. Techniques for value analysis and Engineering, 1972.
3. Management for quality improvement, productivity press.
4. Design, addition -Wesley, wokingham, 1991.
5. Matar, “**Designing For Quality**”, chapman & hall.
6. Indolence through quality and reliability, applied 1989.

7. McGraw -Hill Inc, "**Design for excellence**" New York, 1996.
8. Function development -productivity process.

**II SEMESTER  
INDUSTRIAL DESIGN AND ERGONOMICS**

Subject Code	: <b>08MPD21</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** An approach to industrial design -elements of design structure for industrial design in engineering application in modern manufacturing systems.

**Ergonomics and Industrial Design:** Introduction -general approach to the man- machine relationship- workstation design-working position.

**Control and Displays:** Shapes and sizes of various controls and displays-multiple, displays and control situations - design of major controls in automobiles, machine tools etc., design of furniture -redesign of instruments.

**Ergonomics and Production:** ergonomics and product design -ergonomics in automated systems- expert systems for ergonomic design. Anthropometric data and its applications in ergonomic, design- limitations of anthropometric data-use of computerized database. Case study.

**Visual Effects of Line and Form:** The mechanics of seeing- psychology of seeing general influences of line and form.

**Colour:** Colour and light -colour and objects- colour and the eye -colour consistency- colour terms- reactions to colour and colour continuation -colour on engineering equipments.

**Aesthetic Concepts:** Concept of unity- concept of order with variety -concept of purpose style and environment- Aesthetic expressions. Style-components of style- house style, observation style in capital goods, case study.

**Industrial Design in Practice:** General design -specifying design equipments- rating the importance of industrial design -industrial design in the design process.

**TEXT BOOK:**

1. Mayall W.H. "**Industrial Design for Engineers**", London Hiffie books Ltd. 1988.
2. Brain Shakel (Edited), "**Applied Ergonomics Hand Book**". Butterworth scientific. London 1988.
3. R. C. Bridger, "**Introduction to Ergonomics**", McGraw Hill Publications.
4. Sanders & McCormick, "**Human Factor Engineering**" - McGraw Hill Publications.

**PRODUCT DATA MANAGEMENT**

Subject Code	: <b>08MPD22</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** Introduction to PDM-present market constraints-need for collaboration Internet and developments in server-client computing.

**Components of PDM:** Components of a typical PDM setup-hardware and document management-creation and viewing of documents -creating parts-version Control of parts and documents -case studies.

**Configuration Management:** Base lines-product structure-configuration management-case studies.

**Projects And Roles:** creation of projects and roles -life cycle of a product- life cycle management -automating information flow -work flows -creation of work flow. templates-life cycle -work now integration -case studies.

**Change Management:** Change issue-change request-change investigation-change proposal-change activity-case studies.

**Generic Products And Variants:** Products configuration-comparison between sales configuration and products generic-generic product modeling in configuration modeler-use of order generator for variant creation -registering of variants in product register-case studies.

#### REFERENCE BOOKS:

1. David Bedworth, Mark Henderson & Philips Wolfe, "**Computer Integrated Design and Manufacturing**", McGraw Hill Inc., 1991.
2. Terry Quatrain, "**Visual Modeling with Rational Rose and UML**", Addison Wesley, 1998.
3. Wind-chill R5.0 Reference manuals, 2000, "**Implementing and Integrating Product Data Management and Software Configuration Management**" by Ivica CmKovic, Ulfaskwnd and Annita person dohlgurst publisher Artechhouse.

#### LEAN MANUFACTURING SYSTEMS

Subject Code	: <b>08MPD23</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Just in time production system.** JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies

**Kanban system:-** Kanban rules supplier Kanban and sequence schedule used by supplier. Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table -problems & counter measures in applying Kanban system to subcontractors -Supplier Kanban circulation in the paternal manufacturer -structure of supplier Kanban sorting office.

The rise & fall of Mass Production Mass production, work force, organization, tools, product -logical limits of mass production, Sloan as a necessary compliment to Ford. Case study:- Rouge Production Plant.

The rise of lean production: - Birth place, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer, future of lean production.

Shortening of production lead times -reduction of setup times, practical procedures for reducing setup time.

Standardization of operations. Machine layout, multi function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements.

Elements of lean production viz G M Framingharn -Toyota Takaoka Mass Production V /s lean production, diffusing lean production.

