



Academic Year 2015-16

# HIGHER DEGREE 2015

A computer based online test for admission to  
Higher Degree Programmes of BITS, Pilani  
at Pilani Campus, K.K.Birla Goa Campus & Hyderabad Campus



**BITS Pilani**  
Pilani | Dubai | Goa | Hyderabad





# Birla Institute of Technology & Science, Pilani

## Pilani Campus

**Admission Brochure for Higher Degree Admission Test: First Semester 2015-16**

### INDEX

	<b>Page No</b>
1. Programmes offered	2
2. Eligibility Criteria	3
3. Details of Online Test	4
4. Test Center Details	5
5. Important dates and deadlines	5
6. Syllabus for Test I	6
7. Syllabus for Test II	7
8. Syllabus for Special Test for Software Systems	34

## BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

### Admission Brochure for Higher Degree Admission Test: First Semester 2015-16

#### A Computer based online Test for admission to Higher Degree Programmes at Pilani Campus, Goa Campus and Hyderabad Campus

The Birla Institute of Technology and Science (BITS) Pilani, is an Institution declared as Deemed to be University under Section 3 of the UGC act. It is an all-India Institute for higher education for men and women, fully residential, and awards its own degrees. Admissions to all the higher degree programmes of BITS, Pilani, at its Pilani campus, Goa Campus and Hyderabad Campus for the I Semester 2015-16 will be made on the basis of a Computer based Online test conducted by BITS, Pilani followed by interview(s) of shortlisted candidates.

#### I. Programmes Offered:

	BITS Pilani Campus at:		
	Pilani	Goa	Hyderabad
<b>M.E.</b>			
Biotechnology	√	√	√
Chemical	√	√	√
Civil with specialization in Structural Engineering Civil with specialization in Transportation Engineering Civil with specialization in Infrastructure Systems.	√ √ √		√
Communication Engineering	√		√
Microelectronics	√	√	
Embedded Systems	√	√	√
Mechanical	√		
Mechanical with specialization in Thermal Engineering			√
Design Engineering	√		√
Manufacturing Systems Engineering	√		
Computer Science	√	√	√
Software Systems	√		
M. Pharm.	√		
M. Pharm. with specialization in Pharmaceutics	√		√
M. Pharm. with specialization in Pharmaceutical Chemistry	√		

**Duration:** Normally four semesters.

**Eligibility:** A minimum of 60% aggregate in the qualifying examination.

Once the candidates are selected for admission in the higher degree programmes, they have to report alongwith the original marksheets and qualifying degree certificate on **29th July, 2015**. If their final result of the qualifying examination is not available on the reporting date i.e. 29th July, 2015 then they should have atleast already appeared in all exams of final year and they must submit their qualifying degree and marksheets latest by 1st October, 2015. If they do not submit the original qualifying degree and marksheets by 1st October, 2015, their admission to the program will automatically be discontinued and no

fees will be refunded and they will be asked to leave the institute immediately. Further if the aggregate marks in the qualifying examination is below 60%, the offer of Provisional admission stands automatically cancelled. No further extension of date for submission of final results of the qualifying examination will be given.

**Note:** (i) Admissions to **M.E./M.Pharm** are based on performance of candidates in **computer-based online test** conducted by BITS. The online tests will be held during **30<sup>th</sup> May– 31<sup>st</sup> May 2015** at centers in India.

### **Programme-wise eligibility criteria:**

#### **Normal Input:**

**M.E. Biotechnology** – Any integrated first degree of BITS or its equivalent with adequate preparation in Bio-chemistry and Microbiology.

**M.E. Chemical**– Integrated first degree of BITS in Chemical Engineering or its equivalent such as BE/B.Tech (Chemical)..

**M.E. Civil** – Integrated first degree of BITS in Civil Engineering or its equivalent such as BE/B.Tech (Civil).

**M.E. Computer Science** – Integrated first degree of BITS in Computer Science/Engineering or its equivalent such as BE/B.Tech (Computer Science/Engineering). **Candidates with a B.E./B.Tech degree in IT area will not be eligible to apply for M.E. Computer Science.**

**M.E. Communication Engineering** – Integrated first degree of BITS in Electrical & Electronics/Electronics & Instrumentation/Electronics & Communication or its equivalent such as BE/B.Tech in these disciplines.

**M.E. Mechanical; Design Engineering; Manufacturing Systems Engineering** – Integrated first degree of BITS in Mechanical/Manufacturing Engineering or its equivalent such as BE/B.Tech in these disciplines.

**M.E. Mechanical (with specialization in Thermal Engineering)** – Integrated first degree of BITS in Mechanical or its equivalent such as BE/B.Tech in Mechanical Engineering.

**M.E. Embedded Systems** – Integrated first degree of BITS in Electrical & Electronics/Electronics & Instrumentation/ Electronics & Communication/ Computer Science or its equivalent such as BE/B.Tech in these disciplines.

**M.E. Microelectronics** – Integrated first degree of BITS in Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication / Computer Science/ Physics or its equivalent.

**M.E. Software Systems** – Any Integrated first degree of BITS or its equivalent with specific prior preparation. **Candidates with a B.E./B.Tech degree in IT area are eligible to apply for M.E. Software Systems. They may need some specific prior preparation.**

**M.Pharm; M.Pharm (with specialization in Pharmaceutics/Pharmaceutical Chemistry)** – Integrated first degree of BITS in Pharmacy or its equivalent such as B. Pharm.

Admissions to all Programmes will be made purely on merit. Admissions to all **higher degree Programmes** are based on the performance of the candidates in the **computer based online test** conducted by BITS The test will be a computer based online test conducted by BITS Pilani at dedicated centers at different cities of India. Computer based online test means the candidate sits in front of a computer and the questions are presented on the computer monitor and the candidate submits the answers through the use of keyboard & mouse. Each computer is connected to a server, which prepares the question set and delivers it to the candidate on the computer. **The test are planned to be conducted will be conducted during 30<sup>th</sup> May– 31<sup>st</sup> May 2015 and the candidate can choose the center to take the test as prescribed in later sections.**

### Details of online Test:

**Test I:** Duration: 60 Minutes. Total No of questions: 60

Test I is compulsory for all students who are applying for any of the higher degree programmes of the Institute and will consist of the following sections

Sections	No. of Questions
Core Mathematics	15
Core Physics	15
English Language Skills & Principles of Management	15
Computer Programming	15
<b>Total</b>	<b>60</b>

The course descriptions are available in the syllabus given later in the brochure

**Test II:** Duration: 120 Minutes. Total number of questions: 100

Test II is compulsory for Students applying for all higher degree programmes except those who are applying for only Software systems. The Test II subject for a student is based on his/her qualifying degree programme. This paper will attempt to test student's grasp of the basic subjects of his discipline. The discipline courses of different degree programmes of BITS have been used for constructing the questions. The course descriptions are available in the syllabus given later in the brochure

**Special Test for Software Systems:** Duration 60 Minutes Total number of questions: 50

This Special aptitude test for Software Systems is required for only those students who are applying for M.E. Software systems. The course descriptions are available in the syllabus given later in the brochure.

For all the above tests all questions are of objective type (multiple choice questions); each question with four answers choices only one being the correct choice. Each correct answer fetches 3 marks, while each incorrect answer has a penalty of 1 mark. No marks are awarded or deducted for questions not attempted. While the candidate can skip a question, the computer will not allow the candidate to choose more than one option as the correct answer.

The questions will be selected at random from a large question bank. Different candidates will get different question sets. An expert committee will ensure that the question sets are of comparable difficulty level, content, question type etc. In this matter the decision of the expert committee will be final and binding on the candidate.

All the questions and instructions of the test will be in English only.

**Each candidate who registers for test will be required to download a 'Hall Ticket' from the website during 26th May – 29th May 2015. Candidates** with the hall ticket only will be allowed inside the test centers. Candidates should bring a pen for the purpose of rough work, signing etc. Blank sheets for rough work will be provided, if required. **Candidates can bring a calculator without any network connectivity/programmable feature. Candidates are not allowed to bring any other personal belongings such as mobile phones; ipods or any other electronic gadgets**

All centers are closely monitored for security and candidates' identity and activities will be recorded using web cameras and/or closed circuit TV cameras. Anyone violating the rules of the test center will not be allowed to continue with the test and will be automatically disqualified.

On completion of the test, the computer will display to each candidate his/her score obtained.

**A candidate can submit only one form for Higher Degree Admissions. However if a candidate discovers any mistake in the form submitted by him, he can submit a second application form duly completed before the last date, indicating on the top of second application form that his first application form (giving its number) should be cancelled. In such cases, the second application has to be accompanied by a fresh application fee.**

### Test Centers (Revised)

In order to facilitate a larger number of students all over India to participate in this test, **apart from Pilani, Goa and Hyderabad** where it is expected that a large number of students will take the test, the Institute is also planning to offer the tests at dedicated test centers in several cities. The planned test centers are in the following cities. **The final list of centers and the operating days at each center will depend on the number of applicants and their preferences.**

1. Pilani	2. Goa	3. Bangalore
4. Chennai	5. Delhi	6. Hyderabad
7. Kolkatta	8. Noida	9. Jaipur
10. Lucknow	11. Mumbai	12. Bhopal
13. Nagpur	14. Patna	15. Vijayvada

**The final list of the test centers will be announced only after all the applications are received and candidates will be informed of the same through BITS website <http://www.bitsadmission.com>. Candidates have to give three preferences of examination center and will be allotted to one of the centers. The candidates will also be allotted test date and time.**

### Important dates and deadlines: Important dates and deadlines:

Portal to apply online opens on:	8th April 2015
Deadline for submission of the completed application form online:	20 <sup>th</sup> May 2015
Test Center and slot allotment and announcement to Candidates:	25 <sup>th</sup> May 2015
Candidates to download Hall tickets:	26 <sup>th</sup> – 29 <sup>th</sup> May 2015
Online Tests:	30 <sup>th</sup> May– 31 <sup>st</sup> May 2015
Announcement of admission offers to M.E./M. Pharm. Programmes:	10 <sup>th</sup> June 2015
Admission of Selected students:	29 <sup>th</sup> July. 2015
Freshmen Orientation Programme:	30-31 <sup>st</sup> July 2015
Registration for courses:	1 <sup>st</sup> August 2015

### How to Apply:

Interested and eligible candidates should apply through the prescribed application form available online at <http://www.bitsadmission.com/> and take the printout of the filled form. The completed application form along with the prescribed fee should be sent to Dean Admissions, BITS, Pilani-333031. Details of modes of Fee Payment are available at the website while applying online.

Application Fee: Rs.2090/-

Portal to apply online opens on **8<sup>th</sup> April 2015**

Deadline for submission of the completed application form online is **5.00 P.M. on 20<sup>th</sup> May 2015**.

