BITS Pilani

Pilani | Dubai | Goa | Hyderabad | Mumbai

An Institution of Eminence

Admissions Brochure

2026-27

Higher Degree (M.E./M.Pharm.)

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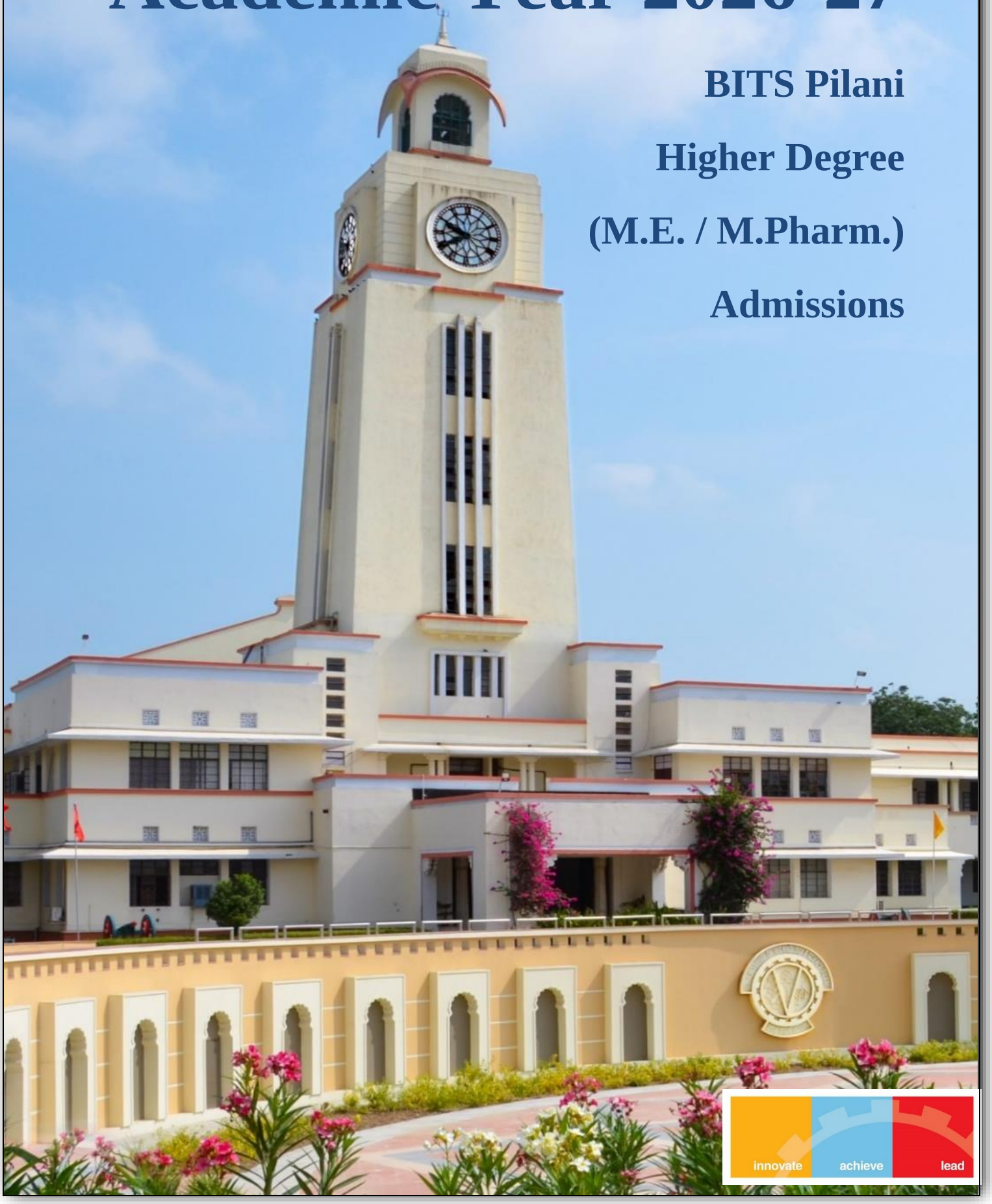
Academic Year 2026-27

BITS Pilani

Higher Degree

(M.E. / M.Pharm.)

Admissions



Brochure for BITS Pilani Higher Degree Admissions

Academic Year | 2026-2027

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BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

ABOUT BITS PILANI

BITS Pilani is a Deemed to be University, offering on-campus programs to more than 18,500 students across its campuses in Pilani, Goa, Hyderabad, Mumbai and Dubai.
It has been recognized as an Institute of Eminence by the Ministry of Education, Government of India in 2020.

In NIRF-2025 Rankings released by the Ministry of Education, Government of India, the institute has ranked the 7th position in the University category and secured 2nd in Pharmacy nationwide.

The institute also advanced to 11th in Engineering, 18th in Research Institutions, and 16th in Overall ranking.
In QS Asia University Rankings 2026, BITS has been ranked 154th in Asia and 12th in India. Further, BITS Pilani has been ranked among the top 300 in QS World University Graduate Employability Rankings 2022 and within top 6 in India.

Having pioneered several curricular and pedagogic attributes, BITS Pilani has a vision to be amongst the top research-led Institutes in the country. The qualities of innovation, enterprise, commitment to excellence, adherence to merit, and transparency, have characterized the Institute during its inexorable march to eminence.

The Institute currently has 629 ongoing projects across its campuses, with a cumulative sanctioned value of approximately ₹ 468 crores. State of the art facilities have been developed to support cutting edge research, led by students and about 930 faculty members, leading to a Scopus h-index of 156, with 221 patents filed so far, and 41 patents granted. Currently, there are 15 BITSian Unicorns and 2 Decacorn. There are over 7500 BITSian founders and co-founders of enterprises.

Admission to BITS Pilani Higher Degree Programmes for Academic Year 2026 - 2027

BITS Pilani invites applications to its 4 Semester on-campus M.E./ M.Pharm. Higher Degree (HD) programmes for the year 2026–27. Admissions are open for the following programmes to be offered at Pilani, K K Birla Goa and Hyderabad campuses of BITS Pilani:

Degree	Programs	Campus		
		Pilani	Goa	Hyderabad
M.E.	Biotechnology	Y	Y	Y
	Chemical	Y	Y	-
	Civil with specialization in Structural Engineering	Y	-	Y
	Civil with specialization in Transportation Engineering	Y	-	Y
	Civil with specialization in Infrastructure Engineering & Management	Y	-	-
	Environmental Engineering*	Y	-	-
	Communication Engineering	Y	Y	Y
	Embedded Systems	Y	Y	Y
	VLSI Design and Microelectronics	Y	Y	Y
	Electrical with specialization in Power Electronics and Drives	Y	-	Y
	Mechanical	Y	Y	-
	Thermal Engineering	-	-	Y
	Mechanical Design Engineering (formerly Design Engineering)	Y	Y	Y
	Computer Science	Y	Y	Y
	Software Systems*	Y	-	-
	Supply Chain Management	Y	-	Y
	Advanced Electronic Systems and Smart Manufacturing#	Y		
	Quantum Information Processing	-	Y	-
	Quantum Science and Technology	-	Y	-
M. Pharm.	M.Pharm. with specialization in Pharmaceutics	Y	-	Y*
	M.Pharm. with specialization in Pharmacology	Y	-	Y*
MBA**	MBA in Business Analytics	Y**		

 # Admission is subject to an additional industry-panel interview due to the sponsored nature of this program.
*** Admission to M.E./M.Pharm. program will be through the BITS HD test only. 'Y' indicates that the programme will be offered only in this/these campuses**
**** MBA admission details are accessible at** https://admissions.bits-pilani.ac.in/MBA/mba.html**.**

DURATION: Normally four semesters (for M.E./ M.Pharm.)

ELIGIBILITY

A minimum of 60% for M.E./ M.Pharm. in the qualifying degree examination.

ADMISSION MODALITY

Admission to all M.E. and M.Pharm. programmes will be made on the basis of marks obtained in the BITS HD admission test **OR** based on GATE/GPAT score.

Interested candidates have to apply online ensuring all deadlines are met. While applying online, candidates will be asked to give their preferences to different programmes offered. In addition, the candidate has to opt for one of the following:

(i) **Consideration for admission only based on GATE/GPAT score**: Scores of GATE 2026 or GATE 2025 or GATE 2024 will only be considered for admissions to M.E. programmes. Similarly, scores of GPAT 2026 or GPAT 2025 or GPAT 2024 will only be considered for admission to M.Pharm. programmes. Candidates must ensure that their GATE/GPAT scores are valid and the validity as mentioned on GATE/GPAT scorecard must be quoted in the application form.

(ii) **Consideration for admission only on the basis of marks obtained in the BITS HD online test.**

(iii) **Consideration for admission based on both GATE/GPAT score and marks obtained in the BITS HD online test.**

- Details of programme-wise input eligibility criteria are given in **Annexure I.**
- Details of programme-wise eligibility through GATE / GPAT examination are given in **Annexure II**.
- Details of BITS HD Test are given in **Annexure III.**

PREPARATION OF MERIT LIST FOR ADMISSIONS:

In the process of making final admission offers to the M.E. / M.Pharm. programmes, two separate merit lists will be prepared for each programme; one based on GATE/GPAT score, and the other based on marks obtained in BITS HD test. In each program, a maximum of 50% of the seats will be filled through GATE/GPAT scores and other 50% by BITS HD test marks. The admission committee will consider a cut- off score in each category, based on the applications received and the seats available. If any seat in one category is not-filled, it will be allocated to the other category. Final decision on this will be taken by the Admissions Committee, BITS Pilani and will be binding on all. Admission to the HD programs will be on the basis of merit only.

IMPORTANT NOTE

Admissions to the **starred (*)** M.E./M.Pharm. programs (as listed in the program table on page 2) will be made only through the BITS HD Test. Details of the BITS HD Test are given in Annexure III. Admissions will be based on students' merit rank in the BITS HD Test.

FINANCIAL ASSISTANCE

Candidates admitted through GATE/ GPAT will be eligible for GATE/ GPAT* scholarship provided by AICTE/PCI. Institute will facilitate the submission of documents to AICTE/PCI for scholarships. In addition, candidates admitted through **GATE/ GPAT*** route **will be eligible for a tuition fee waiver** amounting to Rs. 13,400/- per month (during the semester) over and above the GATE / GPAT* scholarship.

Candidates admitted through the **BITS HD Test route will be eligible for a stipend** of Rs. 13,400/- per month (during the semester).

All the candidates who will be receiving fee waiver or stipend will need to contribute to graduate student teaching assistantship of 8 -10 hours of work per week. Consideration for fellowship will be as per Institute norms.

* *GPAT Scholarship is exclusively applicable to students admitted to the Pilani Campus only*.