Managing lean enterprise:- Finance, Career ladders, geographic spread and advantages of global enterprise.

Prospects for catching up. Simplicity in the natural state -institutional factors -life time employment -educational commodities -quality & productivity in full circle.

**An action plan :** Getting started - Creating an organization to channel your streams.Install business system to encourage lean thinking.The inevitable results of 5 year commitment.

#### REFERENCE BOOKS:

1. Chasel Aquilino, "**Productions and Operations Management**"
2. Yasuhiro Monden, "**Toyoto Production System -An integrated approach to Just in Time**", - Engineering aild Management Press -Institute of Industrial Engineers Norcross Georgia.
3. James P Womack, Daniel T Jones, and Daniel Roos, "**The Machine that changed the World. The Story of Lean Production**", -Harper Perennial edition published 1991.
4. James Womack, "**Lean Thinking**".
5. Richard Schourberger, "**Japanese Manufacturing Techniques. The Nine Hidden Lessons by simplicity**".

6. James Bossert, "**Quality Function Development**", ASQC Press 1991.
7. Launshy and Weese, "**Straight talk on design of experiments**".

### **DESIGN FOR MANUFACTURE**

Subject Code	: <b>08MPD24</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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#### **EFFECT OF MATERIALS & MANUFACTURING PROCESSES ON DESIGN**

- Major phases in design & manufacture
- Effect of material properties on design
- Effect of manufacturing process on design
- Material selection process, Cost per unit property & Weighed properties methods.

#### **TOLERANCING**

- Tolerance specification & representation of various tolerances. their significance in assembly.
- Geo-material tolerances for assembly line -True position tolerancing
- Cumulative effect of tolerances in assembly.
- Interchangeability and selective assembly in manufacturing.
- Process capability & its significance with ref to tolerancing.
- Achieving larger machining tolerances.

#### **DATUM FEATURES**

- Functional datum
- Datum for manufacturing
- Changing the datum.

#### **DESIGN CONSIDERATIONS**

- Design of components with casting considerations
- Pattern, Mould, and Parting line
- Cored holes and Machine holes
- Identifying the possible and probable parting line
- Castings requiring special sand cores
- Designing to obviate sand cores.

#### **COMPONENT DESIGN**

- Component design with machining considerations like design for turning components-milling, drilling and other related processes including finish-machining operations.

#### **DESIGN OF GAUGES**

- Design of gauges for checking components in assembly with emphasis on various types of limit gauges for both hole and shaft.

#### **CASE STUDIES: (Related to the above and the following topics)**

- Redesign to suit manufacture of typical assemblies.
- Tolerance design of a typical assemblies
- Design to minimize cost of a product
- Computer Aided DFMA

#### **TEXT BOOKS:**

1. Harry Peck, "**Design for Manufacture**", Pitman Publications, 1983 for topics 2 to 5.

2. Dieter -"**Machine Design**", McGraw Hill Publications for topic 1.
3. R. K.Jain -"**Metrology**", Khanna Publications for topic 6.
4. Geoffrey Boothroyd ,peter dewhurst , Winston Knight, "**Product Design for Manufacture and Assembly**".  
Mercel dekker .inc. New York.

### QUALITY AND RELIABILITY ENGINEERING

Subject Code	: <b>08MPD251</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Basic Concepts:** Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.

**Concepts in Probability and Statistics :** Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems

**Statistical Aspects and Probability Distributions :** Statistical Tools in Quality Control, The concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution, Problems, Control charts, Variable charts X chart, R chart,  $\sigma$  chart, Attribute charts, – P chart, NP chart, C chart.

**Failure Data Analysis :** Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.

**Acceptance Sampling :** Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.

**System Reliability :** Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solving problems using mathematical models.

**Reliability Improvement and Allocation :** Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.

**Maintainability and Availability:** Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems

#### REFERENCE BOOKS:

1. Halpern, Seigmund (1978) "**The Assurance Sciences**", Prentice Hall International, New Jersey, U.S.A
2. Juran, J.M and Gryna, F.M. (1982) "**Quality Planning and Analysis**", Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India.
3. Blanchard, Bejamin S. (1986) "**Logistics Engineering and Management**" Prentice Hall International, New Jersey, U.S.A
4. Kraus, John W (1988) "**Maintainability and Reliability**", Handbook of Reliability Engineering and Management, Editors – Ireson. W.G. and Cooms, C.F. McGraw Hill Book Company Inc. U.S.A.
5. Srinath K.S. (1985) "**Concepts in Reliability Engineering**" Affiliated East-West Press Private Limited, New Delhi, India.