Last date for the signed applications (printout of the filled application form with candidate signature) to reach admission office is **22<sup>nd</sup> May 2015**. The completed application form is to be sent by registered post/speed post to the under-mentioned address:

**The Dean, Admissions  
BITS Pilani-Pilani – 333 031 (Rajasthan)**

**Important Note:**

- i. The Online tests are generated from a large question bank and different candidates will get different question sets. An expert committee will ensure that the question sets are of comparable difficulty level, content, question type etc. In this matter, the decision of the expert committee will be final and binding on the candidates.
- ii. The test assumes that the candidates have basic familiarity with use of computers like use of keyboard and mouse operation. It is the responsibility of the candidates to acquire these skills before appearing in the test and the Institute cannot take responsibility for the same.
- iii. The Institute is planning to operate test centers in different cities other than Pilani/Goa and Hyderabad as previously stated. The final list of centers will be announced to candidates through the BITS website. The Institute cannot guarantee that test centers will be set up in all these centers. Further, the Institute reserves the right to cancel any test center if such situation arises. In such cases, those candidates allotted to these centers will be accommodated in alternate test centers including Pilani.
- iv. The candidates must fully obey the rules of the test centers; otherwise he/she will be automatically debarred from the test.
- v. In all matters in the conduct of test, the decision of the Vice Chancellor of BITS will be final.
- vi. All disputes pertaining to higher degree admission shall fall within the jurisdiction of Pilani city.
- vii. All notices regarding test, shortlist etc will be put up only on BITS admission website. Candidates should regularly check the same.

**SYLLABUS FOR TEST I****Core Mathematics:**

Functions and graphs; limit and continuity; applications of derivative and integral. Conics; Polar coordinates; Convergence of sequence and series. Maclaurin and Taylor series. Partial derivatives. Vector calculus in  $R^n$ ; vector analysis; theorems of Green, Gauss and Stokes.

Complex numbers, analytic functions, Cauchy's theorems; elementary functions; series expansions; calculus of residues and applications. Vector space; basis and dimension; linear transformation; range and kernel of a linear transformation; row deduction method and application to linear system of equations.

Probability spaces; conditional probability and independence; random variables and probability distributions; marginal and conditional distributions; independent random variables; mathematical expectation; mean and variance; binomial, Poisson's and normal distributions; sum of independent random variables; law of large numbers; central limit theorem, sampling distribution and test for mean using normal and students t-distribution; test of hypothesis; correlation and linear regression.

**Reference books:**

Thomas, G B & R, L Finney, Calculus and Analytic Geometry, Pearson Education, 9<sup>th</sup> ed., 1996

Kolman, Bernard & D R Hill, Introductory Linear Algebra with Applications

Churchill, R V and James W Brown, Complex variables and Applications, MGHISE, 7<sup>th</sup> ed, 2003

Milton. J Susan

**Core Physics:**

Linear momentum and its Conservation, Angular momentum and its conservation, Rotational dynamics of rigid bodies, Work-energy theorem, Conservative forces and potential energy, Collision problems, Damped and forced simple harmonic motions, Coupled oscillations and wave motion

Coulomb's law, Electric fields, Gauss' law, Electric potential, Dielectrics and capacitors, Magnetic fields, Biot-Savart law and its applications, Magnetic materials, Ampere's law, Faraday's law of electromagnetic induction, Maxwell's equations and plane electromagnetic waves

Young's double-slit interference, Interference from thin films, Coherence, Diffraction from single and double slits, Diffraction grating, Photoelectric effect, Compton effect, De-Broglie waves, Uncertainty relation, Schrodinger equation, Particle in a box, Potential barriers and tunneling.

**Reference books:**

R. Resnick, D. Halliday & K.S. Krane, Physics Vol. I & II, John Wiley & Sons, 5th ed., 2004

**English Language Skills and Principles of Management**

Pronunciation skills; Vocabulary – Synonyms and antonyms, using words in appropriate contexts, Idioms and Phrasal verbs; Grammar – Word order and effective sentences, use of tenses, conjunctions and prepositions; Reading comprehension; Paragraph writing; Précis Writing; Letter writing.

Fundamental concepts of management- planning, organization; staffing; directing and controlling; production, financial, personal, legal and marketing functions, accounting and budgeting, balance sheets.

**Reference books:**

Krishna Mohan and Meenakshi Raman, 2000, Effective English Communication, New Delhi: Tata McGraw Hill.:

Robbins, Stephen P & M. Coutler, Management, PHI/Pearson Edu, 8<sup>th</sup> ed., 2005

**Computer Programming**

Basic Data Types and Operations. Control Constructs – Conditionals and Loops Lists - Arrays. Modularity– Functions.

Structured Data – Structures, Unions, Pointers. Applications – Strings.

**Reference books:**

Balagurusamy, E. Programming in ANSI C, TMH, 2<sup>nd</sup>, 2004

**SYLLABUS FOR TEST II**

**Chemical Engineering**

<b>Chemical Process Calculations</b>
Units and Dimensions, The Chemical Equation and Stoichiometry, Material Balances, Energy Balances, Properties of Gases, Vapors, Liquids and Solids, Phase Equilibria, Combustion Calculation, Unsteady-State Material and Energy Balances. <b>Reference books:</b> Himmelblau, D. M. "Basic principles & calculations in chemical Engg", PHI, 6 <sup>th</sup> ed., 1997. Felder, R. M. & R. W. Rousseau, "Elementary Principles of Chemical Processes", John Wiley & Sons, Inc., 3 <sup>rd</sup> ed., 2000.
<b>Fluid Flow Operations</b>
Fundamental Concepts and Fluid Statics, Integral and Differential Analyses for Fluid Motion, Internal and External Fluid Flow and Flow through Packed Bed, Dimensional Analysis and Fluid Machinery, Agitation and Introduction to Compressible Flow. <b>Reference books:</b> Fox, R. W. and A. T. McDonalds, Introduction to Fluid Mechanics (5 <sup>th</sup> edition) John Wiley and Sons Inc., 2001. McCabe, W. L., J. C. Smith and P. Harriott Unit Operations of Chemical Engineering (7th edition),



McGraw Hill Inc., 2005.

### **Chemical Engineering Thermodynamics**

First & Second Laws, PVT behavior & Heat Effects, Properties of pure fluids and thermodynamics of flow processes, Solution thermodynamics, VLE and chemical reaction equilibrium.

#### **Reference books:**

J. M. Smith, and Others, "Introduction to Chemical Engineering Thermodynamics", MGHFSE, 6<sup>th</sup> ed., 2001  
YVC Rao, "Chemical Engineering Thermodynamics", Universities Press, 1997.  
KV Narayanan, "A Textbook of Chemical Engineering Thermodynamics". Prentice Hall of India, 2001.

### **Mass Transfer Operations**

Molecular diffusion and mass transfer coefficients, Interphase mass transfer, Gas absorption, Distillation, Liquid extraction and leaching.

#### **Reference books:**

Treybal, R.E., "Mass Transfer Operations," 3<sup>rd</sup> Ed., McGraw-Hill Book Company, Singapore, 1980.  
Foust, A. S., Wenzel, L.A., Clump, C.W., Anderson, L.B., "Principles of Unit Operations," 2<sup>nd</sup> Ed., John Wiley and Sons, New York, 1980.

### **Heat Transfer Operations**

Steady and Unsteady state heat conduction, Natural & Forced convection, Radiation, Condensation, boiling and evaporation, Heat Exchangers.

#### **Reference books:**

Holman, J. P., "Heat Transfer (9<sup>th</sup> Ed.)", McGraw-Hill, 2002.  
Frank P. Incropera, David P. DeWitt, "Fundamental of Heat & Mass Transfer (6<sup>th</sup> Ed.)", John Wiley & Sons, 2006.  
D. Q. Kern, "Process Heat Transfer", Tata McGraw Hill.  
McCabe & Smith, "Unit Operations of Chemical Engineering (7<sup>th</sup> ed)", McGraw-Hill, 2004.

### **Selected Chemical Engineering Operations**

Properties and Handling of Particulate Solids, Mechanical Separations, Adsorption and Fixed-Bed Separations, Drying of Solids, Membrane Separation Processes and Crystallization.

#### **Reference books:**

McCabe W. L., and Smith J. M., & Harriott P., *Unit Operations of Chemical Engineering*, 7<sup>th</sup> Ed., McGraw-Hill International Edition, 2006.  
Chemical Engineering (Volumes 1-6), Coulson J. M., Richardson J. F. & others, Pergamon Press, London, 1978 & 1997.

### **Kinetics & Reactor Design**

Mole balances and reactor sizing, Rate laws and stoichiometry, Isothermal reactor design for single and multiple reactions, Analysis of laboratory reactor data, and reaction mechanisms for nonelementary reactions, Non isothermal reactor design for single and multiple reactions, Heterogeneous reactors, Data

analysis & design, Non Ideal reactors.

**Reference books:**

H. Scott Fogler "Elements of Chemical Reaction Engineering", PHI, 3<sup>rd</sup> Ed, 2002.

O. Levenspiel, "Chemical Reaction Engineering", John Wiley, 3<sup>rd</sup> Ed., 1999.

J.M. Smith, "Chemical Engineering Kinetics", McGraw Hill, 3<sup>rd</sup> Ed., 1981.

**Chemical Process Technology**

Process synthesis concepts for flow sheet generation; species allocation; separation task sequence and task integration, Technologies related to Inorganic Chemical Industries, Technologies related to Natural Product Industries, Technologies related to synthetic organic chemical industries, Technologies related to Polymerization industries.

**Reference books:**

Rao, G. and Sittig M., "Dryden's outlines of chemical technology for 21<sup>st</sup> century", East West Press, 1997.

Austin, G T, "Shreve's chemical process industries", McGraw Hill, 1984.

**Process Design Decisions**

Engineering Economics; Economic Decision Making, Input Information and Batch versus Continuous; Input-Output Structure, Recycle Structure; Separation System, Heat Exchanger Networks (Energy Integration), Cost Diagrams; Preliminary Process Optimization; Process Retrofits.

**Reference books:**

James M. Douglas. Conceptual Design of Chemical Processes. McGraw-Hill International Editions (Chemical Engineering Series), Mc Graw Hill Book Company, New York, 1988.

Max S. Peters, Klaus D. Timmerhaus, Ronald E. West, Max Peters. Plant Design and Economics for Chemical Engineers. 5<sup>th</sup> Edition, Mc Graw Hill, New York, 2003.

**Process Control**

Dynamic modeling and simulation of momentum, energy, mass transfer and reacting systems, Analysis of the dynamic behavior of chemical processes, Analysis and design of simple feedback and advanced control systems, Design of control systems with multiple input and multiple output, Digital sampling, filtering and control.

**Reference books:**

Stephanopoulos, G., "Chemical Process Control: An Introduction to Theory and Practice," Prentice-Hall, Englewood Cliffs, N.J., 1984

Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control," 2<sup>nd</sup> Ed., John Wiley and Sons, 2004.

Coughnowr, D. R., and Koppel, I. B., "Process Systems Analysis and Control," 2<sup>nd</sup> Ed., McGraw-Hill, New York, 1991.