APPLICATION PROCESS

1. Interested and eligible candidates should apply through the prescribed application form available online at **http://www.bitsadmission.com/hd.** Hard copy of application form is not required to be sent. However, candidates are advised to take a printout of the filled-in form and keep a copy with them for further reference.

2. While filling the application form online, candidates are required to give preferences to programmes, which they wish to apply for. **Please refer to the programme-wise eligibility criteria in Annexure - I before filling the application form**.

3. Candidates, who wish to be considered for admission, as instructed in the application form, must enter details of all relevant information asked for.

4. **Candidates who wish to write BITS HD Test are to give their preference for three Test centers.**

   Note: Candidates selecting **the starred M.E./M.Pharm. programs (as listed in the program table on page 2)** must appear for the BITS HD test, **as GATE/GPAT scores have no bearing on their merit ranking for admission to these programs.** The completed application form along with the application fee should be submitted online by the prescribed deadline. Details of

mode of fee payment are available on the website while applying online.

5. **The application fee is non-refundable and not transferable.**

6. Deadline for submission of the completed application form online is **20th April 2026**.

APPLICATION FEE

- Those who wish to be considered through GATE/ GPAT score only: Rs 1000/-
- All others: Rs 3600/- (including the fee for BITS HD online test)

IMPORTANT DATES AND DEADLINES#

Portal to apply online opens	18th February, 2026
Deadline for submission of completed application form online with prescribed fee	20th April, 2026
Revision / editing (online) in the application form by the candidates	22nd & 23rd April, 2026
Announcement of admission offers to the candidates based on GATE Score (Iteration 1)	4th May, 2026
Deadline for payment of fees by the candidates offered admission through GATE/GPAT*	11th May, 2026
Test Center allotment to Candidates	18th May, 2026
Candidates to download the Hall tickets with instructions	21st May till the exam date
BITS HD Online Test	25th & 26th May, 2026**
Announcement of admission offers to the candidates based on BITS HD test and GATE / GPAT* (Iteration 2)	08th June, 2026
Deadline for payment of fees by the candidates offered admission through Iteration 2	22nd June, 2026
Announcement of admission offers to the candidates admitted through BITS HD test and GATE / GPAT* (Iteration 3)	29th June, 2026
Deadline for payment of fees by candidates offered admission through Iteration 3	06th July, 2026
Reporting of HD students	30th July, 2026
New students' orientation	31st July, 2026
Registration for the coursework	01st Aug, 2026
Classwork begins at respective campuses	03rd Aug, 2026

#The Institute reserves the right to conduct further iteration/s if necessary. The Institute also reserves the right to change the above deadlines. Candidates will be informed well in advance via admission portal, should there be such a change.

*** The result will be declared upon availability of the relevant examination scores.**

**** Test Date, Time and Center address will be declared on the Hall Ticket.**

Details of fee structure for 2026-27 and related modes of payment will be made available on https://admissions.bits-pilani.ac.in/HD/hd.html in the coming days. Candidates must look up the website for information pertaining to fees and regular updates pertaining to HD admissions for 2026 - 2027.

A candidate shall submit **only one application form** for Higher Degree admission. If a candidate notices any mistake in the form submitted by him or her, **an opportunity to edit the form will be made available after the final deadline for submission** (refer to the table above). **However, changes will be restricted to only certain aspects of the application form.**

Only the candidates who have paid fees as per deadlines mentioned above will be considered for further iterations in the admission process.

Queries related to BITSHD – 2026 may be directed to hdadmissions@pilani.bits-pilani.ac.in

ANNEXURE – I

PROGRAMME-WISE ELIGIBILITY CRITERIA (BITS HD)

Programme	Input (Eligibility Criteria)
M.E. Biotechnology[#1]	Integrated First Degree of BITS or its equivalent in Life Sciences and allied subjects.
M.E. Chemical[#2]	Integrated First Degree of BITS in the respective discipline or its' equivalent in Chemical engineering.
M.E. Civil with specialization in Structural Engineering[#3]	Integrated First Degree of BITS in the respective discipline or its' equivalent in Civil engineering.
M.E. Civil with specialization in Transportation Enginering[#3]	
M.E. Civil with specialization in Infrastructure Engineering and Management[#3]	
M.E. Environmental Engineering[#4]	Any Integrated First Degree of BITS in the areas of Biotechnology/Civil/Chemical/Environmental Engineering/Biology/Chemistry/Economics/Mathematics/Physics/Nanoscience or its equivalent.
M.E. Communication Engineering[#5]	Integrated First Degree of BITS in Electrical & Electronics/Electronics & Instrumentation/Electronics & Communication Engineering or its equivalent.
M.E. Embedded Systems[#5]	Integrated First Degree of BITS in Electrical & Electronics/Electronics & Instrumentation/ Electronics & Communication engineering or its equivalent.
M.E. VLSI Design and Microelectronics[#5]	Integrated First Degree of BITS in Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication/Physics or its equivalent.
M.E. Electrical with specialization in Power Electronics & Drives[#5]	Integrated First Degree of BITS in Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication Engineering / Physics or its equivalent.
M.E. Mechanical[#6]	Integrated First Degree of BITS in Mechanical engineering or its equivalent.
M.E. Thermal Engineering[#6]	Integrated First Degree of BITS in Mechanical engineering or its equivalent.
M.E. Mechanical Design Engineering[#6]	Integrated First Degree of BITS in Mechanical/Manufacturing Engineering or its equivalent.
M.E. Computer Science[#7]	Integrated First Degree of BITS or its equivalent in Computer Science or Information Technology.
M.E. Software Systems[#7]	Any Integrated First Degree of BITS or its equivalent with specific prior preparation.
M.E. Supply Chain Management[#8]	Any Integrated First Degree of BITS in Chemical/Civil/Mechanical/Manufacturing/Electrical and Electronics/Electronics and Communication/Electronics and Instrumentation/Computer Science Engineering or its equivalent.
M.E. Advanced Electronic Systems and Smart	Any Integrated First Degree of BITS in

Manufacturing[#11]	Chemical/Civil/Mechanical/Manufacturing/Electrical and Electronics/Electronics and Communication/Electronics and Instrumentation/ Electronics and Computer/Computer Science Engineering or its equivalent.
M.E. Quantum Information Processing[#7]	Any Integrated First Degree of BITS in Computer Science and Engineering/Computer Technology/Electronics and Computer Science/ Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication Engineering/Physics/Mathematics/Chemistry or its equivalent.
M.E. Quantum Science and Technology[#9]	Any Integrated First Degree of BITS in Computer Science and Engineering/Computer Technology/Electronics and Computer Science/ Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication Engineering/Physics/Mathematics/Chemistry or its equivalent.
M.Pharm. with specialization in Pharmaceutics[#10]	Integrated First Degree of BITS in Pharmacy or its equivalent.
M.Pharm. with specialization in Pharmacology[#10]	

#1 Program offered by Department of Biological Sciences

#2 Program offered by Department of Chemical Engineering

#3 Program offered by Department of Civil Engineering

#4 Program offered by Department of Civil and Chemical Engineering

#5 Program offered by Department of Electrical and Electronics Engineering

#6 Program offered by Department of Mechanical Engineering

#7 Program offered by Department of Computer Science and Information Systems

#8 Program offered by Department of Mechanical Engineering and Management

#9 Program offered by Department of Physics

#10 Program offered by Department of Pharmacy

#11 Program offered by Department of Mechanical Engineering and Electrical and Electronics Engineering

Note:

1. Candidates must exercise utmost care when filling programme preferences, ensuring full compliance with eligibility criteria. **Ineligibility for selected preferences will result in exclusion from admission consideration and disqualification from the BITS HD test if chosen as the admission mode**.
2. Students holding an Integrated First Degree from BITS Pilani or its equivalent may qualify for admission to any M.E. programme, subject to completing additional required courses. **In such cases, the programme duration may exceed the standard period and will be assessed individually.**

ANNEXURE - II

PROGRAM-WISE INPUT ELIGIBILITY CRITERIA AND ELIGIBLE GATE/GPAT PAPER

Programme	Input Eligibility Criteria	Eligible GATE/GPAT Paper (Code)
M.E. Biotechnology	Integrated First Degree of BITS or its equivalent in Life Sciences and allied subjects.	• Biotechnology (BT) • Life Sciences (XL)
M.E. Chemical	Integrated First Degree of BITS in Chemical Engineering or its' equivalent	• Chemical Engineering (CH)
M.E. Civil with specialization in Structural Engineering	Integrated First Degree of BITS in Civil Engineering or its equivalent	• Civil Engineering (CE)
M.E. Civil with specialization in Transportation Engineering		
M.E. Civil with specialization in Infrastructure Engineering & Management		
M.E. Communication Engineering	Integrated First Degree of BITS in Electrical & Electronics/Electronics & Instrumentation/Electronics & Communication or its equivalent	• Electronics & Communication Engineering (EC), • Electrical Engineering (EE), • Instrumentation Engineering (IN)
M.E. Embedded Systems	Integrated First Degree of BITS in Electrical & Electronics/Electronics & Instrumentation/ Electronics & Communication or its' equivalent	• Electronics & Communication Engineering (EC), • Electrical Engineering (EE), • Instrumentation Engineering (IN)
M.E. VLSI Design and Microelectronics	Integrated First Degree of BITS in Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication/ Physics or its equivalent	• Electronics & Communication Engineering (EC), • Electrical Engineering (EE), • Instrumentation Engineering (IN) • Physics (PH)
M.E. Electrical with specialization in Power Electronics & Drives	Integrated First Degree of BITS in Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication or its equivalent	• Electronics & Communication Engineering (EC), • Electrical Engineering (EE) • Instrumentation Engineering (IN)
M.E. Mechanical	Integrated First Degree of BITS in Mechanical Engineering or its equivalent	• Mechanical Engineering (ME), • Production and Industrial Engineering (PI)
M.E. Thermal Engineering	Integrated First Degree of BITS in Mechanical Engineering or its equivalent	• Mechanical Engineering (ME), • Production and Industrial Engineering (PI)