### VIRTUAL DESIGN AND MANUFACTURING

Subject Code	: <b>08MPD252</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03

**Review of Computer Graphics:** Review of computer graphics, 2D graphics. 2D primitives and transformations. algorithm to digitize the graphic entities, rasterization, 3D graphics. 3D primitives and transformations, projections and viewing, algorithms for hidden line removals, lighting. shading and ray tracing.

**VR Devices:** Input devices-track balls, 3D Mouse, data gloves, Virtual hand and trackers, output devices graph terminal, stereo glasses, head mounting devices, vision dome, caves.

**Applications:** Virtual prototyping, behavior simulation, digital mockup, walk through/flythrough. Virtual training/simulation, micro electro mechanical systems and nanotechnology.

**Virtual Modelling language:** History, Concepts, syntax, basic nodes-group, transform switch, LOD etc, geometry nodes-indexed face set, indexed line set, coordinate, coordindwx, textures etc. sensor nodes-time sensor touch sensor, sphere sensor, cylinder sensor and proximity sensor, scriping- VRML Script and JAVA Script.

**Tutorials and samples:** VRML authoring tools-3D studio MAX, cosmo World, VRML Pad (editor) VRML Viewing tools-cosmo player, auto Vue, SGI's open inventor, virtual collaborative tools-V collab.

**Practical Lab:** V Collab.

#### TEXT BOOKS:

1. Janes D,Foley et al., "**Computer Graphics-Principles and practice**" Second edition. in C,Addision -Wesley 1997.
2. Jed Hartman and Josie wernecke, "**The VRML- 2.0 Hand book**" Addision-Wesley 1997.
3. R Carey and G Bell "**The Annocated VRML 2.0 hand book Addision**" -Wesley 1997.

#### RAPID PROTOTYPING

Subject Code	: 08MPD253	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

**Introduction:** Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

**Stereo Lithography Systems:** Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

**Selective Laser Sintering:** Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications.

**Fusion Deposition Modelling:** Principle, Process parameter, Path generation, Applications.

**Solid Ground Curing:** Principle of operation, Machine details, Applications.

**Laminated Object Manufacturing:** Principle, Of Operation, Lom materials. Process details, application.

**Concepts Modelers:** Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

#### LASER ENGINEERING NET SHAPING (LENS)

**Rapid Tooling:** Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc >Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

**Software For RP:** STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

**Rapid Manufacturing Process Optimization:** factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

**Allied Processes:** vacuum casting, surface digitizing, surface generation from point cloud, surface modification-data transfer to solid models.

**TEXT BOOKS:**

1. Paul F. Jacobs: "**Stereo lithography and other RP & M Technologies**", SME, NY 1996.
2. Flham D.T & Dinjoy S.S "**Rapid Manufacturing**" Verlog London 2001.
3. Lament wood, "**Rapid automated**", Indus press New York

**REFERENCE BOOKS:**

1. Terry Wohlers "**Wohler's Report 2000**" Wohler's Association 2000.

### III SEMESTER ROBUST DESIGN

Subject Code	: 08MPD31	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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- Taguchi's approach to quality.
- Two level experiments (Full factorial designs and Fractional factorial designs)
  
- Evaluating the variability.
- Steps in robust design.
- Signal to noise ratio.
- Taguchi inner and outer arrays.
- Constructing orthogonal arrays.
- Analysis of variance in engineering design.

#### REFERENCE BOOKS:

1. Robert H. Lochner and Joseph E. Matar –“**Designing for Quality an Introduction, best of Taguchi and western methods of statistical experimental design**”.
2. Madhav S.Phadke –“**Quality Engineering using Robust Design**”.
3. D.C. Montgomery- “**Design of Experiments**”.
4. Philip J Ross- “**Taguchi Techniques for Quality Engineering**”.
5. Taguchi G. Experimental design, “**Maruzen publishing Co**”, Tokyo 1981.

### OPTIMISATION TECHNIQUES FOR DECISION MAKING

Subject Code	: 08MPD321	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** Engineering application of optimization, multivariable optimization Statement of a optimization problem. Design Vector, Design constraints, objective function, classification of optimization problems.