**Civil Engineering**

**Design of Concrete Structures:**

Materials for reinforced concrete, Design of concrete Mix, Design philosophies, Design of singly and doubly reinforced rectangular and flanged sections for Flexure using Working stress and Limit State Design approach, Design for bond, anchorage and development length, Design of beams for Shear,

serviceability requirements, Design of one way slab, two way slab and staircase, yield line theory, Design for columns, Foundations , retaining walls and introduction to prestressed concretes..

**Reference books:**

Limit State Design of Reinforced Concrete, By: P. C. Varghese, PHI, New Delhi.

Reinforced Concrete Design by Pillai and Menon, TaTa McGraw Hill, Publication, New Delhi.

Reinforced Concrete Design by S. N. Sinha, TaTa McGraw Hill, Publication, New Delhi.

Design of Concrete Structures by Nilson, Darwin and Dolan, TaTa McGraw Hill, Publication, New Delhi

**Design of Steel Structures (Limit State Design) :**

Steel Design Specifications and Connections, Design of Tension and Compression Members, Design of beams and plate girders, Design of Industrial Structures, Introduction to plastic analysis and design.

**Reference books:**

Teaching Resource for Structural Steel Design, Vol. 1, 2, 3: Institute for Steel Development and Growth, Kolkatta.

Design of Steel Structure by N. Subramaniam, 2007, Oxford University Press.

**Analysis of Structures:**

Statics of Structures and Degree of Indeterminacy, Analysis of Determinate and Indeterminate Structures, Deflection of beams and Frames, Influence lines and its Applications, Introduction to Matrix Methods of Structural Analysis.

**Reference books:**

Fundamentals of Structural Analysis by Kenneth M. Leet & Chia-Ming Uang, McGraw Hill Publications, New Delhi.

**Transportation Engineering:**

Highway Planning and Geometric Design, Highway Materials & Pavement Design, Traffic Engineering & Transport Planning, Railway Engineering, Airport Engineering.

**Reference books:**

Khanna, S.K. and Justo C.E.G : Highway Engineering, Nem Chand and Bros. Roorkee(U.P.), 5<sup>th</sup> Edition 1982.

Khanna, S.K., Arora,M.G. and Jain S.S. : Airport Planning and Design, Nem Chand and Bros. Roorkee(U.P.), 4<sup>th</sup> Edition 1990.

Kadiyali L.R., Principles of Highway Engineering, Khanna Publications, New Delhi 1989.

S.C. Saxena & S Arora, Railway Engineering, Dhanapatrai & Sons, 1986.

Relevant IRC and IS Codes of Practice.

**Geodesy:**

Chain Survey, Compass Survey & leveling, Theodolite, Tachometric surveying & Traversing, Curve Ranging, Contouring & Plane Tabling, Trigonometric Leveling, Areas and Volumes, Spherical triangle system, astronomical coordinate system, Geodetic surveying, Total Stations and other advancements in surveying.

**Reference books:**

Arora K.R.; Surveying (in SI units), Standard Publisher., Vol. I, II and III (Latest edition)

Punmia B.C; Surveying; Laxmi Publishers, Vol I, II and III, (1990)

Duggal S.K.; Surveying; Tata McGraw-Hill, New Delhi, Vol I and II (1996)

**Mechanics and Strength of Materials :**

Fundamental principles of Mechanics, Introduction to Mechanics of Deformable Bodies, Forces and Moments Transmitted by Slender Members, Stress and Strains, Deflections due to Bending.

**Reference books :**

An Introduction to Mechanics of Solids, Second Edition with SI units Crandall/Dahl/Lardner, Tata McGraw Hill Publication, New Delhi.

Strength of Materials BC Punamia, Ashok Jain, Arun Jain, Laxmi Publications, New Delhi.

Mechanics of Materials Fifth Edition James M. Gere, Thomson Brooks/Cole.

**Construction Planning and Technology:**

Building materials, Geotechnical materials, compaction & stabilization, Geotechnical materials, compaction stabilization, Construction planning and scheduling, Advanced construction techniques.

**Reference books:**

Arora. S.P. & S.P. Bindra. 'A Textbook of Building construction,' Dhanpat Rai & Sons, 4th ed., 1988

Penrifoy, R.L., & C.L., Schexnayder, 'Construction Planning, Equipment and Methods', T.M.H., 8<sup>th</sup> edition, 2003.

Project Management for Construction: Chris Hendrickson First Edition originally printed by Prentice Hall, 1989, <http://www.ce.cmu.edu/pmbook/>

Gupta R., Construction Planning & Technology', CBS, 1994.

**Soil Mechanics and Foundation Engineering:**

Index properties, classification and compaction of soil, Effective stress, permeability and seepage through soil., Stresses due to applied load and settlements, Shear strength of soil, stability of slopes and earth pressure, Shallow foundations, deep foundations and soil exploration,

**Reference books:**

Ranjan, G. and Rao, A.S.R. (2002), "Basic and Applied Soil Mechanics" New Age International Publishers.

**Water and Wastewater Treatment :**

Introduction to the basics of water supply and wastewater engineering, Natural methods for water and wastewater treatment, Unit operation for water and wastewater treatment, Treatment and disposal of sludge, Advance methods of treatment for water and wastewater, application of hydraulics in designing of sewers and water supply distribution networks

**Reference books:**

Water Supply Engineering And Wastewater Engineering by B.C.Punmia. Laxmi Publications (P) Ltd., New Delhi. 1995 & 1998.

Water Supply Engineering and Sewage & Wastewater Disposal Engineering by S.K.Garg. Khanna Publishers, Delhi, 1998 & 2000.

Environmental Engineering by H.S. Peavy. McGraw Hill International editions, 1985.

Laboratory Manual for Civil Engineering by H.S.Moondra and R. Gupta. CBS Publishers, 1992.

Relevant IS codes, National and International Journals pertaining to the subject.

### **Hydraulics and Fluid Mechanics:**

Fluid Statics and Fluid Flow Kinematics, Boundary Layer Theory, Flow through pipes and open channels under different conditions & types, Dimensional Analysis and Similitude, Application of both Hydraulic and Hydrologic processes.

#### **Reference books:**

Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, Post Box 1074, New Delhi, 2005

Patra K.C., "Hydrology and Water Resources Engineering", Narosa Publishing House, 2001.

Mays L.W., "Water Resources Engineering", John Wiley and Sons, 2001.

## **Electrical and Electronics Engineering**

### **Analog Electronics:**

Operational amplifier basics, ideal and practical Op-amp configurations, special purpose linear Op-amp circuits: instrumentation amplifiers, isolation, programmable, negative feedback amplifiers etc., Active filters, IC filters; non-linear operational amplifier circuits, analog multipliers, precision and wave shaping circuits, comparators and Schmitt triggers and applications, Signal generators: sinusoidal and non-sinusoidal oscillators, integrated circuits timers. function generators, PLL, Voltage Regulators; voltage regulator IC, switched capacitor voltage converters, switching regulators, Power amplifiers and output stage circuits, IC power amplifiers, high frequency amplifiers, tuned amplifiers.

#### **Reference books:**

L K Maheshwari & M M S Anand " Analog Electronics" PHI Private Ltd. 2005.

Adel S Sedra & K C Smith" Microelectronic Circuits" OUP, 5<sup>th</sup> edition, 2005.

### **Digital Electronics & Computer Organization:**

Number systems & Codes, Boolean algebra & Simplification, Digital Logic Families, Combinational logic Design – Decoders, Encoders, MUX, DeMUX, Arithmetic Circuits, Sequential Logic design- Flip-flops, State machines, ASM

Counters & Registers, PLDs & FPGAs & Computer Organization.

#### **Reference books:**

M. Morris Mano, " Digital Design", PHI, 3<sup>rd</sup> Edition, 2002.

### **Microprocessors:**

Architectures of Intel - x85 & x86 Processors, Instruction set & Assembly Language programming, Memory Interfacing, Data Transfer Schemes, Peripherals & I/O Interfacing using 8255, 8253, 8251, Disk Organization

#### **Reference books:**

Barry B Brey, C R Sarma, The Intel Microprocessors. Pearson, Sixth Ed. 2005.

### **Circuits & Signals, Digital Signal Processing:**

Linear convolution, Fourier Transforms, DFT & FFT, Laplace Transforms & its application to system analysis, Z-transform & its application to system analysis, Analog & digital filter design (FIR, IIR), Multirate

signal processing.

**Reference books:**

B P Lathi “ Signal Processing & Linear Systems” Oxford Univ. Press, 2004.

2.Sanjit K Mitra “ Digital Signal Processing” Tata MCGra Hill 3 rd Edition, 2006.

**Electrical Sciences:**

Basic Circuit elements and laws, Analysis Techniques & Theorems, Time-domain analysis of 1<sup>st</sup> & 2<sup>nd</sup> Order Circuits, AC Circuit Analysis, Frequency domain analysis, Series and Parallel RCL Circuit, Important Power Concepts, Semiconductors, Construction, operation and application of Junction Diode, Zener Diode, Transistor (BJT's), FET's, MOSFET etc., Feedback in Amplifier Circuits, AC Generation and Magnetic Circuits, Single- phase circuit analysis, Magnetic Circuit Calculations, Three- phase Circuit analysis, Electrical Machines (Construction, Operation & usage), Transformers, DC Machines, Three-phase synchronous generator, Three-phase induction motors, Single-phase induction motor, Fractional KW motors.

**Reference books:**

Leonard S Bobrow “ Fundamental of Electrical Engineering” OUP, 2<sup>nd</sup> ed.,1996.

**Electronic Devices & Integrated Circuits, Microelectronics Circuits:**

Semiconductor materials and their properties, Carrier transport and excess carriers in semiconductors; Single p-n junction devices- rectifier diodes, switching diodes, microwave diodes, optoelectronic devices, Bipolar junction transistors; JFET; MOSFET; MOS and CMOS devices; Device fabrication techniques and introduction to ICs, Basic single and two stage transistor amplifier; current mirrors and current sources; active load biasing in integrated circuits, Voltage sources and voltage references, differential and multistage amplifiers; frequency response and frequency compensation, Operational amplifiers-2 stage, stability analysis and compensation techniques.

**Reference books:**

B G Streetman & Sanjay Banerjee” Solid state Electronic Devices” PHI? Pearson Edu, 6<sup>th</sup> ed.,2006.

Adel S Sedra & K C Smith” Microelectronic Circuits” OUP, 5<sup>th</sup> edition,2005.

**Control Systems, Power Electronics:**

Mathematical model of physical systems (Differential equations, Block diagram, signal flow graph, transfer function) feedback characteristics of control systems, control systems components, Time response analysis, stability, Root locus concepts, frequency response (Bode plots, Polar plots, Nyquist plots), state space analysis and compensation concepts, Phase control resistors, DC-DC step down chopper, Step up chopper, inverters.

**Reference books:**

I. J. Nagrath & M Gopal “Control Systems Engineering” NAIL, 5<sup>th</sup> Edition, 2007.

N. Mohan, T.M. Undeland, W.P. Robbins, John Wiley, 3 rd edition.

**Electromechanical Energy Conversion, Power Systems:**

DC Machines, construction, Operation, Characteristics & design, AC motors & generators, Transformers, Transmission lines: modeling & analysis, Steady state power system analysis & load flows.