M.E. Mechanical Design Engineering	Integrated First Degree of BITS in Mechanical/Manufacturing Engineering or its equivalent	• Mechanical Engineering (ME), • Production and Industrial Engineering (PI) • Metallurgical Engineering (MT)
M.E. Computer Science	Integrated First Degree of BITS or its equivalent in Computer Science or Information Technology	• Computer Science and Information Technology (CS) • Data Science and Artificial Intelligence (DA)
M.E. Supply Chain Management	Any Integrated First Degree of BITS in Chemical/Civil/Mechanical/Manufacturing/Electrical and Electronics/Electronics and Communication/Electronics and Instrumentation/Computer Science Engineering or its equivalent.	• Aerospace Engineering (AE) • Agricultural Engineering (AG) • Biomedical (BM) • Civil Engineering (CE) • Chemical Engineering (CH) • Computer Science and Information Technology (CS) • Data Science and Artificial Intelligence (DA) • Electronics & Communication Engineering (EC) • Electrical Engineering (EE) • Environmental Science and Engineering (ES) • Geomatics Engineering (GE) • Instrumentation Engineering (IN) • Mechanical Engineering (ME) • Mining Engineering (MN) • Metallurgical Engineering (MT) • Naval Architecture and Marine Engineering (NM), • Petroleum Engineering (PE) • Production and Industrial Engineering (PI) • Textile Engineering and Fiber Science (TF) • Engineering Sciences (XE)
M.E. Advanced Electronic Systems and Smart Manufacturing	Any Integrated First Degree of BITS in Chemical/Civil/Mechanical/Manufacturing/Electrical and Electronics/Electronics and Communication/Electronics and Instrumentation/ Electronics and Computer/ Computer Science Engineering or its equivalent.	• Aerospace Engineering (AE) • Civil Engineering (CE) • Chemical Engineering (CH) • Computer Science and Information Technology (CS) • Data Science and Artificial Intelligence (DA) • Electronics & Communication Engineering (EC) • Electrical Engineering (EE) • Instrumentation Engineering (IN) • Mechanical Engineering (ME) • Mining Engineering (MN) • Metallurgical Engineering

		(MT) • Production and Industrial Engineering (PI) • Engineering Sciences (XE)
M.E. Quantum Information Processing	Any Integrated First Degree of BITS in Computer Science and Engineering/Computer Technology/Electronics and Computer Science/ Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication Engineering/Physics/Mathematics/ Chemistry or its equivalent.	• Computer Science and Information Technology (CS) • Data Science and Artificial Intelligence (DA) • Electronics & Communication Engineering (EC) • Electrical Engineering (EE) • Instrumentation Engineering (IN) • Mathematics (MA) • Physics (PH) • Chemistry (CY)
M.E. Quantum Science and Technology	Any Integrated First Degree of BITS in Computer Science and Engineering/Computer Technology/Electronics and Computer Science/ Electrical & Electronics/ Electronics & Instrumentation/ Electronics & Communication Engineering/Physics/Mathematics/ Chemistry or its equivalent.	• Computer Science and Information Technology (CS) • Data Science and Artificial Intelligence (DA) • Electronics & Communication Engineering (EC) • Electrical Engineering (EE) • Instrumentation Engineering (IN) • Mathematics (MA) • Physics (PH) • Chemistry (CY)
M.Pharm. with Specialization in Pharmaceutics	Integrated first degree of BITS in Pharmacy or its equivalent	Through GPAT (Pilani Campus)[#]
M.Pharm. with Specialization in Pharmacology		

[#]Admission to M.Pharm. programme at BITS Pilani, Hyderabad campus is only through BITSHD Test.

- Candidates applying to any of the three M.Pharm. programmes will be admitted based on GPAT score or BITS HD Test score only. **GATE score will not be considered for admission to these programs.**

- Candidates applying for programmes other than the three M.Pharm. programmes will be admitted based on GATE score or BITS HD test score based on the candidate's applied admission mode. **GPAT score will not be considered for admission to these programmes.**

- Please note that admission to the **M.E. Advanced Electronic Systems and Smart Manufacturing** program requires a mandatory interview (30% weightage) alongside BITSHD test/GATE scores (70%); final decisions regarding selection, stipends, and fee waivers are at the discretion of the concerned departments, sponsoring industry partners and institute's admissions committee; for details, visit departments website.

Annexure III

DETAILS OF BITS HD (BITS HIGHER DEGREE) TEST

The test will be a computer based online test conducted by BITS Pilani at dedicated Centers in different cities of India. Computer based online test means the candidate sits in front of a computer, the questions are presented on the computer monitor, and the candidate submits the answers using keyboard & mouse. Each computer is connected to a server, which prepares the question set and delivers to the candidate on the computer. **The online tests will be conducted on 25th May & 26th May 2026 and the candidates can choose the Center to take the test as mentioned in later sections.**

A. DETAILS OF THE ONLINE TEST

Test I: Duration: 45 Minutes **Total No of questions: 30**

Test I is compulsory for all students who are applying for any of the Higher Degree programs of the Institute and will consist of the following sections:

Sections	**No. of Questions**
Core Mathematics	15
English Language Skills & Logical Reasoning	15
Total	**30**

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

Test II: Duration: 105 Minutes **Total number of questions: 70**

Test II is for students applying to all Higher Degree programs except those who are applying for M.E. in Environmental Engineering and M.E. in Software systems. This paper will attempt to test the student's grasp of the basic subjects of his/her 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.

Test for Software Systems:

Duration: 60 Minutes **Total number of questions: 50**

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

Test for M.E. Environmental Engineering

Duration: 60 Minutes **Total number of questions: 50**

This special test for Environmental Engineering is required for only those students who are applying for M.E. Environmental Engineering. The course description is available in the syllabus given later in the brochure.

For all the above tests, the questions are of objective type (multiple-choice questions); each question with four answer 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.

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

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.

B. TEST CENTER DETAILS**

The planned HD 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.

Sr.	Test City	State	Sr.	Test City	State
1	Agra	Uttar Pradesh	37	Kathmandu, Nepal	Kathmandu
2	Ahmedabad	Gujarat	38	K K Birla Goa Campus BITS	Goa
3	Aizawl	Mizoram	39	Kolhapur	Maharashtra
4	Ajmer	Rajasthan	40	Kolkata	West Bengal
5	Asansol	West Bengal	41	Kollam	Kerala
6	Bareilly	Uttar Pradesh	42	Lucknow	Uttar Pradesh
7	Bathinda	Punjab	43	Madurai	Tamil Nadu
8	Belagavi (Belgaum)	Karnataka	44	Mangaluru (Mangalore)	Karnataka
9	Bengaluru	Karnataka	45	Mohali	Punjab
10	Bhopal	Madhya Pradesh	46	Mumbai	Maharashtra
11	Bhubaneswar	Odisha	47	Mysuru (Mysore)	Karnataka
12	Chennai	Tamil Nadu	48	Nagpur	Maharashtra
13	Chhatrapati Sambhaji Ngr	Maharashtra	49	New Delhi	Delhi
14	Coimbatore	Tamil Nadu	50	Noida	Uttar Pradesh
15	Dhanbad	Jharkhand	51	Patiala	Punjab
16	Dibrugarh	Assam	52	Patna	Bihar
17	Dubai Campus of BITS	Dubai, UAE	53	Pilani Campus of BITS	Rajasthan
18	Ernakulam	Kerala	54	Prayagraj	Uttar Pradesh
19	Ghaziabad	Uttar Pradesh	55	Pune	Maharashtra
20	Guwahati	Assam	56	Raipur	Chhattisgarh
21	Gwalior	Madhya Pradesh	57	Rajahmundry	Andhra Pradesh
22	Haldwani	Uttarakhand	58	Rajkot	Gujarat
23	Hamirpur	Himachal Pradesh	59	Ranchi	Jharkhand
24	Hyderabad Campus BITS	Telangana	60	Sambalpur	Odisha
25	Hyderabad City	Telangana	61	Shimoga	Karnataka
26	Indore	Madhya Pradesh	62	Siliguri	West Bengal
27	Jabalpur	Madhya Pradesh	63	Surat	Gujarat
28	Jaipur	Rajasthan	64	Tiruchirappalli	Tamil Nadu
29	Jalandhar	Punjab	65	Tirupathi	Andhra Pradesh
30	Jammu	J & K	66	Udaipur	Rajasthan
31	Jamshedpur	Jharkhand	67	Udupi	Karnataka
32	Jodhpur	Rajasthan	68	Varanasi	Uttar Pradesh
33	Jorhat	Assam	69	Vijayawada	Andhra Pradesh
34	Kalaburagi (Gulbarga)	Karnataka	70	Visakhapatnam	Andhra Pradesh
35	Kanpur	Uttar Pradesh	71	Warangal	Telangana
36	Karimnagar	Telangana			

**** BITS Pilani reserves the right not to conduct the BITS HD Test in some of the centers listed above. The center for any shortlisted candidate will be informed through the BITS HD Test Hall Ticket.**

Candidates have to give three preferences for the examination city, and they will be allotted one of the choices.

Candidates will be informed about the test center allotment through BITS admission's website https://admissions.bits-pilani.ac.in/HD/hd.html.

Each candidate who registers for the test will be required to download a 'Hall Ticket' from the website during 21st May to till the exam date.

Candidates with a 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, tablet PCs, laptops or any other smart 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.

IMPORTANT DATES AND DEADLINES (RELATED TO BITS HD TEST)

Test Center allotment to Candidates	18th May, 2026
Candidates to download Hall tickets	21st May till the exam date
Online HD Test	25th and 26th May 2026

Important Notes

i. 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 will not be responsible for the same.

ii. The Institute will operate Test Centers in different cities other than Pilani, Goa and Hyderabad as previously stated. **The Institute cannot guarantee that Test Centers will be set up in all these cities. The final list of Centers will be announced to candidates through the BITS website.** Further, **the Institute reserves the right to cancel any Test Center if situation arises. In such cases, those candidates allotted to these centers will be accommodated in alternate test centers including Pilani, Goa and Hyderabad.**

iii. The candidates must fully obey the rules of the Test Centers; otherwise, he/she will be automatically debarred from the test.

iv. In all matters in the conduct of Test, the decision of the Vice Chancellor of BITS Pilani will be final.

v. All disputes pertaining to the Higher Degree admission shall fall within the jurisdiction of Pilani city.

vi. All notices regarding test, shortlisting etc. will be put up only on BITS Pilani admission website https://admissions.bits-pilani.ac.in/HD/hd.html. Candidates should regularly check the same and related updates.

vii. If a candidate is applying through GATE/GPAT route, he/she should upload a self-attested GATE/GPAT scorecard (scanned copy) while applying online.

viii. The candidates, **who are opting for GPAT-2026, will be required to upload the scorecard at a later stage, once the same is available**. In such scenario, the candidates can complete their application form by filling in the available details.