**Classical Optimization Technique:** Single variable optimization, with equality Constraints solution by direct substitution, solution by the method of constrained Variation. Solution by the method of Lagrange multipliers, multivariable optimization with inequality constraints Kuhn – Tucker condition.

**Non-linear Programming:** (One Dimensional minimization method) Numerical method, Unimodal function, Unrestricted search, Exhaustive search. Dichotomous search, Fibonacci and Golden section method.

**Interpolation Method:** Quadratic and Cubic Nonlinear programming (Unrestricted Optimization Technique) Random search methods, Univariate method, powels method, Simplex method.

**Descent Methods:** Steepest descent, conjugate gradient, variable metric method.

**Non Linear Programming:** (Constrained Optimization problem) Characteristic of a constrained problem.

**Direct Methods:** The complex method, cutting plane method, methods of Feasible directions.

**Indirect Methods:** Transformation technique, change variables and elimination of variables, penalty function methods- interior and exterior penalty function.

**TEXT BOOKS:**

1. S.S. Rao, Optimization, "**Theory and Application**", Willey Eastern.

**REFERENCE BOOKS:**

1. R.L Fox, "**Optimization methods for Engg. Design**", Addison – Wesley
2. GSG Beveridge and R.S. Schechter, "**Optimisation Theory and Practice**".
3. Ram, "**Optimisation and Probability in System Engg.**" Van Nostrand.

## PRODUCT PLANNING AND MARKETING

Subject Code	: 08MPD322	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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Product strategy and planning product, Market evolution, Successful product development.

New product strategy, a proactive new product development process, Market definition and entry strategy.

Consumer measurement, perceptual mapping, consumers perceptions of new and existing products.

Product positioning –Preference analysis and benefits, segmentation.

Forecasting sales potential.

Launching products and services

### TEXT BOOKS:

1. Glen L. Urban. John R. Hauser, “**Design and Marketing of new products**”
2. William L. Moore & Edgar, “**Product Planning and Management**”, A. Pessemier

## AGILE MANUFACTURING

Subject Code	: 08MPD323	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** what is agile Manufacturing? -Competitive environment of the future- the business case for agile manufacturing conceptual framework for agile manufacturing.

**Four Core Concepts:** strategy driven approach- integrating organization, people technology interdisciplinary design methodology.

**Agile Manufacturing and Change Management:** The change implications, post failures in advanced manufacturing, changes on the way, traditional management accounting, paradigm, investment appraisal, product costing -performance, Measurement and control systems. Traditional organization, control technological and design paradigms- traditional problems in workplace- organizational issues -role of technology.

**Agile Manufacturing Enterprise Design:** Agile manufacturing –enterprise design -system concepts as the basic manufacturing theory -joint technical & organizational design as a model for the design of agile manufacturing enterprise,, enterprise design process -insights into design processes, what is interdisciplinary design, Main issues - simple design example.

**Skill & Knowledge Enhancing Technologies For Agile Manufacturing:** Skill and Knowledge enhancing Technologies -scheduling -technology design strategic-Design Concepts. Design & Skill of Knowledge enhancing Technologies for machine tool systems- Historical Overview, Lessons, Problems and Future Development.

### REFERENCE BOOKS:

1. Paul T. Kidd, “**Agile Manufacturing -Forging new Frontiers**”, Addison Wesley Publication- 1994.
2. Dr. M.P Chowdiah (Editor), “**Agile Manufacturing -Proceeding of International Conference on Agile Manufacturing**”, TATA Mc Graw Hill Publications 1996.

3. Paul T Kidd, “**Agile Manufacturing -Forging Neat Furniture**”. Addition Wesley Pub (1994).
4. Paul T Kidd –“**Concurrent Engg.**”
5. Paul T Kidd –“**World Class manufacturing**”.

### **PRODUCT ANALYSIS AND COST OPTIMIZATION**

Subject Code	: <b>08MPD331</b>	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Introduction:** New products, new product strategy -market definition Idea generation introduction to the design process -forecasting sales potential -product engineering and markets-monopoly competitive.

**Manufacturing Planning:** Selection of optimum process, standardization. Break even analysis- application and area of use -problems -multi - product analysis.

**Value Analysis:** Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost -problems.

**Cost Accounting:** Cost estimation -difference -types -steps involved in cost estimation.

**Types of Cost:** Direct -indirect -labour variance -material cost -direct indirect material cost -variance with examples. Overhead cost. Elements in overheads: machine hour rate, apportioning methods -variance -examples -Activity based costing - Introduction to target costing.