**Reference books:**

I.J. Nagrath & D.P. Kothari, "Electric machines" TMH third edition 2004.

I.J. Nagrath and D.P. Kothari, "Power system engineering" TMH.

**Communication Systems:****Electromagnetic Fields, Telecom Switching:**

Maxwell's equation in free space and time varying fields, plane waves in dielectric and conducting media, wave reflection, refraction, diffraction and polarization, transmission lines and resonators, Smith chart and its application in stub and impedance matching calculations, Antennas and radiation, half-wave dipole, loop, helical, directive antenna, reflector, lens and horn antennas, antenna practice and measurements, Voice digitization, digital transmission and multiplexing, digital switching, Data and asynchronous transfer mode networks, telecommunication traffic analysis.

**Reference books:**

John D Kraus and D.A. Fleisch, "Electromagnetics & applications".

John C Bellamy "Digital Telephony" John Wiley 3 rd Edition, 2003.

**Mechanical Engineering****Workshop Practice:**

Metal casting, Metal machining, Metal forming, powder metallurgy, plastic forming and molding, Metal joining, Metrology and heat treatment processes,.

**Reference books:**

Campbell J. S., Principles of Manufacturing Materials and Processes, 23<sup>rd</sup> reprint, Tata McGraw Hill, 2006.

**Production Techniques:**

Advanced casting processes, Advances in metal cutting theory, machining processes, Advanced welding processes, Advanced metal forming processes, Manufacturing systems.

**Reference books:**

Kalpakistan, S. and Schmid, S. R., Manufacturing Engineering and Technology, 5th edition, Pearson Education, 2006.

HMT, Production Technology, 4th reprint, Tata McGraw Hill, 1988.

**Production Planning and Control:**

Forecasting and product planning, Process planning, job design and work measurements, Facilities location and layout, Capacity planning, aggregate planning and scheduling, Inventory and quality control.

**Reference books:**

Gaither, N. and Frazier, G., Operations Management, 9<sup>th</sup> Edition, Thomson South Western, 2007 Reprint.

**Design of Machine Elements:**

Criteria for static failure and fatigue failure, design of screws and bolted joints, design of welded joints and riveted joints, Mechanical springs, Design of rolling element bearings, journal bearings and hydrodynamic lubrication, Design of gears, clutches, brakes, couplings, flywheels, flat and V-belt drives, Computer aided

design, geometric modeling of mechanical parts and finite element analysis.

**Reference books:**

Shigley, J. E. and Mischke, C. R., Mechanical Engineering Design, 6th edition, Tata McGraw-Hill, 2001.

Zeid, I., CAD/CAM: Theory and Practice, Tata McGraw-Hill, 1991.

**Kinematics & Dynamics of Machines and Vibrations:**

Principle of virtual work, D'Alembert's principle, Kinetic Modeling, kinetics of mechanism (Four-bar mechanisms) and synthesis of cam – follower motion, Flywheels, governors, gyroscope and balancing, Free and forced vibration, Multi-degree of freedom (two dof) free and forced vibrations, mode shapes, approximate methods of solutions.

**Reference books:**

Uicker J.J., Pennock G.R., Shigley J.E., Theory of Machines and Mechanisms, 3rd edition, Oxford University Press, 2003.

**Transport Phenomena I:**

Fluid statics, Conservation laws, Viscous and inviscid flow analysis, Dimensional analysis, Analysis of fluid machines.

**Reference books:**

Welty, J. R., Wicks, C. W. and Wilson, R. E., Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 4th edition, 2000.

Kadambi, V. and Prasad, V., An Introduction to Energy Conservation, NAIL.

**Transport Phenomena II :**

Conduction: steady state and unsteady state heat conduction, Convection: analytical and empirical relations for forced and free convection heat transfer, condensation and boiling, Radiation heat transfer: basic laws, shape factor, radiation heat exchange between surfaces, Heat exchanger: analysis and design, Mass transfer: diffusion and convective mass transfer.

**Reference books:**

Holman, J. P., Heat Transfer, McGraw Hill, 9<sup>th</sup> Edition, 2002.

Welty, J. R., Wicks, C. W. and Wilson, R. E., Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 4th edition, 2000.

**Thermodynamics:**

Properties of pure substance, First law of thermodynamics, Second law of thermodynamics, Entropy, Irreversibility, energy and thermodynamic relations.

**Reference books:**

Sonntag, R. E., Borgnakke, C. and Van Wylen, G. J. Fundamentals of Thermodynamics, 6th edition, John Wiley & Sons (Asia) Pte. Limited, 2003.

**Applied Thermodynamics:**

Air standard cycles, gas power cycles, I.C. engines, Vapour compression and absorption cycle, Psychometrics and air conditioning, Vapour power cycles, boilers, its mountings and accessories.

**Reference books:**

Nag P.K., Basic and Applied Thermodynamics, 3<sup>rd</sup> edition, Tata McGraw Hill, 2002.



Ganesan V., Internal Combustion Engines, Tata McGraw Hill, 1994.  
Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw Hill, 2<sup>nd</sup> edition, 2000.  
Nag P.K., Power Plant Engineering, 2<sup>nd</sup> edition, Tata McGraw Hill, 2001.

**Mechanics of Solids:**

Fundamental principle of mechanics, Introduction to mechanics of deformable bodies, slender members, energy Methods, Stress and strain: stress-strain-temperature relations, Symmetric and asymmetric bending, torsion, Curved beams and thick shells, Buckling.

**Reference books:**

Candall, S. H., Dahl, N. C. and Langner, T. J., An Introduction to Mechanics of Solids, McGraw Hill, 1984.  
Boresi, A. and Schimid, R., Advanced Mechanics of Materials, John Wiley & Sons.

**Pharmacy**

**Natural Drugs , Phyto chemistry , Pharmalcognosy :**

General Pharmacognosy, traditional systems of medicine, plant nomenclature & classification, macro & micro morphology, standardization parameters; Properties, isolation techniques, tests and functions of alkaloids, alkaloidal drugs belonging to the classes: tropane, ecgonine, quinoline, isoquinoline, indole, purine, phenanthrine, diterpene, peptide, steroidal classes including pseudoalkaloids; Classification, isolation techniques, test for glycosides, glycoside drugs of class: anthraquinone, cardenolide, bufedienolide, saponins; Classification, isolation techniques, tests for volatile oils and fixed oils, volatile oil containing drugs including acyclic, monocyclic, bicyclic and tri cyclic terpenoidal drugs, fixed oils containing saturated, unsaturated fatty acids; Classification, isolation procedures, test for resins, drugs of resin alcohol, acid resin and ester resin classes, classification and tests for gums, prepared gums and naturally occurring gums.

**Reference books:**

Trease & Evans 'Pharmacognosy'Saunders, 15<sup>th</sup> Ed., 2002.  
Wallis T. E. 'Text book of Pharmacognosy', 5<sup>th</sup> Ed. 1997.

**Anatomy Physiology & Hygiene:**

Anatomy of a generalized cell, cellular transport mechanisms, cell division, body tissue types and functions, their properties and characteristics., Composition and functions of blood, Plasma Proteins, RBC, WBC, platelets- anatomy & functions, hemoglobin and blood groups, blood typing, anatomy and physiology of the heart, blood pressure, ECG and its significance, blood vessels., General aspects of neurology, central, peripheral nervous system ( CNS and PNS), autonomic nervous system, endocrine glands, hormones:- their functions and mechanisms of action., Anatomy of the urinary system, mechanisms of urine production, diseases of the kidney, male, female reproductive systems and related disorders., Organs of the respiratory system, process of respiration, diseases related to the systems.

**Reference books:**

Martini F H – Fundamentals of Human Anatomy & Physiology. 4<sup>th</sup> Ed, P-H International Inc.  
Guyton & Hall, A Text book of Medical Physiology XI Ed., WB Saunders Co.(Indian Ed.), Elsevier 2006.

**Pharmaceutical Chemistry (Medicinal Chemistry, Chemistry of Synthetic Drugs and Applied Pharmaceutical Chemistry) :**

Physico-chemical and stereo chemical properties affecting drug actions, drug-receptor interactions, pro-drugs and drugs metabolism., Classification, structure, synthesis, S.A.R. and mechanism of action of local anaesthetics, sedatives, hypnotics, anti-histaminics, antihypertensive agents., Various organic reactions involved in drug synthesis, addition, condensation, rearrangement, carbon – carbon bond formation, carbon- heteroatom bond formation, heterocyclic ring forming reactions., Chemotherapeutic agents: sources, synthesis and S.A.R, mechanisms of action of anti-bacterial, anti-cancer, anti-viral agents., Lead compound identification, retero-synthetic analysis, bio-technological approach to drug design and development, alkyl chain addition / deletion, ring expansion, ring contraction methods, synthesis and use of intermediates in organic systems.

**Reference books:**

Foye, William. "Principles of Medicinal Chemistry" – Lippincott Williams & Williams, 5<sup>th</sup> Ed., 2002.

D. Sriram, P-Yogeeswari "Medicinal Chemistry" Pearson Education, I Ed., 2007.

**Pharmaceutical and Instrumental Methods of Analysis :**

IR, NMR, MASS – spectroscopic techniques, their principles, instrumentation, molecular characterization, calibration, operation, sample preparation and interpretation of results., UV-Vis. Spectrophotometer, spectrofluorimeter, AAS: - their principles, instrumentation, calibration, operation, sample preparation and interpretation of results., Chromatographic Techniques – HPLC, GC, Paper, Gel electrophoresis – their principles, instrumentation, calibration, operation, sample preparation and interpretation of results., Titrimetric methods – neutralization (aqueous and non-aqueous), redox, precipitation, complexometric, iodometric and iodimetric titrations: – their principles, applications, assay techniques., Limit tests, microbiological assay, determination of water content, methoxyl groups; T.L.C, paper and column chromatographic techniques and their applications.

**Reference books:**

Willard H H "Instrumental Methods of Analysis" CBS, 7<sup>th</sup> Ed. 1988.

Beckett and Stenlake J.B.

'Practical Pharmaceutical Chemistry' – 4<sup>th</sup> Ed. Part I & II, 1997.

**Pharmacology and Toxicology :**

Introduction, Scope and principles of basic pharmacology and toxicology, mechanisms of drug action, receptors and drug action, pharmacodynamic parameters affecting drug- receptor interaction, Pharmacokinetics and Pharmacodynamics., Cholinergic drugs, cholinergic blockers, adrenergic drugs and their blockers, ganglionic and neuromuscular blocking agents – their mechanisms action., General and local anesthetics, anxiolytics, sedatives and hypnotics, antipsychotics and antidepressants, narcotic and non-narcotic drugs, NSAID's, CNS stimulants anti-convulsants, anti-parkinsonics agents, their mechanisms., Cardiotonics, antianginals, antihypertensives, diuretics, anti arrhythmic, drugs for blood disorders – their mechanisms., Principles of Chemotherapy, classification of chemotherapeutic agents, folate antagonists, protein, cell wall synthesis inhibitors, quinolone antibiotics, drugs for UTI, antifungal, antiviral, antitubercular, anthelmintics, antimoebics, anti-cancer drugs.