SYLLABUS FOR TEST I

Core Mathematics

Calculus: Functions and graphs; limit and continuity; Applications of Derivatives, Applications of Definite Integrals, Convergence of Infinite sequences and series, Maclaurin and Taylor series. Functions of several variables, Limits and Continuity in Higher Dimensions, Partial derivatives, The chain rule Directional Derivatives and Gradient vectors, Tangent planes and Normal lines, Extreme values and saddle points, Double Integrals, Triple Integrals, Line and surface Integrals, Conservative fields, Curl and divergence Theorems of Green, Gauss and Stokes.
Linear Algebra: Matrix Algebra, Row reduction method, Rank and inverse of a matrix, System of linear equations, Vector space; basis and dimension; linear transformation; range and kernel of a linear transformation; Eigenvalues and eigenvectors. **Complex Variables:** Analytic functions, Cauchy's theorems; Cauchy's integral formula, Taylor Series and Laurent Series; Calculus of residues and applications.
Probability and Statistics: Sample space and events, Conditional probability and independence; Random variables and probability distributions; Independent random variables; Mathematical expectation; mean and variance; Geometric, Binomial, Poisson's, Exponential, Gamma and Normal distributions; sum o independent random variables; law of large numbers; Central limit theorem, Marginal and conditional distributions; Sampling distribution, Point estimation, Statistical intervals based on a Single sample, Tests of hypotheses based on a single sample, test for mean using normal and Students t-distribution Correlation and linear regression.
Differential Equations: First order differential equations (linear and nonlinear), higher order linear differential equations with constant coefficient, method of variation of parameters, Cauchy-Euler's equation Fourier Series, Laplace Transform, Initial and boundary value problems, Partial differential equations Method of separation of variables.
Numerical Methods: Solution of nonlinear algebraic equations: Newton's method, Secant method, Fixe point iteration method, method of false position, Solution of system of linear equations: Direct methods & Iterative methods, LU decomposition, Integration by Trapezoidal and Simpson's rule.

English Language and Logical Reasoning

(a) English Language

This test is designed to assess the test takers' general proficiency in the use of English language as a means of self-expression in real life situations and specifically to test the test takers' knowledge of basic grammar, their vocabulary, their ability to read fast and comprehend, and also their ability to apply the elements of effective writing.

1. Grammar	
1.1	Agreement, Time and Tense, Parallel construction, Relative pronouns
1.2	Determiners, Prepositions, Modals, Adjectives
1.3	Voice, Transformation
1.4	Question tags, Phrasal verbs
2. Vocabulary	
2.1	Synonyms, Antonyms, Odd Word, One Word, Jumbled letters,
Homophones, Spelling	

2.2	Contextual meaning.
2.3	Analogy
3. Reading Comprehension	
3.1	Content/ideas
3.2	Vocabulary
3.3	Referents
3.4	Idioms/Phrases
3.5	Reconstruction (rewording)
4. Composition	
4.1	Rearrangement
4.2	Paragraph Unity
4.3	Linkers/Connectives
(b) Logical Reasoning	
The test is given to the candidates to judge their power of reasoning spread in verbal and nonverbal areas. The candidates should be able to think logically so that they perceive the data accurately, understand the relationships correctly, figure out the missing numbers or words, and to apply rules to new and different contexts. These indicators are measured through performance on such tasks as detecting missing links, following directions, classifying words, establishing sequences, and completing analogies.	

5. Verbal Reasoning	
5.1	Analogy
Analogy means correspondence. In the questions based on analogy, a particular relationship is given and another similar relationship has to be identified from the alternatives provided.	
5.2	Classification
Classification means to assort the items of a given group on the basis of certain common quality they possess and then spot the odd option out.	
5.3	Series Completion
Here series of numbers or letters are given and one is asked to either complete the series or find out the wrong part in the series.	
5.4	Logical Deduction – Reading Passage

Here a brief passage is given and based on the passage the candidate is required to identify the correct or incorrect logical conclusions.
5.5 Chart Logic
Here a chart or a table is given that is partially filled in and asks to complete it in accordance with the information given either in the chart / table or in the question.
6. Nonverbal Reasoning
6.1 Pattern Perception
Here a certain pattern is given and generally a quarter is left blank. The candidate is required to identify the correct quarter from the given four alternatives.
6.2 Figure Formation and Analysis
The candidate is required to analyze and form a figure from various given parts.
6.3 Paper Cutting
It involves the analysis of a pattern that is formed when a folded piece of paper is cut into a definite design.
6.4 Figure Matrix
In this more than one set of figures is given in the form of a matrix, all of them following the same rule. The candidate is required to follow the rule and identify the missing figure.
6.5 Rule Detection Here a particular rule is given and it is required to select from the given sets of figures, a set of figures, which obeys the rule and forms the correct series.

SYLLABUS FOR TEST II

Chemical Engineering

Chemical Process Calculations

Chemical Process Calculations: Units and Dimensions, Chemical Equation and Stoichiometry, Thermodynamic properties of Gases, Vapors, Liquids and Solids, Steady and unsteady state mass and energy balances, Phase Equilibria (multiphase, multicomponent), reacting and non-reacting systems, recycle, bypass and purge calculations, Combustion Calculations.

Reference books:

(1) Himmelblau, D. M. Riggs, J. B. "Basic principles & calculations in chemical Engg", PHI, 8th ed., 2015.

(2) Felder, R. M. & R. W. Rousseau, "Elementary Principles of Chemical Processes", John Wiley & Sons, Inc., 4th ed., 2011.

Fluid Mechanics

Fundamental Concepts and Fluid Statics, basic concept of Newtonian and non-Newtonian fluids, head losses, velocity and pressure drop calculation. Integral and Differential Analyses for Fluid Motion, Internal and External Fluid Flow and Flow through Packed & fluidized beds, Dimensional Analysis, flow meters, pumps and compressors.

Reference books:

(1) R. W. Fox, A. T. McDonalds, and P. J. Pritchard, "Introduction to Fluid Mechanics", John Wiley and Sons Inc., 8th ed., 2013.

(2) W. L. McCabe, J. C. Smith, and P. Harriott, "Unit Operations of Chemical Engineering", McGraw HillInc., 7th ed., 2014.

Chemical Engineering Thermodynamics

First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Reference books:

(1) J. M. Smith, H.C. Ness, and M. Abbott, B Bhatt (Adapted), "Introduction to Chemical Engineering Thermodynamics", McGraw Hill Education, 7th ed., 2009.

(2) Y. V. C. Rao, "Chemical Engineering Thermodynamics", Universities Press, 1997.

(3) K. V. Narayanan, "A Textbook of Chemical Engineering Thermodynamics", Prentice Hall of India, 2nd ed., 2013.

Mass Transfer

Molecular diffusion and mass transfer coefficients Interphase mass transfer, heat and mass transfer analogies, design and operation of equipment for distillation, absorption, Adsorption, leaching, extraction, drying and adsorption, humidification, crystallization.

Reference books:

(1) Treybal, R.E., "Mass Transfer Operations," 3rd ed., McGraw-Hill Education, 2012.

(2) Foust, A. S., Wenzel, L.A., Clump, C.W., Anderson, L.B., "Principles of Unit Operations," 2nd ed., John Wiley and Sons, New York, 2008.

Heat Transfer

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

Reference books:

(1) Holman, J. P., Bhattacharyya, S "Heat Transfer" 10th ed., McGraw-Hill, 2011.

(2) Frank P. Incropera, David P. DeWitt, "Fundamental of Heat & Mass Transfer" 6th ed., John Wiley &Sons, 2006.

(3) D. Q. Kern, "Process Heat Transfer", Tata McGraw Hill, 2001.

(4) McCabe & Smith, "Unit Operations of Chemical Engineering" 7th ed., McGraw Hill, 2014.

Mechanical Operations

Properties and Handling of Particulate Solids, Mechanical Separations, particle size distribution, size reduction operation, operation of centrifuge and cyclones, filtration, agitation and mixing.

Reference books:

(1) McCabe W. L., and Smith J. M., & Harriott P., Unit Operations of Chemical Engineering, 7th ed.,McGraw Hill International Edition, 2014.

(2) J. M. Coulson, J. F. Richardson's Chemical Engineering, Vol. 1 (6th ed.,) & Vol. 6 (4th ed.,) ElsevierButterworth-Heinemann, MA, USA, 2004 & 2005.

Chemical Reaction Engineering

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, Heterogeneous reactors, Non Ideal reactors.

Reference books:

(1) H. Scott Fogler "Elements of Chemical Reaction Engineering", PHI, 4th ed, 2015.

(2) O. Levenspiel, "Chemical Reaction Engineering", John Wiley, 3rd ed., 2006.

(3) M. Smith, "Chemical Engineering Kinetics", McGraw Hill, 3rd Ed., 2013.

Chemical Process Technology

Inorganic chemical industries (sulphuric acid, phosphoric acid); Fertilizer industries (Ammonia, Urea,SSP, TSP); Natural product industries (Pulp & paper, Sugar, Oils & fats); Petroleum Refining and

Petrochemicals; Polymerization industries (polyethylene, polypropylene, polyester synthetic fibers, PVC).

Reference Books:

(1) Moulin A J., Makkee, M., Diepen, A V., "Chemical Process Technology", 2nd ed., Wiley, 2013.

(2) Rao M G., Sittig M., "Dryden's Outlines of Chemical Technology for the 21st Century", East West Press, 3rd ed., 2006.

(3) Austin G T., Shreve R.N., "Shreve`s Chemical Process Industries", McGraw Hill, 5th ed., 2012.

Plant Design and Economics

Principles of process economics, depreciation calculation, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as evaporator, heat exchangers, multistage contactors.

Reference books:

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

(2) Max S. Peters, Klaus D. Timmerhaus, Ronald E. West, Max Peters. Plant Design and Economicsfor Chemical Engineers. 5th ed., McGraw Hill, New York, 2011.

(3) J. M. Coulson, J. F. Richardson's Chemical Engineering, Vol. 6 (4th ed.,) Elsevier Butterworth-Heinemann, MA, USA, 2005.

Process Dynamics and Control
Dynamic process modeling, Laplace transform, transfer functions, analysis of the dynamic behavior of chemical processes, Analysis and design aspect of feedback controllers (P, PI and PID), controller tuning, advanced control systems, measurement of process variables; sensors, transducers and their dynamics. Reference Books: (1) Stephanopoulos, G., "Chemical Process Control: An Introduction to Theory and Practice," Prentice-Hall, Englewood Cliffs, N.J., 2008. (2) Seborg, D.E., Edgar, T.F., Mellichamp, D.A. and Doyle III F. J. "Process Dynamics and Control," 4 th ed., Wiley, 2016. (3) Coughnowr, D. R., Leblanc S., "Process Systems Analysis and Control," 3rd ed., McGraw-Hill, 2013.

Civil Engineering

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, Stresses due to Bending, Torsion. **Reference books:** (1) An Introduction to Mechanics of Solids, Second Edition with SI units Crandall/Dahl/Lardner, Tata McGraw Hill Publication, New Delhi. (2) Mechanics of Materials(In SI units) , Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill Publication, New Delhi
Analysis of Structures
Statics of Structures and Degree of Indeterminacy, Analysis of Determinate and Indeterminate Structures (trusses, beams, frames, cables and arches), Deflection of beams and Frames, Influence lines and its Applications, Introduction to Matrix Methods of Structural Analysis. **Reference books:** Structural Analysis by R.C. Hibbler, Pearson, India. Fundamentals of Structural Analysis by Kenneth M. Leet & Chia-Ming Uang, McGraw Hill Publications,New Delhi.