**Cost Calculation:** Cost calculation for machined components, welding, casting and forged components illustrations - calculation of sales cost.

**Cost Optimization Techniques:** Analytical, Graphical and incremental methods Learning curves.

#### **TEXT BOOKS:**

1. Glen L Urban, John R Hauser, "**Design and Marketing of New Products**"- Prentice Hall. New Jersey, 1980
2. Narang CBS & Kumar V., "**Production and Costing**", Khanna Publishers, 2001

#### **REFERENCE BOOKS:**

1. Yasuhiro Monden, "**Cost management in the New Manufacturing Age**", ProductivityPress-1992
2. "**Manufacturing Engineers Handbook**", S M E 1984.
3. Miles Lawrence.D, "**Technique for Value Analysis And Engineering.**" McGraw Hill, New york-1972

## ADVANCED MANUFACTURING PRACTICE

Subject Code	: 08MPD332	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Need of CPC for a company**, what CPC can do, CPC-getting the right tool.

**JIT – Introduction** – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

**Just in Time Production** – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

**Sequence and scheduling used by suppliers:** Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

**Toyota Production System**-The philosophy of TPS, Basic Frame work of TPS, Kanbans. Determining the Number of Kanbans in Toyota Production System.

- Kanban Number under Constant Quantity Withdrawal System.
- Constant Cycle, Non-constant Quantity Withdrawal System.

Supplier Kanban and the Sequence Schedule for Use by Suppliers.

- Later Replenishment System by Kanban.
- Sequenced Withdrawal System.
- Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS, Production Planning, Production Smoothing

Adaptability to Demand Fluctuations, Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.

**Just-in-Time Production** with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

**Total Quality Control-Introduction**-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.

**Plant Configurations: Introduction**-ultimate plant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring.

### REFERENCE BOOKS:

- Yasuhiro Monden, “**An integrated approach to just in time**”, Toyota Production system
- James Womack, “**Lean Thinking**”.
- James P. Womack, Daniel T Jones, and Daniel Roos, “**The machine that changed the World – The story of Lean production**”, Harper Perennial edition published 1991.

### TEXT BOOKS:

- Richard Schonberger, “**Japanese Manufacturing Techniques**”.
- Kargoanker, “**Just in Time Manufacturing**”, Wind-chill reference manual.

## ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Subject Code	: 08MPD333	IA Marks	: 50
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

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**Artificial Intelligence:** Introduction, definition, underlying assumption, important of AI, AI & related fields State space representations, defining a problem, production systems and its characteristic, search and control strategies – Introduction, preliminary concepts, examples of Search problems.

**Uniformed or Preliminary Concepts:** Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques – Generate and Test, Hill climbing, best first search, problem reduction, constraint satisfaction, Means – Ends Analysis.

**Knowledge Representation Issues:** Representations and Mapping, Approaches, Issues in Kr, Types of Knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

**Use of Predicate Logic:** Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to causal form, Resolution, Natural deduction

**Statistical and Probabilistic Reasoning:** Symbolic reasoning under uncertainly, Probability and Bayes' theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster – Shafer Theory, Fuzzy Logic

**Expert Systems:** Introduction, Structure and uses, Representing and using domain knowledge, Expert System shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

**Introduction to Knowledge Acquisition:** Types of learning, General learning model, and performance measures.

**Typical Expert Systems:** MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF etc.

**Introduction to Machine Learning:** Perceptrons, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

### TEXT BOOKS:

1. Elaine Rich & Kevin Knight, “**Artificial intelligence**”, M/H 1983.
2. Wendry B.Ranch, “**Artificial Intelligence in Business**”, Science & Industry –Vol II application, Ph 1985.
3. Waterman, D.A., Addison, “**A Guide to Expert Systems**”– Wesley inc. 1986.
4. Hayes, Roth, Waterman, “**Building expert systems**” D.A (ed), AW 1983.
5. S.M. and Kulliknowske, “**Designing Expert Systems**”, Weis, London Champion Hull 1984.

### **Special Purpose**

- Software, all design tools in case
- Academic Calendar and frame work
- Research focus

List of typical research projects.

- Industry Linkage
- Publications (if any) out of research in last three years out of masters projects
- Placement status
- Admission procedure
- Fee Structure
- Hostel Facilities
- Contact address of co-ordinator of the PG programme

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