**Reference books:**

Goodman & Gilman's "The Pharmacological Basis of Therapeutics' - Fundamentals, 10<sup>th</sup> Ed., McGraw Hill, 2001.

M J Mycek et.al., Lippincott's Illustrated reviews – Pharmacology-Lippincott-Ramen-III Ed. 2001.

**Pharmaceutical Microbiology and Biochemistry :**

Introduction and classification of microbes, bacteria, virus, fungi, protozoa – physiology and cellular

function, infections and immunity, microbials in antibiotic and vaccine preparations., Nutritional requirements and cultivation of microbes, culture media types, physical and chemical methods of microbial control, staining techniques, sterility testing and their validation, sterilization methods and applications., Microbial mechanisms of human pathogenicity, diseases of the skin, CNS, GIT, Respiratory Tract, immune system disorders, antimicrobial drugs and their evaluation., Carbohydrates Lipids, Proteins, Nucleic acids: their structures, biosynthesis, biochemical energetic functions, clinical pathology, deficiency disorders., Enzymes and their regulation; classification, structures, kinetics, inhibition mechanisms, applications.

**Reference books:**

Microbiology – An introduction – 8<sup>th</sup> Ed. Tortora, et.al Pearson Pub., 2004.

Prescott et.al Microbiology' 6<sup>th</sup> Ed. McGraw Hill, 2005.

“ Lehniger Principles of Biochemistry” – David L Nelson W.H, Framan & Co, 4<sup>th</sup> Ed. 2004.

**Forensic Pharmacy and Quality Control Management :**

Regulatory control of manufacturing and sales of pharmaceuticals and cosmetics, Drugs & Cosmetics Act, Medicinal and Toilet Preparations Act, Narcotics and Psychotropic Substances Act., Regulatory control of teaching and practice of Pharmacy: Pharmacy Act, Objectionable Advertisements Act, Shops and Establishments Act, Drug Price Control Order, Quality Assurance and Quality Audit: QC/QA functions, GLP, Quality audit, ISO certification, Good Manufacturing Practices: All aspects of good manufacturing practices, documentation, protocols involved, design of premises., Pharmaceutical Management: Planning, organizing, controlling of pharmaceutical manufacturing and marketing activities.

**Reference books:**

B.M. Mittal – Textbook of Forensic Pharmacy Vallabh Prakashan, 10<sup>th</sup> Ed., 1999.

Khanna O.P., Industrial Engineering and Management, Dhanpat Rai Rev.Ed. 1999.

Willing, etal, Good Manufacturing Practice for Pharmacy: A plan for Total Q.C, Marcel Dekker, 5<sup>th</sup> Ed., 2001.

**Industrial And Physical Pharmacy :**

Physicochemical properties of Pharmaceutical agents, Rheology, Interfacial phenomenon, Micromeretics, Raw materials and Materials of construction of equipments., Kinetic Phenomenon, Chemical Kinetics, Stability testing, Dissolution, Diffusion., Materials of construction, Extraction, Communion, Mixing., Heat transfer, Distillation, Evaporation, Drying, Fluid Flow, Humidification, Dehumidification., Filtration, Crystallization, Compression

**Reference books for:**

Aulton M.E – ‘Pharmaceutics -The Science of Dosage Form Design-Churchill Livingston, 2<sup>nd</sup> Ed. 2002 or ELBS, I Ed.

Lachmann, L. and Others – Theory and Practice of Industrial Pharmacy Lea Feberger 3<sup>rd</sup> ed. 1986.

**Pharmaceutical Formulations and Biopharmaceutics :**

Preformulation studies, Physicochemical properties of drugs and their impact on design of drug delivery systems, classification of dosage forms; Design, Preparation, Evaluation of Pharmaceutical Dosage Forms: Tablets, Solutions, Capsules ,Micro-encapsulation techniques;, Design, Preparation and Evaluation of Novel Drug Delivery Systems such as : Sustained Release, Controlled Release, Transdermal and Transmucosal, Ocular., Parenteral Products: Sterilization methodology, calculations, evaluation and preparation., Biopharmaceutics: ADME characteristics of drug and their importance in disease conditions, Pharmacokinetic drug interactions, bio-equivalence and bio-availability studies,

Prodrugs.

**Reference books:**

Mittal B.M., - Text book of Pharmaceutical Formulation – Vallabh Prakashan 6<sup>th</sup> Ed. 1997.

Brahmanker et al – Biopharmaceutics and Pharmacokinetics - A Treatise, Vallabh Prakashan, 1995.

**Dispensing Pharmacy :**

General Dispensing Procedures, Latin terms and Abbreviations, Pharmaceutical Calculations, Posology., Disperse Systems: Suspensions, Emulsions, Creams: General methods of manufacturing, problems associated with stability., Semi-solid Preparations like Ointments, Gels, Pastes, Suppositories and Pessaries: General methods of manufacturing, problems associated with stability., Incompatibilities involved in prescriptions and usage of additives., Containers and Closures: selection of appropriate containers and closures, Hospital Pharmacy Practice.

**Reference books:**

Cooper and Gunn – Dispensing for Pharmaceutical students – CBS, 12<sup>th</sup> ed., 1987.

**Computer Science**

**Discrete Mathematics & Theory of Computation:**

Principles of Counting, Recurrence Relations., Sets, Functions, Relations, Propositional Logic and Predicate Logic., Strings and Languages, Regular Expressions, Finite Automata., Context Free Grammars and Pushdown Automata., Turing Machines and Decidability. Recursive Languages and Recursively Enumerable Languages.

**Reference books:**

Mott, Kandel, and Baker. Discrete Mathematics for Computer Scientists & Mathematicians, PHI 2003.

Harry Lewis and Christos Papadimitriou. Elements of the Theory of Computation 2<sup>nd</sup> Edition, Pearson Education.

**Data Structures and Algorithms :**

Algorithm Analysis, Asymptotic notion, Sorting – Comparison based Sorting, Distribution Sorting, External Sorting., ADTs, stacks and queues. Searching-lists, sequences, dictionaries and hash tables. Priority queues and heaps., Trees – Traversals and applications. Binary Trees – Structure, Representation and Search. Search Trees – Binary Search Trees, Balanced Search Trees (AVL, Red-black). Multi-way Trees and Trees for External Storage., Graphs – Structure and Representation, Traversals, Path Problems, Spanning Trees, Flow Problems., Design techniques-greedy method, divide and conquer, dynamic programming, and backtracking. Complexity classes-P and NP. Reductions, NP-hard problems and NP-completeness.

**Reference books:**

Cormen T.H., Leiserson, C.E., Rivest, R.L., and C. Stein. Introduction to Algorithms, MIT Press, 2<sup>nd</sup> Edition.

**Digital Electronics and Microprocessors:**

Combinational Logic Design, Adders, Multiplexers, De-Multiplexers, Encoders, Decoders. Sequential Logic Design, Counters, Registers., Programmable Logic Devices and Logic Families., 8085, 8086 architecture and assembly programming., Memory interfacing ,Programmable peripheral devices and interfacing (8253, 8255,8259, 8251).

**Reference books:**

Digital Design by M. Morris Mano, Third edition, Pearsoned

The Intel Microprocessors by Barry B Brey, Seventh edition, PHI

**Operating Systems:**

Tasks, Processes, and Threads. Process States & Transitions. Process organization. Process Scheduling.

Concurrency, Mutual Exclusion, Process synchronization, Deadlock and Deadlock handling., Memory allocation, Paging and Segmentation. Locality. Virtual memory. Frame allocation and Page replacement algorithms. Thrashing., File systems - Interface, Structure and Implementation., I/O system. Secondary Storage and Mass Storage Structure.

**Reference books:**

Silberschatz, A and Galvin, P.B. "Operating System Concepts" 7th edition, Addison Wesley, 2005.

**Computer Organization and Architecture :**

Instruction Set Architecture - RISC & CISC processors., Computer Arithmetic & Control Unit., Cache Memory & Main Memory., I/O, Secondary Memory, RAID System, Bus & Interconnections., Pipelining, Superscalar Processors, and Introduction to Parallel Processing.

**Reference books:**

William Stallings, "Computer Organization and Architecture", Seventh Ed., Pearson Ed., 2006.

**Computer Networks:**

Physical Layer (Basics, Encoding schemes, Wireline and wireless Transmission media, Wireless and Wireline Protocols), Data Link Layer (Basics, Wireless and Wireline Protocols, Performance, Security), Network Layer (Basics, Protocols, Performance, Security), Transport Layer (Basics, Protocols, Performance, Security), Application Layer (Basics, Protocols, Performance, Security).

**Reference books:**

A.S. Tanenbaum, "Computer Networks", Fourth Edition, PHI / PE, New Delhi, 2006.

**Database Management Systems :**

Data Modeling – ER Model, Relational Model, Object-oriented Model, Object-relational Model., Query Languages – Relational Algebra, Relational Calculus, & SQL., Normalization & Indexing – Functional Dependencies (FDs), Closure of set of FDs, Attribute Closure, Canonical Cover, Normal forms upto 4NF. Primary, Clustering, & Secondary Indices, Tree-based Indexing., Query Evaluation & Optimization: Algorithms for evaluation of relational operators, Cost-based & heuristic query optimization techniques., Transaction Management – Concurrency: Locking & Timestamping & Crash Recovery: Log-based & Shadow Paging.,

**Reference books:**

Ramakrishna R. & Gehrke J, *Database Management Systems*, 3e, Mc-Graw Hill, 2003.

Silberschatz A, Korth H F, & Sudarshan S, *Database System Concepts*, 5e, TMH, 2005.

**Programming Languages and Compiler Construction:**

Imperative Programming Languages – Control Abstraction and Statements, Data Types and Data Representations., Imperative Programming Languages – Procedure Calls, Call Stack, Parameter Passing, Scope and Lifetime of Variables, Dynamic Memory Allocation., Syntax Analysis – Lexical Analysis, Parsing (Top-down and Bottom-up Parsing), Abstract Syntax and Symbol Tables., Semantic Analysis. Types, Representations and Type Checking. Syntax Directed Translation. Intermediate Code., Code Generation – Basic Blocks and Flow Graphs, Register Allocation and Assignment, Code

Generation Techniques.

**Reference books:**

Sethi, R., Programming Languages - Concepts & Constructs, 2<sup>nd</sup> Ed., Addison-Wesley, 1996. (Indian reprint 1999).

Aho, A. V., Sethi, R., and Ullman, J. D., Compilers - Principles, Techniques and Tools, Addison-Wesley, 1988. (Indian reprint 2000).