Design of Concrete Structures

Ingredients for reinforced concrete, Design of concrete Mix, Design philosophies, Design of singly anddoubly 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, Design of columns.

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 Concrete Structures, by J. N. Bandyopadhyay, Prentice-Hall of India, New Delhi.

Design of Steel Structures (Limit State Design)

Steel Design Specifications and Connections, eccentric and moment connections, Design of Tension and Compression Members, Design of beams and plate girders, Introduction to plastic analysis and design.

Reference books:

Design of Steel Structure by N. Subramaniam, Oxford University Press.
Teaching Resource for Structural Steel Design, Vol. 1, 2, 3: Institute for Steel Development and Growth, Kolkata.

Transportation Engineering

Highway alignment; Geometric design of highways: Cross-sectional elements, sight distances, horizontal and vertical alignment designs, , Highway Materials - Desirable properties of bitumen, aggregates, soil and bituminous paving mixture design using Marshall's specifications; Design factors for flexible and rigid pavements, Pavement Design: Factors controlling flexible and rigid pavement designs, design of flexible pavement using IRC: 37, design of rigid pavements using IRC: 58; Overlaydesign using IRC:81, Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, EPCU concept, V/C ratios and Level of Service Concepts, , traffic control devices - Signal design by IRC and Webster's methods, Types of intersections and channelization.

Reference books:

1. Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros. Revised10th Edition, 2014
2. Kadiyali L.R. and Lal N B, Principles and Practices of Highway Engineering; 4th Edition; KhannaPublishers, New Delhi, 2011
3. Design Codes: IRC 37, IRC 58, IRC 81, MoRTH Code of Provision

Surveying

Chain Survey, Compass Survey & leveling, Theodolite, Tachometric surveying & Traversing, Curve Ranging, Contouring & Plane Tabling, Trigonometric Leveling, Areas and Volumes, Geodetic surveying, Total Stations. Introduction to advanced surveying techniques like DGPS, GIS.

Reference books:

Arora K R, Surveying (in SI Units), Standard Publisher, Vol 1, II and III, 13th Edition, 2015PunmiaB C, Surveying, Laxmi Publishers, Vol 1, II and III, 17th Edition, 2016
Duggal S K, Surveying, Tat McGraw Hill, New Delhi, Vol. I and II, 4th Edition, 2013

Construction Planning and Technology

Concrete ingredients- cement, aggregates, chemical and mineral admixtures. Mix design, Fresh and hardened characteristics, Properties, testing and applications of concrete, Masonry materials, Timber, Bituminous materials, Steel, Non-ferrous metals and alloys, Ceramics, Glass, Polymeric materials, Paints, distemper and varnishes, Construction planning and scheduling, Advanced construction techniques.

Reference books:

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

Peurifoy, R.L., & C.L., Schexnayder, 'Construction Planning, Equipment and Methods', T.M.H..

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

Duggal, S.K. "Building Materials" New Age International Pvt. Ltd., New DelhiGhambir, Concrete Technology, Tata McGraw-Hill Publishing Company Ltd.

Soil Mechanics and Foundation Engineering

Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepagethrough soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One- dimensional consolidation, time rate of consolidation; Shear strength of soil using various tests, effective and total shear strength parameters, characteristics of clays and sand. Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories -Rankine and Coulomb; Stability of slopes - finite and infiniteslopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's bearing capacity theory and determination of bearing capacity as per IS:6403, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Reference books:

Ranjan, G. and Rao, A.S.R.,(2016) "Basic and Applied Soil Mechanics" New Age International Publishers.

Water and Wastewater Treatment

Water and wastewater characteristics; Basic unit processes and operations for water treatment; Drinking water standards; Distribution of water; Sewage and sewerage treatment; Primary, secondary and tertiary treatment of wastewater, effluent discharge standards; Sludge disposal.

Reference books:

Water Supply Engineering and Wastewater Engineering by B. C. Punmia. Laxmi Publications (P) Ltd., New Delhi.

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

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

Water Resource Engineering

Fluid Mechanics and Hydraulics: Fluid Properties, Fluid pressure and measurement, Hydrostatics, Buoyancy, Fundamentals of fluid flow and Kinematics of fluid in motion, Conservation of mass, momentum and energy, Analysis of flow through pipes, Laminar flow, Study of flow pattern through Orifices and Mouthpieces, Notches and Weirs, Dimensional analysis and similitude, Boundary Layer Theory, Flow past immersed bodies, turbulent flow through conduits; analysis of closed-conduit hydraulic systems including pipes, valves, fittings, and pumps, pipe networks and analysis: Hardy cross method and linear graph method; Open channel hydraulics: uniform and non-uniform flow; analysis and design of hydraulic systems; Analysis of impact of jets; Fluid machinery: theory, performance and application of Pumps and Turbines.

Hydrology: Hydrological Cycle and Budget; Precipitation Measurement and Analysis; Hydrologic Abstractions; Stream Flow analysis and concepts of hydrograph; Hydrologic measurements; Statistical analysis in hydrology; Ground Water hydrology; Flood Routing; Introduction to dams, spillways, diversion head-works and distribution systems, Reservoir planning and multi-purpose reservoirs, hydropower engineering.

Reference books:

Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, Post Box 1074, New Delhi.
Patra K.C., "Hydrology and Water Resources Engineering", Narosa Publishing House.
Mays L.W., "Water Resources Engineering", John Wiley and Sons.

Electrical and Electronics Engineering

Electrical Sciences

Basic Circuit elements, sources and laws, Circuit analysis Techniques & Theorems, Time-domain analysis of 1st & 2nd Order Circuits, AC Circuit Analysis, Important Power Concepts, Power factor correction, Single phase and Three- phase Circuit Analysis, Frequency response and Resonance, Semiconductors: Construction, operation and application of Junction Diode, Zener Diode, Transistor (BJT's), JFET's and MOSFET, Ideal operational amplifiers configuration, Magnetic Circuits.

Reference book:

Leonard S Bobrow and Navneet Gupta "Foundation of Electrical Engineering" Oxford University Press,Asian Edition, 2015.

Electromagnetics

Maxwell's équations in free space and in time-varying fields, boundary conditions, wave equation, Poynting vector; Plane waves in dielectric and conducting media, wave reflection, refraction, and polarization, phase and group velocity, skin depth; Transmission lines, Smith chart and its application in impedance matching calculations, Basics of guided wave propagation, Antennas and radiation, antenna parameters, Hertziandipole, half-wave dipole, loop, helical and hornantennas, antenna arrays, Radio Link and Friis Formula.

Reference book:

John D Kraus and D.A. Fleisch, "Electromagnetics & applications". 5th Edition, McGraw-Hill, New Delhi

Digital electronics

Number systems & Codes, Boolean algebra & Simplification, Digital Logic Families, Combinational logicDesign – Decoders, Encoders, MUX, DeMUX, Arithmetic Circuits, Sequential Logic design- Flip- flops, State machines, ASM, Counters & Registers, and PLDs & FPGAs & Computer Organization.

Reference books:

M. Morris Mano, " Digital Design", PHI, 3rd Edition, 2002.

Signals & systems and Digital Signal Processing

Continuous-time and discrete-time signals and systems, Sampling and reconstruction, Properties of linear time-invariant (LTI) systems, Linear convolution, Fourier series (CTFS, DTFS), Fourier transform (CTFT, DTFT), Laplace transform, Z-transform, System analysis and frequency response. Discrete Fourier Transform, Fast Fourier Transform, Analog filters, Digital filters (FIR and IIR), Linear estimation and prediction, Adaptive filters, Multi-rate signal Processing.

Reference books:

1. B P Lathi "Principles of Signal Processing and Linear Systems" Oxford University Press, Internationalversion, 2009.
2. Alan V. Oppenheim, Alan S. Willsky, "Signals and Systems," Pearson Education Ltd., 2nd edition,2015.
3. Sanjit K. Mitra "Digital Signal Processing-A computer-based approach" McGraw Hill education, 4th Edition, 2013.

Electrical machines

Transformer: Constructional features, equivalent circuit and phasor diagram - regulation and efficiency, parallel operation. Three phase transformer connections; Harmonic in transformers; Testing; Phase conversion; Autotransformer. D.C Machines: Construction, armature windings, armature voltage and torque equations, classification. D.C generators, performance characteristics; D.C motors - torque/speed characteristics, speed control and braking. Testing and efficiency. Induction machines: Constructional features and rotating magnetic field. Circuit model and phasor diagram. Steady state characteristics. Testing, starting and speed control. Time harmonics and space harmonics. Wound rotor induction motors, Single phase induction motors - classification and equivalent circuit. Synchronous machines: Constructional features; synchronous generators and motors; equivalent circuit and phasor diagram; power and torque characteristics and capability curves. Parallel operation. Salient pole synchronous machine - phasor diagram and determination of synchronous reactances; starting and speed control of synchronous motors.

Control system and 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. Line frequency Uncontrolled/Controlled AC-DC Converter (Rectifier); DC-DC Switch- Mode Converters; Switch- Mode DC-AC Converters (Inverters).

Power systems

Power system concepts, per unit system, Transmission line parameters and modeling, Characteristics and performance of lines, Load flow studies, Optimal system operation, Automatic Generation and voltage Control, Power system fault analysis, Power Systems stability.

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, 5th edition, 2005.

Electronic devices and microelectronics circuits

Semiconductor materials and their properties, Carrier transport and excess carriers in semiconductors; Single p-n junction devices- rectifier, Zener diodes, switching diodes, microwave diodes, optoelectronic devices, Bipolar junction transistors; JFET; MOSFET; MOS and CMOS devices; Basic device fabrication steps and techniques and introduction to ICs. Basic single and two stage transistor BJT and MOSFET amplifier; current mirrors and current sources; active load biasing in integrated circuits, Voltage sources and voltage references, differential and multistage amplifiers with and without feedback; 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, 6th ed.,2006.

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

Microprocessor

Introduction to Intel 80x86 processor ISA (8086-80486) , Assembly programming, Programmers model of processor, processor architecture; Instruction set, modular assembly programming using subroutines, macros etc. Timing diagrams, Concept of interrupts: hardware & software interrupts, Interrupt handling techniques, Interrupt controllers, Types of Memory & memory interfacing, Programmable Peripheral devices and I/O Interfacing, DMA controller and its interfacing, Serial Interface – PCI Buses, RISC Vs CISC, Cache Memory Organization, Concept of multicore microprocessors, Design of processor based system.

Reference books:

Barry B Brey, C R Sarma, The Intel Microprocessors. Pearson, 6th Ed. 2005. Douglas V Hall, Microprocessor and Interfacing, TMH, Second Edition.

Communication systems

Signals & Signal Space, Analysis and transmission of signals, Continuous Wave Modulation and Demodulation - AM, FM, PM, Sampling, A/D and D/A conversion, Pulse Shaping and Transmission, Synchronization & Multiplexing Techniques, Random Process and Spectral Analysis, Bandpass Digital Modulation and Demodulation Schemes, Distortive and Noisy Channels, Fading Channels, Performance analysis of Communication systems, Communication Link Analysis, Information Theory, Source Encoding, Error-control Coding, Modulation and Coding Trade-offs, Spread Spectrum Communication Systems, Multiuser & Multicarrier Communication Systems.

Reference Books:

- B. P. Lathi and Zhi Ding. Modern Digital and Analog Communication Systems. 4th ed. Oxford University Press 2010.
- Simon Haykin and Michael Moher. Communication Systems. 5th ed. John Wiley & Sons 2009.
- John G Proakis and Masoud Salehi. Digital Communications. 5th ed. McGraw-Hill 2008.
- Andrea Goldsmith. Wireless Communications. Cambridge University Press 2005.
- John G. Proakis and Masoud Salehi. Communication Systems Engineering. 2nd ed. Pearson Education 2002.
- Herbert Taub and Donald L. Schilling. Principles of Communication Systems. 2nd ed. McGraw-Hill Higher Education 1986. Machining

Telecom switching

Switching Systems, Signaling Systems and Standards, Voice Digitization, Digital Transmission and Multiplexing, Signal Encoding Techniques and Transmission Media, Synchronization, Digital Switching

- Space and Time Division Switching, Data and Asynchronous Transfer Mode Networks, Circuit Switching, Packet Switching, Routing, Data Transfer Protocols, OSI Model, Networks Topologies - LAN, MAN, WAN, Internetworking and Applications, Network Control and Management, Subscriber Access

Techniques - ISDN, DSL, Wireless Connectivity, Cellular Networks and Mobile Telephony, Fiber Optic Communication Systems, Optical Network Standards, Telecommunication Traffic Engineering and Analysis Delay Systems, Voice-over-IP.

Reference Books:

John C Bellamy. Digital Telephony. 3rd ed. John Wiley & Sons 2003.

Roger L. Freeman. Telecommunication System Engineering. 4th ed. John Wiley & Sons 2004.

Thiagarajan Viswanathan and Manav Bhatnagar. Telecommunication Switching Systems and Networks. 2nd ed. Prentice-Hall India 2015.

Behrouz A. Forouzan. Data Communications and Networking. 5th ed. McGraw Hill Education (India) 2013.

William Stallings. Data and Computer Communications. 8th ed. Pearson Education 2007.

Mechanical Engineering

Production Techniques
Metal casting, Metal forming, powder metallurgy, plastic forming and molding, Metal joining, Metrology, metal cutting theory, machining processes, welding processes and Non-conventional manufacturing processes. **Reference books:** Campbell, J.S., Principles of Manufacturing Materials and Processes, 23rd reprint, Tata McGraw Hill, 2006. Ghosh, A. and Malik, A.K., Manufacturing Science, 2nd edition, East-West Press Pvt. Ltd., 2010. Kalpakjain, S. and Schmid, S. R., Manufacturing Engineering and Technology, 5th edition, Pearson Education, 2006.
Materials Science and Engineering
Introduction, Structure of Materials (Metal and Ceramics), Dislocations, heat treatment of steel and strengthening Mechanisms of Metals, Phase diagrams, Iron-carbide phase diagram, Phase transformation in Metals, Mechanical and thermal properties of Metals, Polymers (Structure, processes and properties) and introduction to non-destructive testing. **Reference books**: William D. Callister, David G. Rethwisch, Materials Science and Engineering: An Introduction, NinthEdition, Wiley, 2013. V. Raghavan, Material science and engineering, 6th Edition, Prentice-Hall of India private Limited, 2015.
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, 9th 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, flat and V-belt drives, Computeraided design, and geometric modeling of mechanical parts.
Reference books: Shigley, J. E. and Mischke, C. R., Mechanical Engineering Design, 9th edition, Tata McGraw-Hill, 2001.Zeid, I., CAD/CAM: Theory and Practice, Tata McGraw-Hill, 1991.
Kinematics & Dynamics of Machines and Vibrations

Basics of mechanisms, inversions, Velocity and acceleration analysis, Instantaneous centres, transmission angle, 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.

Thomson W T, Dahleh M D & Padmanabhan C, Theory of Vibrations with applications, 5th Edition, Pearson,2015.

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:

Crandall, 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.

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, 7th edition, John, Wiley & Sons (Asia) Pte. Limited, 2009.

A. Cengel, Michael A. Boles, Thermodynamics an Engineering Approach, 7th edition, Mcgraw Hill Education, 2011.

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, steam turbines, gas turbines, compressors.

Reference books:

Nag P.K., Basic and Applied Thermodynamics, 3rd edition, Tata McGraw Hill, 2002.NagP.K., Power Plant Engineering, 2nd edition, Tata McGraw Hill, 2001.

T.D. Eastop, A. Mcconkey, Applied Thermodynamics for Engineering Technologists, Pearson Education, 2009.

Fluid Mechanics

Fluid statics, Conservation laws, Viscous and inviscid flow analysis, Boundary layer theory and analyses.

Reference books:

Frank White, Fluid Mechanics, 8th edition, McGraw Hill Education, 2016

Fox, Mcdonald, Pritchard, Fluid Mechanics, 8th edition, John Wiley & Sons, 2011

Fluid Machines

Dimensional analysis as applied to fluid machines; Hydraulic turbines, Reciprocating and Rotodynamic Pumps; Gas Turbines; Gas compressors.

Reference books:

Frank White, Fluid Mechanics, 8th edition, McGraw Hill Education, 2016

Fox, Mcdonald, Pritchard, Fluid Mechanics, 8th edition, John Wiley & Sons, 2011

Heat Transfer

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, 9th Edition, 2002.
T. Bergman, A. S. Lavine, F. P. Incropera, D. P. DeWitt, Fundamentals of Heat and Mass Transfer, 7th Edition, John Wiley & Sons, 2011

Pharmacy

Natural Drugs, Phyto-chemistry, Pharmacognosy :

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, iso-quinoline, 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 andnaturally occurring gums.

Reference books:

Trease & Evans 'Pharmacognosy' Saunders, 15th Ed., 2002.Wallis T. E. 'Text book of Pharmacognosy', 5th 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. 4th 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, 5th 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, assaytechniques., 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, 7th Ed.
1988. Beckett and Stenlake J.B.
'Practical Pharmaceutical Chemistry' – 4th 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 inhibitiors, quinolone antibiotics, drugs for UTI, antifungal,antiviral, antitubercular, anthelmintics, antimoebics, anti-cancer drugs.

Reference books:

Goodman & Gilman's "The Pharmacological Basis of Therapeutics' - Fundamentals, 10th Ed., McGrawHill, 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 – 8th Ed. Tortora, et.al Pearson Pub.,

2004.Prescott et.al Microbiology' 6th Ed. McGraw Hill, 2005.

"Lehninger Principles of Biochemistry" – David L Nelson W.H, Framan & Co, 4th 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, 10th Ed., 1999.
Khanna O.P., Industrial Engineering and Management, Dhanpat Rai Rev. Ed. 1999.

Willing, et.al, Good Manufacturing Practice for Pharmacy: A plan for Total Q.C, Marcel Dekker, 5th 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, Communition, Mixing, Heat transfer, Distillation, Evaporation, Drying, Fluid Flow, Humidification, Dehumidification., Filtration, Crystallization, Compression

Reference books:

Aulton M.E – 'Pharmaceutics -The Science of Dosage Form Design-Churchill Livingston, 2nd Ed. 2002 or ELBS, I Ed.

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

Pharmaceutical Formulations and Biopharmaceutics

Pre-formulation 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 6th 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, 12th ed., 1987.

Computer Science

Discrete Mathematics

Principles of Counting, Recurrence Relations, Sets, Functions, Relations, Propositional Logic and Predicate Logic, Strings and 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 2nd Edition, Pearson Education.

Theory of Computation

Regular Languages, Regular Expressions, Finite Automata (deterministic and non-deterministic), Grammar, Context Free Grammar, Context Free Languages, Push Down Automata (deterministic and non-deterministic), Proving languages to be regular vs. not-regular and context free vs. not-context free, Turing Machines, Universal Turing Machine, Recursive and Recursively Enumerable Languages, Decidability and Un-decidability.

Reference books:

Harry R. Lewis and Christos H. Papadimitriou. Elements of the Theory of Computation 2nd Edition, Pearson Education.

Data Structures & Algorithms

Abstract Data Types and Data Structures. Algorithm Analysis and Order Notation.
Sorting and Searching – Algorithms and Complexity; Design and Implementation Techniques.
Linear Data Structures – Lists and Representation; Access-Restricted Lists; Queries, Design, and Implementation.
Dictionary Data Type: Lists, Hash Tables, Search Trees – Height Balancing; Queries, Design, and Implementation.
Non-linear Data Structures and Partially Ordered Data: Trees – Representation, Applications, and Traversal; Graphs – Representation, Connectivity, Traversal, and Paths; Design and Implementation
Reference Books:
Michael T. Goodrich, Roberto Tamassia. Algorithm Design. Wiley Student Edition.

Cormen T.H., Leiserson, C.E., Rivest, R.L., and C. Stein. Introduction to Algorithms, MIT Press, 2nd Ed.

Design & Analysis of Algorithms

Algorithm Design Techniques: Top-Down Design (Divide-and-Conquer, Greedy); Bottom-Up Design(Dynamic Programming); Randomization.
Analysis and Complexity: Analysis of Algorithms; Complexity of Problems – Lower Bound Analysis; Non-deterministic Algorithms, Complexity Classes and Reductions, NP-completeness / NP-hardness.
Handling Hard Problems: Search – Backtracking, Branch-and-Bound; Introduction to Approximation Algorithms.
Reference Books:
Cormen T.H., Leiserson, C.E., Rivest, R.L., and C. Stein. Introduction to Algorithms, MIT Press, 2nd 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, 5th edition, Pearson Education, Delhi,
2012.The Intel Microprocessors by Barry B Brey, 8th edition, PHI, 2014.

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", 9th edition, Addison Wesley, 2012.

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,and Instruction-Level Parallelism.

Reference books:

Hennessey & Patterson: Computer Organization & Design: Hardware-Software Interface, 5th edition, MK/Elsevier, NY, 2013.