**Software Engineering:**

Software Development – Lifecycle, Process Models, Project Management., Requirements Analysis, SRS, Structured Analysis, Object Oriented Analysis and Modeling based on UML., Structured Design, Object Oriented Design, Architectural Design, Design Patterns, Use of UML in Design., Software Testing – Black Box and White Box Testing, Test Cases, Testing Process, Testing for object oriented applications and Testing for web applications., Software Metrics and cost Measurement. Product and Process management. Software complexity. Software coding styles., Quality attributes and CMM Model.,

**Reference books:**

Pressman, R.S., Software Engineering: A Practitioner's Approach, MGHISE, 6th Ed. 2004.

**Artificial Intelligence:**

Searching Strategies., Knowledge Representation., Reasoning (Certainty and Uncertainty based), Machine Learning., Multiagent Systems.

**Reference books:**

Russell and Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, PE.

**Instrumentation**

**Analog Electronics:**

Operational amplifier basics, ideal and practical Op-amp configurations, Special purpose linear Op-amp circuits: instrumentation amplifiers, isolation, programmable, Negative feedback amplifiers etc., Active filters, IC filters; Non-linear operational amplifier circuits, analog multipliers, precision and wave shaping circuits, Comparators and Schmitt triggers and applications, Signal generators: sinusoidal and non-sinusoidal oscillators, integrated circuits timers. function generators, PLL, Voltage Regulators; Voltage regulator IC, Switched capacitor voltage converters, Switching regulators, Power amplifiers and output stage circuits, IC power amplifiers, High frequency amplifiers, Tuned amplifiers.

**Reference books:**

L K Maheshwari & M M S Anand "Analog Electronics" PHI Private Ltd. 2005.

Adel S Sedra & K C Smith" Microelectronic Circuits" OUP, 5<sup>th</sup> edition, 2005.

**Digital Electronics & Computer Organization:**

Number systems & Codes, Boolean algebra & Simplification, Digital Logic Families, Combinational logic Design – Decoders, Encoders, MUX, DeMUX, Arithmetic Circuits, Sequential Logic design- Flip-flops, State machines, ASM

Counters & Registers, PLDs & FPGAs & Computer Organization.

**Reference books:**

M. Morris Mano, " Digital Design", PHI, 3<sup>rd</sup> Edition, 2002.

**Microprocessors:**

Architectures of Intel - x85 & x86 Processors, Instruction set & Assembly Language programming, Memory Interfacing, Data Transfer Schemes, Peripherals & I/O Interfacing using 8255, 8253, 8251, Disk Organization

**Reference books:**

Barry B Brey, C R Sarma, The Intel Microprocessors. Pearson, Sixth Ed. 2005.

**Circuits & Signals, Digital Signal Processing:**

Linear convolution, Fourier Transforms, DFT & FFT, Laplace Transforms & its application to system analysis, Z-transform & its application to system analysis, Analog & digital filter design (FIR, IIR), Multirate signal processing.

**Reference books:**

B P Lathi " Signal Processing & Linear Systems" Oxford Univ. Press, 2004.

2.Sanjit K Mitra " Digital Signal Processing" Tata MCGra Hill 3 rd Edition, 2006.

**Electrical Sciences:**

Basic Circuit elements and laws, Analysis Techniques & Theorems, Time-domain analysis of 1<sup>st</sup> & 2<sup>nd</sup> Order Circuits, AC Circuit Analysis, Frequency domain analysis, Series and Parallel RCL Circuit, Important Power Concepts, Semiconductors, Construction, operation and application of Junction Diode, Zener Diode, Transistor (BJT's), FET's, MOSFET etc., Feedback in Amplifier Circuits, AC Generation and Magnetic Circuits, Single- phase circuit analysis, Magnetic Circuit Calculations, Three- phase Circuit analysis, Electrical Machines (Construction, Operation & usage), Transformers, DC Machines, Three-phase synchronous generator, Three-phase induction motors, Single-phase induction motor, Fractional KW motors.

**Reference books:**

Leonard S Bobrow " Fundamental of Electrical Engineering" OUP, 2<sup>nd</sup> ed.,1996.

**Electronic Devices & Integrated Circuits, Microelectronics Circuits:**

Semiconductor materials and their properties, Carrier transport and excess carriers in semiconductors; Single p-n junction devices- rectifier diodes, Switching diodes, Microwave diodes, Optoelectronic devices, Bipolar junction transistors; JFET; MOSFET; MOS and CMOS devices; Device fabrication techniques and introduction to ICs, Basic single and two stage transistor amplifier; Current mirrors and current sources; Active load biasing in integrated circuits, Voltage sources and voltage references, Ddifferential and multistage amplifiers; Frequency response and frequency compensation, Operational amplifiers-2 stage, Stability analysis and compensation techniques.

**Reference books:**

B G Streetman & Sanjay Banerjee" Solid state Electronic Devices" PHI? Pearson Edu, 6<sup>th</sup> ed.,2006.

Adel S Sedra & K C Smith" Microelectronic Circuits" OUP, 5<sup>th</sup> edition,2005.

**Control Systems, Power Electronics:**

Mathematical model of physical systems (Differential equations, Block diagram, signal flow graph, transfer function) feedback characteristics of control systems, control systems components, Time response analysis, stability, Root locus concepts, frequency response (Bode plots, Polar plots, Nyquist plots), state space analysis and compensation concepts, Converters, Inverters and Choppers, Step up

chopper, inverters.

**Reference books:**

I. J. Nagrath & M Gopal “ Control Systems Engineering” NAIL, 5<sup>th</sup> Edition, 2007.

N. Mohan, T.M. Undeland, W.P. Robbins, John Wiley, 3 rd edition.

**Industrial Instrumentation & Control, Analysis Instrumentation**

Elements of process control loop, mathematical modeling, dynamic closed loop characteristics, Controller principles & tuning, DDC loop, Hydraulic, Pneumatic, Electronic controller, Complex multivariable control schemes, final control elements, PLCs, DCS, SCADA, AI techniques: Expert system, ANN, Fuzzy Logic, UV/VIS/IR Spectrophotometer, FES/AAS, X-ray analyzers, NMR, Mass spectrometers, Sampling systems for online analyzers, TC analyzer, Paramagnetic O<sub>2</sub> Analyzer, Fluid density monitors, GLC.

**Reference books:**

Curtis D. Johnson. “Process control instrumentation technology” Prentice Hall of India.

Stephanopolous George, “Chemical process controls.

Computer based industrial control by Krishan Kant, Prentice Hall of India

Analysis Instrumentation by R P Khare (CBS).

Handbook of Instrumental Techniques for analytical Chemistry by Frank Settle (Pearson).

**Transducers & Measurement systems :**

Generalized measurement system, functional elements, Static and dynamic characteristics, Resistive, inductive, capacitive, piezoelectric, Hall effect, photoelectric, fiber optic transducer, MEMS based transducers, Measurement of Motion, pressure, flow, temperature level, viscosity, pH, humidity, vibration, Signal conducting techniques using op-amps, instrumentation amplifier, bridges, carrier amplifier, chopper amplifier, charge amplifier and Isolation amplifier, Data converter, filters, Data acquisition system, inverse transducers & feed back measurement systems.

**Reference books:**

Measurement Systems, application and design by E.O Doebelin and Dhanesh N. Manik, Tata McGraw-Hill.

**Electronic Instruments and Instrumentation Technology + Medical Instrumentation**

Electronic indicating, display, Recording & Analysis instruments, Signal generators, Frequency synthesizers, Counters, Grounding and Shielding techniques, Instrumentation in hazardous areas, Industrial data communication, Transducers for biomedical measurements, Cardio vascular measurements, Patient care monitoring systems, Instrumentation for respiratory and nervous system, clinical lab measurements.

**Reference books:**

Electronic Instruments and Instrumentation Technology by M.M.S. Anand, Prentice Hall of India.

Biomedical Instrumentation and measurements, by L. Cromwell, et al. PHI.

Introduction to Biomedical equipment & Technology, J.J Carr and J.M. Brown (Pearson).

**Biological Sciences**

**Genetics :**



Laws of inheritance and genetic interaction, Genetic mapping in Virus. Bacteria, & Eukaryotes, Gene expression in prokaryotes and eukaryotes, Control of gene expression in prokaryotes eukaryotes and Viruses., Population and evolutionary genetics

**Reference books:**

Principles of Genetics –Robert H. Tamarin, 7<sup>th</sup> edition, Tata McGraw – Hill,2002.

**Molecular Technique:**

Restriction endonucleases, Vectors and cloning, Blotting technique, PCR, Sequencing

**Reference books:**

Principles of Gene Manipulation- R.W.Old & S.B.Primrose, 7<sup>th</sup> Edition

**Biological Chemistry:**

Chemistry of Biomolecules, Enzymes, Vitamins & Coenzymes, Bioenergetics and biological oxidation, Metabolism of Biomolecules, Photosynthesis

**Reference books:**

Principle of Biochemistry-Lehninger, Macmillan Worth Publication, 3<sup>rd</sup> edition

**Microbiology:**

Fundamentals of Microbiology, A survey of the microbial world, Host-Microbe interaction, Microbes and Human disease, Environmental and applied microbiology

**Reference books :**

Microbiology-An introduction (8<sup>th</sup> edition)- Tartora,Funk & Cane-Pearson publishing house.

**Ecology :**

Abiotic factors, Ecosystem ecology and energy flow, Community ecology and population ecology, Regional Ecology (Terrestrial and Aquatic), Regional Ecology (Terrestrial and Aquatic)

**Reference books :**

Concepts of Ecology by E J Kormondy

Fundamentals of ecology by E. P. Odum .

**Plant Physiology :**

Transport and translocation of water and solutes, Essential elements and their function, Plant development and PGRs, Ascent of sap and translocation in phloem, Movement in plants

**Reference books:**

Plant physiology, 3<sup>rd</sup> edition by Salisbury & Ross- CBS Publisher and Distributor.

**Biophysics :**

Chemical properties of basic unit of life, energy forces, bonds., Conformation of Biomolecules, Biological membranes and Biomechaniques, Physiochemical techniques to study biomolecules, X-ray crystallography, NMR, molecular modeling.

**Reference books :**

Biophysical chemistry by Cantor and Schimmel.

Biophysics by Rodney Cotteril.

### **Developmental Biology :**

Model systems- Vertebrates, Invertebrates and Plants, Axis and germ layers, The mesoderm and early nervous system, Morphogenesis and cell differentiation, Organogenesis, germ cells and sex.

#### **Reference books:**

Principles of Development –Lewis Wolpert-Oxford University Press, 2<sup>nd</sup> edition

### **Cell Biology:**

Preview of cell, cellular membranous systems, Transport, Mitochondria, Chloroplast, energy transducing organelle, Golgi, Nucleus, Cytoskeletal network, Cell growth & proliferation, Cell Immunity

#### **Reference books:**

Cell and Molecular Biology-Philip Sheeler & Donald E. Bianchi. 3<sup>rd</sup> edition, John Wiley Publication.