Computer Networks

Concept of autonomous computing nodes in Computer Networks, Concept of Services, Interfaces & Protocols in Network Architectures; Classification of Networks: LAN MAN, WAN, SAN, PAN, Network Topologies: Bus, Star, Ring, Tree etc., The IEEE 802 Workgroup and select standards: IEEE 802.1, IEEE 802.2, IEEE 802.3 (& Variants): Ethernet, Error Control, Flow Control, Bridges, Basics of Wi-Fi & IEEE 802.11 (WLAN), Protocols at the Network / Internet Layer: IPv4, IPv6, ICMP(v4), IGMP (v4), ICMPv6, IP Addressing Schemes, IP Sub-netting: FLSM, VLSM, Unicast Routing Algorithms &

Protocols: Distance Vector Routing (RIP), Link-State Routing (OSPF), Multicast Routing: PIM-SM, PIM-DM, MOSPF, DVMRP, Path-Vector Routing (BGP), Mobile IP(v4) and Mobile IPv6, Transport Layer Protocols: TCP, UDP, Ports, Sockets, Flow Control, Congestion Control & Avoidance, Application Layer Protocols: HTTP, FTP, DNS, DHCP, SMTP, POP, IMAP, Elementary aspects of Network Security: Integrity, Privacy, Confidentiality, Protection, Authentication, Role of Cryptography, Non-Repudiation, Digital Signatures & Certificates, Intrusion Detection Systems, Firewalls

Reference Books:

1. James F. Kurose & Keith W. Ross: Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education Inc. Boston, 2016.
2. Larry L. Peterson & Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, MorganKaufmann / Elsevier, New Delhi, 2012, reprint 2016.
3. Andrew S. Tanenbaum & David J. Wetherall: Computer Networks, 5th Edition, Pearson, New Delhi,2014.

Database Systems

Data Modeling – ER Model, Relational Model, Object-oriented Model, Object-relational Model., QueryLanguages – Relational Algebra, Relational Calculus, & SQL, Normalization & Indexing – Functional Dependencies (FDs), Closure of set of FDs, Attribute Closure, Cannonical Cover, Normal forms up to
4NF. Primary, Clustering, & Secondary Indices, Tree-based and Hash-based Indexing, Multi-Dimensional 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:

1. Silberschatz, Korth & Sudarshan. Database System Concepts – 3rd edn, Mc-Graw Hill, 2011
2. Garcia-Molina, Ullman, Widom, The Complete Book - Database Systems, 2nd edn, PearsonEducation,2009

Compiler Construction

Overview of Compiler, phases of compiler, Lexical Analysis, Parsing (Top-down and Bottom-up Parsing), Abstract Syntax tree, Symbol Tables, Semantic Analysis. Types inferencing and Type Checking. Syntax Directed Translation. Intermediate Code, Code Generation – Basic Blocks and FlowGraphs, Register Allocation and Assignment, Code Generation Techniques.

Reference books:

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

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

Instrumentation

Electrical Sciences

Basic Circuit elements, sources and laws, Circuit analysis Techniques & Theorems, Time- domain analysis of 1st & 2nd Order Circuits, AC Circuit Analysis, Important Power Concepts, Power factor correction, Single phase and Three- phase Circuit Analysis, Frequency response and Resonance, Semiconductors: Construction, operation and application of Junction Diode, Zener Diode, Transistor (BJT's), JFET's and MOSFET, Ideal operational amplifiers configuration, Magnetic Circuits.

Reference book:

Leonard S Bobrow and Navneet Gupta "Foundation of Electrical Engineering" Oxford University Press,Asian Edition, 2015.

Analog Electronics

perational 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 shapingcircuits, 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, 5th edition,2005.

Digital Electronics

Number systems & Codes, Boolean algebra & Simplification, Digital Logic Families, Combinational logicDesign – 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, 3rd Edition, 2002.

Microprocessors

Introduction to Intel 80x86 processor ISA (8086-80486) , Assembly programming, Programmers model of processor, processor architecture; Instruction set, modular assembly programming using subroutines, macros etc. Timing diagrams, Concept of interrupts: hardware & software interrupts, Interrupt handling techniques, Interrupt controllers, Types of Memory & memory interfacing, Programmable Peripheral devices and I/O Interfacing, DMA controller and its interfacing, Serial Interface – PCI Buses, RISC Vs CISC, Cache Memory Organization, Concept of multicore microprocessors, Design of processor basedsystem.

Reference books:

Barry B Brey, C R Sarma, The Intel Microprocessors. Pearson, 6th Ed. 2005. Douglas V Hall, Microprocessor and Interfacing, TMH, Second Edition.

Signals & systems and Digital Signal Processing

Continuous-time and discrete-time signals and systems, Sampling and reconstruction, Properties of linear time-invariant (LTI) systems, Linear convolution, Fourier series (CTFS, DTFS), Fourier transform (CTFT, DTFT), Laplace transform, Z-transform, System analysis and frequency response. Discrete Fourier Transform, Fast Fourier Transform, Analog filters, Digital filters (FIR and IIR), Linear estimation and prediction, Adaptive filters, Multi-rate signal Processing.

Reference books:

1. B P Lathi "Principles of Signal Processing and Linear Systems" Oxford University Press, International version, 2009.

2. Alan V. Oppenheim, Alan S. Willsky, "Signals and Systems," Pearson Education Ltd., 2nd edition,2015.
3. Sanjit K. Mitra "Digital Signal Processing-A computer-based approach" McGraw Hill education, 4th Edition, 2013.

Electronic devices and microelectronics circuits

Semiconductor materials and their properties, Carrier transport and excess carriers in semiconductors; Single p-n junction devices- rectifier, Zener diodes, switching diodes, microwave diodes, optoelectronic devices, Bipolar junction transistors; JFET; MOSFET; MOS and CMOS devices; Basic device fabrication steps and techniques and introduction to ICs. Basic single and two stage transistor BJT and MOSFET amplifier; current mirrors and current sources; active load biasing in integrated circuits, Voltage sourcesand voltage references, differential and multistage amplifiers with and without feedback; 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, 6th ed.,2006. Adel S Sedra & K C Smith" Microelectronic Circuits" OUP, 5th edition, 2005.

Control Systems and 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. Line frequency Uncontrolled/Controlled AC-DC Converter (Rectifier); DC-DC Switch- Mode Converters; Switch- Mode DC-AC Converters (Inverters).

Industrial Instrumentation & Control

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.

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

Transducers & Measurement Techniques

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 & feedback measurement systems.

Reference books:

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

Electronic Instruments & Instrumentation Technology

Electronic indicating, display, Recording & Analysis instruments, Signal generators, Frequency synthesizers, Counters, Grounding and Shielding techniques, Instrumentation in hazardous areas, Industrial data communication.

Reference books:

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

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, 7th edition, Tata McGraw – Hill, 2002.
Molecular Technique
Restriction endonuleases, Vectors and cloning, Blotting technique, PCR, Sequencing **Reference books**: Principles of Gene Manipulation- R. W. Old & S. B. Primrose, 7th 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, 3rd edition
Microbiology
Fundamentals of Microbiology, A survey of the microbial world, Host-Microbe interaction, Microbes andHuman disease, Environmental and applied microbiology **Reference books**: Microbiology-An introduction (8^{th} 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, 3rd 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.

Cell and Developmental Biology

Preview of cell, cellular membranous systems, Transport, Mitochondria, Chloroplast, energy transducing, organelle, Golgi, Nucleus, Cytoskeletal network, Cell growth & proliferation, Cell Immunity,Morphogenesis and cell differentiation, Organogenesis, germ cells and sex, Stem cells.

Reference books:
Cell and Molecular Biology-Philip Sheeler & Donald E. Bianchi. 3rd edition, John Wiley Publication
Principles of Development –Lewis Wolpert-Oxford University Press, 2nd edition

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, 1st edition- Thomson Publication. Animal Physiology by Sherwoodet al, 1st edition- Thomson Publication.

Bio statistics and Introduction to Bioinformatics

Introduction to genomic & Proteomics, Human Genome and other sequencing projects, Biological databases and data mining, sequence similarity search and sequence alignment, Protein structure prediction and structure analysis, Phylogenetic analysis, use of software packages in Bioinformatics, Probability and Statistics.

Reference Books:
Introduction to Bioinformatics "By Arther M Lesk, Oxford,2003(TB- 1)Bioinformatics Genome and sequence Analysis" by David W Mount, CSHL Press

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 tri-molecular 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, 7th 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, 5th edition

Donald 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, 20033.

Molecular Quantum Mechanics", P.W. Atkins and R.S. Friedman, 3rd Ed. OUP (1997). [4th ed. Has comeout].

Elementary Quantum Chemistry" F.L. Pilar, 2nd ed., McGraw Hill

(1990). Quantum Chemistry", John P. Lowe, 2nd ed., Pearson Education Inc.

Structure and Reactivity of Organic Compounds

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

Reference books:

March Jerry, Advanced Organic Chemistry, John Wiley & Sons, 4th edition, 1992

Morrison and Boyd, Organic Chemistry, Prentice & Hall, 6th edition, 1992

Instrumental methods of analysis

Magnetic Resonance Spectroscopy (^{1}H NMR, ^{13}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, 3rd 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., 4th 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 5th edition Vogel's textbook of quantitative inorganic analysis

Vogel's qualitative inorganic analysis, 7th edition

Synthetic organic Chemistry

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

Reference books:

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

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

Stuart Warren, Designing Organic Syntheses: A Programmed Introduction to the Synthon 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', 8th 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, 5th Edition, Tata McGraw-Hill Publications Company Ltd., 2003.P

A Bruice, Organic Chemistry, 3rd Edition, Reason Edution, Inc. 2001.

Wade, Organic Chemistry, 5th Edition, Reason Edution, Inc. 2003

Economics

Principles of Economics

Elements of Market Economy, Demand, Supply, Elasticity, Marginal Utility & Indifference Curve Analysis, Consumer Behavior, Analysis of Production and Cost Analysis, Markets, Basics of Macroeconomics, GDP and Components of GDP, Role of Money, Banking and Credit Creation, Economics of Public Goods

Reference books:

Case K. E, Fair Ray C. and Oster S, "Principles of Economics", Pearson Education, 9th Edition, 2014

Fundamentals of Finance & Accounting

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

Reference books:

Horngren Charles T & Others Introduction to Financial Accounting Pearson Edu, 9th ed, 2008

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 Hill3rd ed. 1980.
- Snyder, Christopher & W Nicholson Fundamentals of Microeconomics Cengage-L, 11th ed, 2014

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: Theory and Policies", Pearson Education Inc.; 10th Edition, 2014

Econometrics

Basics of Statistics, Ordinary Least Squares (OLS), k-variable Linear Equation, General Linear Model, Violation of Classical Assumptions, Heteroskedasticity, Autocorrelation, Multicollinearity, Dummy variables, Time Series Analysis, Cross sectional and Panel Time Series Models, ARIMA Models, Simultaneous Equation System

Reference books:
Dougherty, Christopher Intro to Econometrics OUP, 4th ed., 2011

Money Banking & Financial Markets

Money and its Functions; Money Markets; Foreign Exchange Markets; Financial Markets; Financial Derivatives; the Banking Firm; Non-banking Financial Institutions; Indian Banking; Monetary Transmission Mechanisms; Money and Inflation; Theory of Rational Expectations; Central banking: Determinants of the Money Supply; Tools, Goals and Targets of Monetary Policy; International Monetaryand Financial System. IMF

Reference books:

Mishkin, Frederic S. The Economics of Money, Banking and Financial Markets: A Global PerspectiveAddison Wesley, 7th ed. 2004.