### **Animal physiology:**

Digestive and Respiratory system, Circulatory system, Excretory system, Nervous and Endocrine system, Body Immune system

#### **Reference books :**

Animal Physiology by Sherwood et al, 1<sup>st</sup> edition- Thomson Publication. Animal Physiology by Sherwood et al, 1<sup>st</sup> edition- Thomson Publication.

## **Chemistry**

### **Chemical Kinetics:**

Integrated rate laws for simple and complex reactions. Integrated rate laws in terms of properties dependent on concentrations of reactants and/or products. Effect of temperature on reaction rates, Theories of reaction rates: Collision theory and transition state theory, Rate laws and reaction mechanism. Unimolecular, bimolecular and trimolecular reactions. RRK theory of unimolecular reaction, Reactions in solution. Reactions in excited state. Fast reaction kinetics, Homogeneous and heterogeneous catalysis

#### **Reference books:**

Principles of Genetics –Robert H. Tamarin, 7<sup>th</sup> edition, Tata McGraw –Hill,2002.

### **Chemical Thermodynamics:**

Concept and laws of thermodynamic, Thermodynamics of gases, Thermodynamics of non-ideal and electrolyte solutions, Statistical thermodynamics, Non-equilibrium thermodynamics

#### **Reference books:**

Ira N. Levine, Physical Chemistry, Tata McGraw Hill, 2002, 5<sup>th</sup> edition

Donal A. McQuarrie & J. D. Simon, Molecular Thermodynamics Viva Book Pvt Ltd., New Delhi, 2004

R. C Srivastava, S K Saha, A K Jain, Thermodynamics, 2004

**Quantum chemistry and atomic and molecular structure:**

Mathematical and Physical Foundations of Quantum Chemistry, Simple potential problems in one, two and three dimension including particle in a box, harmonic oscillator, potential barrier, rigid rotator hydrogen atom, He-atom, effective nuclear charge, Slater orbitals, electron spin, Solution of Hartree-Fock equation for He-atom, self-consistent field, Two electron system, Slater determinants, Hartree-Fock method, Approximation methods, variation, perturbation theory angular momentum, Atomic structure, Molecular structure,

**Reference books :**

'Quantum Chemistry', Donald A. McQuarrie, University Science Books (First Indian Edition 2003, Viva Books Private Limited).

'Quantum Chemistry', Ira N. Levine, Pearson Education Inc. (2000) (First Indian Reprint, 2003. Molecular Quantum Mechanics", P.W. Atkins and R.S. Friedman, 3<sup>rd</sup> Ed. OUP (1997). [4<sup>th</sup> ed. Has come out].

Elementary Quantum Chemistry" F.L. Pilar, 2<sup>nd</sup> ed., McGraw Hill (1990).

Quantum Chemistry", John P. Lowe, 2<sup>nd</sup> ed., Pearson Education Inc.

**Structure and Reactivity of Organic Compounds :**

Aliphatic & Aromatic Nucleophilic Substitutions, Aromatic Electrophilic Substitution, Addition to carbon-carbon multiple and carbon-heteromultiple bonds, Eliminations, Orbital symmetry in organic reactions

**Reference books:**

March Jerry, Advanced Organic Chemistry, John Wiley & Sons, 4<sup>th</sup> edition, 1992

Morrison and Boyd, Organic Chemistry, Prentice & Hall, 6<sup>th</sup> edition, 1992

**Instrumental methods of analysis:**

Magnetic Resonance Spectroscopy (<sup>1</sup>H NMR, <sup>13</sup>C NMR, EPR), IR Spectroscopy, Mass Spectrometry, Ultraviolet and visible spectroscopy, fluorescence spectroscopy, chromatography and other separation techniques, Structure Resolution by combination of techniques.

**Reference books :**

William Kemp, "Organic Spectroscopy", Macmillan, 3<sup>rd</sup> ed. , 1991

**Bonding in inorganic compounds:**

Point Groups and Molecular Symmetry, Character Tables and applications of point group symmetry, Ionic bond; Polarization, Covalent bond; VB and MO theories, Coordination Compounds bonding and spectra.

**Reference books:**

Huheey, J. E. and others, "Inorganic Chemistry", Pearson Edu., 4<sup>th</sup> ed., 1993

**Chemical experimentation :**

Acid base titrations, Complexometric titrations, Synthesis of organic compounds and functional group identification, Study of kinetics of chemical reactions, Determination of partition function, Adsorption isotherm, Synthesis and characterization of nanomaterials, Qualitative analysis of salts/mixture of salts

**Reference books:**

Vogel's textbook of practical organic chemistry 5<sup>th</sup> edition

Vogel's textbook of quantitative inorganic analysis

Vogel's qualitative inorganic analysis, 7<sup>th</sup> edition

**Synthetic organic Chemistry:**

One Group C-X Disconnections, Two Group C-X Disconnections, One Group C-C Disconnections, Two Group C-C Disconnections, Ring Synthesis and Synthesis of Heterocyclic Compounds.

**Reference books :**

R.O.C.Norman, Principles of Organic Synthesis, 2<sup>nd</sup> edition., Chapman & Hall, 1978.

W.A.Smit, A.F.Bochkov and R.Caple, Organic Synthesis: The Science Behind the art, 1<sup>st</sup> edition, The Royal society of chemistry, 1998.

Stuart Warren, Designing Organic Syntheses: A Programmed Introduction to the Synthron Approach, John Wiley and sons Ltd., 1978.

**Basic organic and inorganic chemistry:**

Stereochemistry (Isomerism, chirality, origin of optical activity, stereochemistry of cyclic compounds, resolution), Conformations (Rotation around sigma bonds, conformational analysis of butane, cyclohexane, and substituted cyclohexanes.), Name reactions (Diels Alder reaction; Friedel-Crafts(acylation and alkylation) reaction; Clemmensen reduction; Wittig reaction; Claisen condensation; Hofmann and Cope eliminations), Co-ordination chemistry, Chemistry of main group elements.

**Reference books:**

W. Graham Solomons and Craig B. Fryhle, 'Organic Chemistry', 8<sup>th</sup> Edition, John Wiley & Sons, Inc. New York, 2004.

J.D. Lee, 'Concise Inorganic Chemistry', 5th edition, Blackwell Science, Oxford, 1999.

**Chemistry of Organic Compounds :**

Carboxylic acid and carboxylic acid derivatives, Chemistry of aliphatic and aromatic amines, Structure, property and reactions of five and six membered heterocyclic compounds containing O, N and S., Organometallic compounds in organic synthesis: Organolithium, Organomagnesium, Organozinc and Organocopper, Carbohydrates

**Reference books:**

F A Carey, Organic Chemistry, 5<sup>th</sup> Edition, Tata McGraw-Hill Publications Company Ltd., 2003.

P A Bruice, Organic Chemistry, 3<sup>rd</sup> Edition, Reason Edution, Inc. 2001.

Wade, Organic Chemistry, 5<sup>th</sup> Edition, Reason Edution, Inc. 2003

**Economics**

**Principles of Economics :**

Demand, Supply, Elasticity, Consumer Behavior, Analysis of Production and Cost Analysis, Markets, Basics of Macro economics, Economics of Public Goods

**Reference books:**

Lipsey R G & Chrystal K A Economics OUP, 10<sup>th</sup> ed. 2004

**Fundamentals of Finance & Accounting:**

Basics of Accounting, Financial Statements and Analysis, Introduction to Securities, markets and analysis, Banking System, RBI, Non-bank financial intermediaries, Markets for Future, Options & Derivatives; Foreign Exchange Markets

**Reference books :**

Horngren, Sundem, and Elliott, Introduction to Financial Accounting, Pearson Education India Ltd. 8<sup>th</sup> ed. 2004

Bhole L.M, Financial Institution & Market Structure: Growth & Innovation, Tata McGraw Hill, 4<sup>th</sup> ed. 2004.

**Microeconomics :**

Theory of Consumer Behaviour, Topics in Consumer Theory, Theory of Firm, Theory of Market Structure, General Equilibrium, Welfare Economics, Externalities, Common & Public Goods

**Reference books**

Henderson J M and Quandt R E , Microeconomic Theory : A Mathematical Approach , McGraw Hill 3rd ed. 1980.

**Macroeconomics:**

Macroeconomic System- Measurement, I-O System, Flow of Funds, Keynesian System – Demand, Money, Interest , Income, Output, Inflation& Unemployment, Money Supply, Consumption and Investment, Consumption and Investment

**Reference books :**

Froyen, Richard T Macroeconomics: Theories & Policies Pearson Education, 8<sup>th</sup> ed. 2005.

**Econometrics :**

Basics of Statistics, OLS, ,k-variable Linear Equation, General Linear Model, Violation of classical Assumptions, Heteroscedasticity, Autocorrelation, Multi co linearity, ARIMA Model, Time Series Analysis, Simultaneous Equation System

**Reference books :**

Johnston J and John Dinardo, Econometric Methods McGraw Hill International, 4<sup>th</sup> ed. 1997.

**Money Banking & Financial Markets :**

Money and its Functions, Money Markets, Financial Markets and Financial Institutions, Foreign Exchange Markets, International Monetary Financial System, Banking Business, Bank Management , Financial Derivatives, Money, prices, economic activity; IMF

**Reference books :**

Mishkin, Frederic S The Economics of Money, Banking and Financial Markets: A Global Perspective Addison Wesley, 7<sup>th</sup> ed. 2004.

**Public Finance – Theory and Practice :**

Scope of Public Finance, Allocation, Distribution & Public Choices, Equity in Distribution, Public Choice & Fiscal Policy, Public Expenditure – Structure, Growth & Evaluation, Public Revenue, Principles of Taxation, Role of Fiscal Policy in India, Budgeting in India

**Reference books:**

Musgrave, R.A and Musgrave, P.B Public Finance : Theory and Practice McGraw Hill Book Co. 1999.

**Economics of Growth and Planning :**

Economic Growth Models – Harrod-Domar, Neo-classical, Two sector Models, The Fel'dman Model of Economic Growth, Samuelson Model of Economic Growth, Kaldor's Model of Income, Population, Environment, Inequality and Development, Planning in India

**Reference books :**

Jones H.G. An Introduction to Modern Theories of Economic Growth, McGraw Hill, Kogakusha Ltd. 1976.,  
Devraj Ray Development Economics OUP, Delhi 1998

**International Trade and Balance of Payments:**

International Economics, Trade Theories, International Trade – Comparative Advantage, Heckscher – Ohlin (H-O) Model, Modern Theories of International Trade, Tariffs, Quotas, FDI, BOP, GATT, WTO, International Monetary System

**Reference books:**

Salvatore.D. International Economics WSE 8<sup>th</sup> ed. 2004

**Issues in Indian Economy:**

India's Economic Growth & Development, Significant Aspects of Indian Economy – Agriculture, Infrastructure, Private & Public Sector, Industrial Growth, Import- Exports, Unemployment, Commercial Banking & Finance, Inflation & Income Growth, Money Supply, Monetary Control, India's Trade, External Aid, Public Debt

**Reference books:**

Agarwal.A.N, Indian Economy – Problems of Development & Planning  
Wishwa Prakashan, A division of New Age International(P) Ltd.,2005

**Mathematics**

**Algebra I**

Groups, Subgroups, Normal Subgroups, & Quotient Groups, Homomorphisms & Automorphism, Permutation groups, Cauchy Theorem & Sylow Theorem, Rings, Ring Homomorphisms, Ideals & Quotient Rings, Euclidean Rings, Unique Factorization domain, Polynomial Rings.