Public Finance and Theory

Theory and Practice: Scope of Public Finance, Allocation, Distribution & Public Choices, Equity in Distribution, Public Choice & Fiscal Policy, Public Expenditure – Structure, Growth & Evaluation, PublicRevenue, 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, Tata Mc Graw- Hill Book Company, 5th Edition, 2004, New Delhi

Economics of Growth and Development

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 Economics

International Economics, Early Trade Theories, International Trade – Comparative Advantage, The Standard Theory of International Trade, Offer Curves and the terms of Trade, Edgeworth Box Diagram & the Production possibility Frontier, Heckscher – Ohlin (H-O) Model, Modern Theories of International Trade, Tariffs, Quotas, Economic integration: custom union and free Trade Areas, Foreign Direct Investment, Balance of Payments: Concepts and Definitions, The Price Adjustment Mechanism with Flexible and Fixed Exchange Rate International Monetary System, GATT, WTO, Income Adjustment Mechanism and Synthesis of automatic Adjustment Mechanism, The Euro, Capital Account Convertibility, SAARC, SAPTA.

Reference books:
Salvatore. D. International Economics WSE 8th ed. 2004

ssues in Economic Development

Economic Development, Diverse Structure and Characteristics of Developing Nations, Classic Theories of Development; Contemporary Models of Development and Underdevelopment, Poverty, Inequality and Development, Population Growth and Economic Development: Causes, Consequences, and Controversies, Urbanization and Rural-Urban Migration: Theory and Policy, Human Capital: Education and Health in Economic Development, Gender and Development, Agriculture and Development, The Environment and Development, External Aid, Public Debt.

Reference books:

- Michael P. Todaro and Stephen C. Smith. Economic Development, 10th edition. Pearson Addison Wesley, 2012.
- Meier & Rauch (2012): Leading Issues in Economic Development, 8/e, Oxford University Press.
- Agarwala and Singh (eds.) (1992): The Economics of Underdevelopment, Oxford University Press,1992

Mathematics

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

Discrete Mathematics

Logic and methods of proof, Elementary Combinatorics, recurrence relations, Relations and digraphs, orderings, Boolean algebra and Boolean functions.

Reference book:
Joe L. Mott, Abraham Kandel& Theodore P. Baker: Discrete Mathematics for Computer Scientist & Mathematicians PHI, 2nd Edition 2010.

Elementary Real Analysis

Countable & Uncountable sets, Sequence of real numbers, Limsup & liminf., Metric space, Open & closedsets, limit point, compact sets in Rn, Metric space, Open & closed sets, limit point, compact sets in Rn, 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

Algebra

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.

Mathematical Methods

Integral Transforms: Fourier, Fourier sine/cosine and their inverse transforms (properties, convolution theorem and application to solve differential equation), Discrete Fourier Series, Fast Fourier transform, Calculus of Variation: Introduction, Variational problem with functionals containing first order derivatives and Euler equations, Variational problem with moving boundaries. Integral equations: Classification of integral equations, Voltera equations, Fredholm equations, Greens functions.

Reference books:
F. B. Hildebrand, Methods of Applied Mathematics, Dover Publications; 2nd edition, 1992. Sudhakar Nair**,** Advanced Topics in Applied Mathematics: For Engineering and the Physical Sciences, Cambridge University Press, 2011.

Operations Research

Queuing Systems: Poisson Queueing Systems, Reliability: Reliability & hazard rate function of seriesand 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. SinghOperations Research: AnIntroduction by Hamdy A Tah

Graphs and Networks

Basic concepts of graphs and digraphs behind electrical communication and other networks behind social, economic and empirical structures; connectivity, reachability and vulnerability; trees, tournaments and matroids; planarity; routing and matching problems; representations; various algorithms; applications.
Reference book:
Narsingh Deo: Graph theory with applications to engineering & computer science, PHI 1974.

Measure and Integration

Lebesgue measure, measurable sets, Measurable function, Riemann and Lebesgue, integral and its properties, Differenation, Function of Bounded variations, Lp – 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.

Ordinary Differential Equations

Existence and uniqueness theorems; properties of linear systems; behaviour of solutions of nth order equations; asymptotic behaviour of linear systems; stability of linear and weakly nonlinear systems; conditions for boundedness and the number of zeros of the nontrivial solutions of second order equations; stability by Liapunov's direct method; autonomous and non autonomous systems.

Reference book:
S Ahmad & M R M Rao : Theory of Ordinary Differential Equations with Applications in Biology and Engineering, East West Press, 1999

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

Introduction to Functional Analysis

Vector spaces, dimension, infinite dimensional vector, faces, Normed linear spaces, Riesz Lemma, Banach spaces, Normed linear spaces lp, C0,C[a,c], Continuous linear transformations on normed linear spaces, Inter product spaces, Hilbert spaces, orthogonal sets direct sum, Bessels Inequality, Riesz Representation theorem, uniform bounded ness, 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

Partial Differential Equations

Nonlinear equations of first order, Charpits Method, Method of Characteristics; Elliptic, parabolic and hyperbolic partial differential equations of order 2, maximum principle, Duhamels principle, Greens function, Laplace transform & fourier transform technique, solutions satisfying given conditions, partial differential equations in engineering & science.

Reference book:
Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, Birkhauser, 4th Edition.

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 ofMolecules, Nuclear Transformations
Reference books:
R. Eisberg& R. Resnick, Quantum Physics of Atoms, Molecules & Solids, WSE, 2nd ed., 1985Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill, 6th 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, 6th 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, 3rd 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:

C. J. Griffiths, Introduction to Electrodynamics, Pearson Education, 3rd 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, 4th ed., 2003

Stephen Gisiorowicz, Quantum Physics, John Wiley & Sons Inc., 3rd ed., 2003

Methods of Mathematical Physics

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

Reference books:

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

Arfken& Weber, Mathematical Methods for Physicists, Academic Press, 6th 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, 2nd 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, 7th ed., 1995
Optics & Spectroscopy
Geometrical Optics, Interference, Diffraction, Polarization, Crystal Optics & Lasers, Atomic & MolecularSpectroscopy **Reference books:** Ghatak, A K, Optics, Tata McGraw-Hill, 3rd ed., 2005 Banwell C N, Fundamentals of Molecular Spectroscopy, Tata Mc-Graw-Hill, 4th 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, 1st ed., 1988Griffiths, D J, Introduction to Elementary Particles, WIE, 1st ed., 1987

SYLLABUS FOR SPECIAL TEST IN ENVIRONMENTAL ENGINEERING

Environmental Pollution

Cause (Sources), effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes (Sources), effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution. Hazardous waste management, Air Quality Index.

Reference books:

Erach Bharucha, Text book for Environmental Studies, University Grants Commission, New Delhi,India, 2004

Water and Wastewater Treatment

Water and wastewater characteristics; Basic unit processes and operations for water treatment; Drinking water standards; Distribution of water; Sewage and sewerage treatment; Primary, secondary and tertiary treatment of wastewater, effluent discharge standards; Sludge disposal.

Reference books:

Water Supply Engineering and Wastewater Engineering by B. C. Punmia. Laxmi Publications (P) Ltd., New Delhi.

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

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

C.S. Rao, Environmental Pollution Control Engineering, New Age International (P) Limited,Publishers.

Measurement of Water Quality

Sampling, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Organic Carbon, Turbidity, Color, Taste, and Odor, Alkalinity, Solids, Nitrogen and Phosphorus,Pathogens, Heavy Metals, Other Organic Compounds

Reference books

Ruth F Weiner and Robin A Matthews., Environmental Engineering, Fourth Edition, 2003. Butterworth and Heinemann

Sludge Treatment and Disposal

Sources of Sludge, Characteristics of Sludges, Sludge Treatment, Ultimate Disposal

Reference books:

Ruth F Weiner and Robin A Matthews., Environmental Engineering, 4th Edition, 2003. ButterworthandHeinemann

Solid Waste Management

Quantities and Characteristics of Municipal Solid Waste, Collection, Disposal Options

Reference books:

Ruth F Weiner and Robin A Matthews., Environmental Engineering, 4th Edition, 2003. ButterworthandHeinemann

SYLLABUS FOR SPECIAL TEST IN 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.

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

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/Q 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:

Herbert Schildt., Java: The Complete Reference, 9th Edition, 2014. Oracle Press.

Database Systems

Database Modeling & Design – ER modeling, Normalization Techniques, Database Querying – SQL.

Reference books

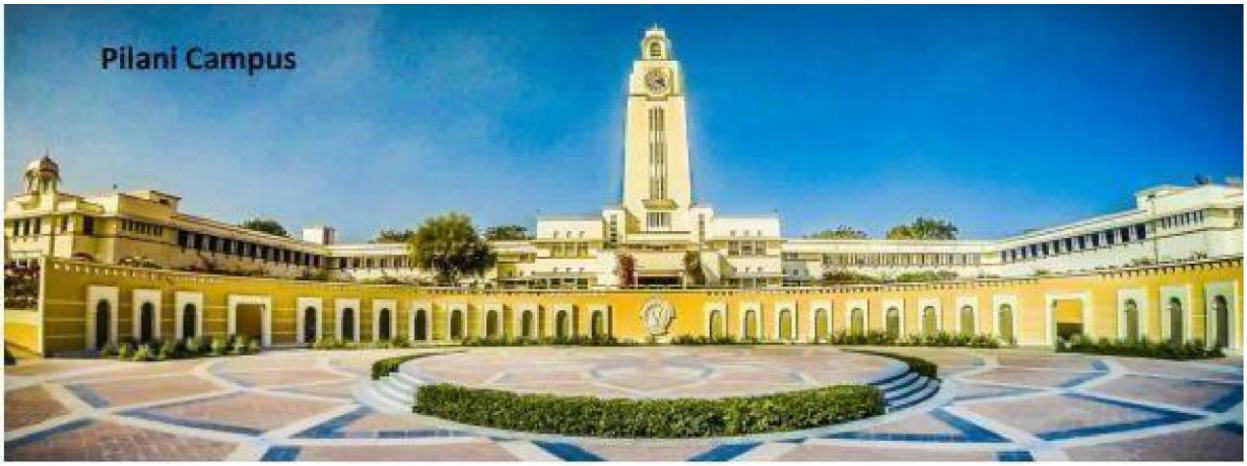
Database System Concepts. Silberschatz, Korth and Sudarshan. 6th Ed. McGraw Hill, 2016.

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,", 2nd edition,Prentice-Hall, 2011.


Pilani Campus

K K Birla Goa Campus

BITS Pilani Hyderabad Campus