**Reference books:**

Topics in Algebra by I.N. Herstein ,Vikas Publishing House Pvt Ltd.

**Algebra II**

**Fields, Extension of Fields & Roots of Polynomial, The Elements of Galois Theory, The Algebra of linear Transformations, Minimal polynomials & characteristic roots, Triangular, Nilpotent & Jordan Canonical Forms**

**Reference books:**

Topics in Algebra by I.N. Herstein ,Vikas Publishing House Pvt Ltd

**Elementary Real Analysis**

Countable & Uncountable sets, Sequence of real numbers, Limsup & liminf., Metric space, Open & closed sets, limit point, compact sets in  $R^n$ , Metric space, Open & closed sets, limit point, compact sets in  $R^n$ , Continuous Functions, continuity and compactness, functions, Riemann Integral & Riemann Stieltjes Integral, Sequence & Series of Functions

**Reference books :**

Principle of Mathematical Analysis by Rudin, Mc-graw hill Publishers

**Measure and Integration**

Lebesgue measure, measurable sets, Measurable function, Riemann and Lebesgue , integral and its properties, Differentiation, Function of Bounded variations,  $L_p$  – spaces, Different modes of convergent

**Reference books :**

Lebesgue Measure and Integration by P.K.Jain & V.P. Gupta, New Age International Ltd, 1986

**Introduction to Topology**

Topological spaces; Special topologies, Subspaces; Product spaces & Quotient spaces, Continuity & homeomorphisms, Connectedness & Compactness, Fundamental Groups of Surfaces

**Reference books :**

J. R. Munkres: Topology, Pearson Publication.

**Introduction to Functional Analysis**

Vector spaces, dimension, infinite dimensional vector spaces, Normed linear spaces, Riesz Lemma, Banach spaces, Normed linear spaces  $l_p$ ,  $C_0$ ,  $C[a,c]$ , Continuous linear transformations on normed linear spaces, Inner product spaces, Hilbert spaces, orthogonal sets direct sum, Bessels Inequality, Riesz Representation theorem, uniform boundedness principle, open mapping theorem, closed graph theorem.

**Reference books:**

Limaye : Introduction to Functional Analysis , New Age international Publishers 2000.

**Differential Geometry**

Plane curves, Space Curves, Surfaces and Curvatures, First & Second Fundamental Forms, Geodesics

**Reference books :**

Pressly: Elementary Differential Geometry, Springer –Verlag

**Optimization**

Modeling with linear programming, General L.P.Solution, The simplex method, Duality and post optimal analysis, Transportation model and its variants, Goal Programming and Integer linear programming, Non linear programming Algorithms,

**Reference books:**

Operations Research: An Introduction by Hamdy A Taha 8/E, Prentice Hall India/Pearson Education

**Operations Research**

Queuing Systems: Poisson Queuing Systems, Reliability: Reliability & hazard rate function of series and parallel systems, Inventory Systems: Single item Inventory models, Simulation & Game Theory, Network Models and Deterministic Dynamic Programming.

**Reference books:**

Operations Research Vol.III, EDD Notes; S.Venkateswaran & B. Singh

Operations Research: An Introduction by Hamdy A Tah

### **Numerical Analysis**

Computer arithmetic and errors, solving nonlinear equations, Solving set of Equations, Interpolation, Numerical differentiation and numerical integration, Numerical solution of ordinary differential equations

#### **Reference books :**

Applied Numerical Analysis by Gerald and Wheatley 6/E, Pearson Education

## **Physics**

### **Modern Physics**

Special Theory of Relativity, Particle-like Properties of Waves, Wave-like Properties of Particles, Heisenberg Uncertainty Relation, Bohr's Model of Hydrogen-like Atoms, Schrodinger Equation, Particle in One-dimensional Potential, Particle in One-dimensional Potential, Many Electrons Atoms, Physics of Molecules, Nuclear Transformations

#### **Reference books :**

R. Eisberg & R. Resnick, Quantum Physics of Atoms, Molecules & Solids, WSE, 2<sup>nd</sup> ed., 1985

Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill, 6<sup>th</sup> ed., 2005

### **Thermodynamics & Properties of Matter**

Thermometry, Thermal Expansion, Heat, Work and the First Law of Thermodynamics, Second Law of Thermodynamics, Heat Engines and Entropy, Kinetic Theory, Phase Transformations, General Properties of Matter

#### **Reference books :**

Zemansky & Dittman, Heat & Thermodynamics, 6<sup>th</sup> ed., McGraw-Hill, 1981

### **Classical Mechanics**

Constraints, Generalized Coordinates, De-Alembert's principle, Lagranges Equations of Motion, Two-body Central force motion, Rigid Body Kinematics, Rigid Body Dynamics, Hamilton's Equations of Motion

#### **Reference books :**

H Goldstein, Classical Mechanics, Pearson Education, 3<sup>rd</sup> ed., 2002

### **Electromagnetic Theory**

Electrostatics in Free Space, Electrostatics in Matter, Magnetostatics in Free Space, Magnetostatics in Matter, Faraday's Law of Electromagnetic Induction, Maxwell's Equations, Conservation Laws, Electromagnetic Waves, Electromagnetic Potentials, Fields and Radiations

#### **Reference books :**

D. J. Griffiths, Introduction to Electrodynamics, Pearson Education, 3<sup>rd</sup> ed., 1999

### **Quantum Mechanics**

Schrodinger Equation, Eigenvalues, Eigenfunctions, Eigenfunction Expansion, Dirac Notation, Operator Methods, Harmonic Oscillator, Angular Momentum, Central Force Problem, The Hydrogen Atom, Spin,



Identical Particles, Time Independent Perturbation Theory

**Reference books :**

Richard L. Liboff, Introductory Quantum Mechanics, Pearson Education, 4<sup>th</sup> ed., 2003

Stephen Gasiorowicz, Quantum Physics, John Wiley & Sons Inc., 3<sup>rd</sup> ed., 2003

**Methods of Mathematical Physics**

Vector Analysis, Curvilinear Coordinates, Matrices and Vector Spaces, Functions of Complex Variables, Ordinary Differential Equations, Sturm-Liouville Theory and Special Functions, Elements of Partial Differential Equations

**Reference books :**

Mathew Jon & R. Walker, Mathematical Methods of Physics, Pearson Education, 2<sup>nd</sup> ed., 1970

Arfken & Weber, Mathematical Methods for Physicists, Academic Press, 6<sup>th</sup> ed., 2005

**Statistical Physics**

Elements of Probability Theory, Elementary Kinetic Theory, Microcanonical, Canonical & Grand Canonical Ensembles and Their Applications, Quantum Statistics of Ideal Bose Gases, Quantum Statistics of Ideal Fermi Gases

**Reference books :**

Pathria R K, Statistical Mechanics, Elsevier, 2<sup>nd</sup> ed., 1996

**Solid State Physics**

X-ray Diffraction and Crystal Structure, Lattice Dynamics, Free Electron Theory of Metal, Electron in Periodic potential, Energy Bands, Semiconductors, Superconductivity

**Reference books:**

Kittel C., Introduction to Solid State Physics, WSE, 7<sup>th</sup> ed., 1995

**Optics & Spectroscopy**

Geometrical Optics, Interference, Diffraction, Polarization, Crystal Optics & Lasers, Atomic & Molecular Spectroscopy

**Reference books:**

Ghatak, A K, Optics, Tata McGraw-Hill, 3<sup>rd</sup> ed., 2005

Banwell C N, Fundamentals of Molecular Spectroscopy, Tata Mc-Graw-Hill, 4<sup>th</sup> ed., 1994

**Nuclear & Particle Physics**

Nuclear Properties and Nuclear Models, Fission & Fusion, The Quark Model, Elementary Particles, their Classification and Interactions, Particle Accelerators, Conservation Laws of Elementary Particles and Fundamental Interactions

**Reference books :**

Krane K, Introductory Nuclear Physics, John Wiley & Sons, 1<sup>st</sup> ed., 1988

Griffiths, D J, Introduction to Elementary Particles, WIE, 1<sup>st</sup> ed., 1987



## SYLLABUS FOR SPECIAL TEST FOR SOFTWARE SYSTEMS

### Structured Programming in C

Control Constructs: Conditionals, Loops, and Jumps, Tuples, Unions, and Lists, Functions and Variables, Recursion, Memory Allocation model, Dynamic Memory Allocation – Pointers and Address Arithmetic, Dynamically Allocated Data and Linked Lists

### Advanced Programming in C

User Defined Types, Access Restricted Lists (Stacks/Queues). Binary Trees, Macros and Preprocessing, Modular Programming – Separate Compilation and linking. Libraries, File and I/O operations, String Processing

#### Reference books :

Brian W. Kernighan & Dennis M. Ritchie – The C Programming Language, Prentice Hall, Inc., 1988.

### Object Orientation and Software Engineering

Basics of OOP – Objects and Classes, and Delegation , Inheritance and Dynamic Binding. Types and Polymorphism. Templates/Generics. Software Lifecycle, Development Methodologies, Software Requirements Analysis and Modeling, Object Oriented Design, Design Patterns. Architectural Design, Modeling for Design. Software Testing and Quality

#### Reference books

Object Oriented Design and Patterns. 2<sup>nd</sup> Edition – Cay Horstmann. John Wiley

Software Engineering – A Practitioner's Approach. 6<sup>th</sup> Edition. Roger Pressman. McGraw Hill.

### Databases and Networked Systems

Database Modeling & Design – ER modeling, Normalization Techniques, Database Querying – SQL, Local Area Networks and Ethernet, Internetworking: TCP, UDP and IP, World Wide Web: Client-Server Systems, HTTP, HTML, XML, Web-based Systems.

#### Reference books

Database System Concepts. Silberschatz, Korth and Sudarshan. 5<sup>th</sup> Ed. McGraw Hill.

Computer Networks. A. S. Tanenbaum 4<sup>th</sup> Ed. Prentice Hall.

### Core Systems

Number Representations and Boolean algebra, Logic Gates, Combinational and Sequential Circuits, Computer Organization: Instruction Set. Computer Arithmetic, Control and Memory Organization, Operating Systems – Basics, Processes and Threads, Operating systems – Memory Hierarchy, Virtual Memory, Secondary Storage, File Systems, Local Area Networks and Ethernet, Internetworking: TCP/UDP and IP, World Wide Web: Client – Server Systems, HTTP, HTML, XML, Web-based Systems

#### Reference books :

R. E. Bryant and David O'Hallaron, "Computer. Systems: A Programmer's Perspective," Prentice-Hall