Fifth Meeting of the Senate

July 8, 2019

Minutes of the Meeting

Indian Institute of Information Technology Vadodara

The Fifth meeting of the Senate was held on 8th July, 2019 at 2.00 pm in Conference Room, IIIT Vadodara

The following members were present:

1. Prof. Sarat Kumar Patra, Director IIIT Vadodara, Chairperson
2. Prof. Surendra Prasad, IIT Delhi, Member
3. Prof. G Sivakumar, IIT Bombay, Member
4. Prof. Pratik Shah, IIIT Vadodara, Head of Department IT
5. Prof. Dhirendra Sinha, IIIT Vadodara, Head of Department Sciences and HSS
6. Prof. Jignesh Bhatt, IIIT Vadodara, Head of Department CSE
7. Col. Ravi Chugh, Registrar IIIT Vadodara, Member Secretary

Leave of absence was granted to Prof. Pandu Rangan and Dr. K. Kesavasamy as they could not attend the meeting due to their prior commitment. However, Dr. K. Kesavasamy had forwarded his comments on the agenda which were tabled by the Secretary.

Agenda of the fifth meeting of the Senate
8th July, 2019

ANNEXURES

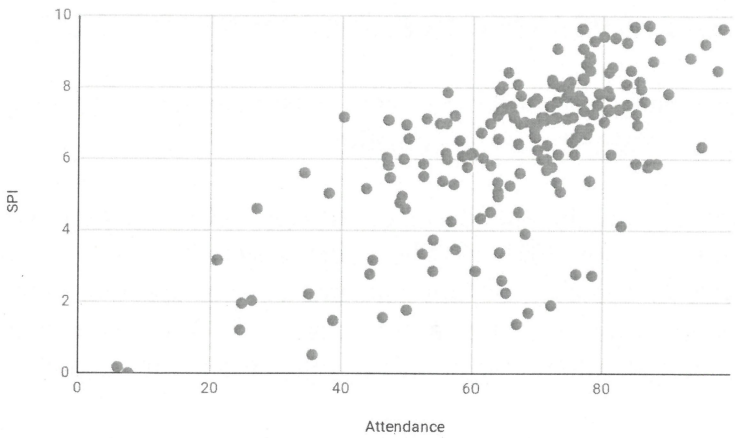
Annexure-I	The list of students having a very low attendance along with their academic performance for Winter 2018-19
Annexure-II	Results for Autumn and Winter Semesters 2018-19
Annexure-III	Academic calendar for Autumn 2019-20
Annexure-IV	Ordinance of B.Tech., M.Tech. and Ph.D. Programs
Annexure-V	Curriculum for B.Tech. in CSE and IT
Annexure-VI	The evaluation guidelines for M.Tech. thesis
Annexure-VII	The guidelines for Ph.D. comprehensive examination
Annexure-VIII	Draft Endowment Fund Policy
Annexure-IX	MHRD Office Memorandum No F No:12-4/2019-U1 dated 17th January 2019

SEN:5-1 APPROVE THE MINUTES OF THE FOURTH MEETING OF THE SENATE HELD ON OCTOBER 2, 2018

The Minutes of the "Fourth meeting of the Senate" held on October 2, 2018 was circulated to all members. There were no corrections/ changes suggested by the members. The Senate adopted the minutes.

SEN:5-2 REPORT ON THE ATTENDANCE OF STUDENTS IN WINTER SEMESTER 2019 (JAN TO MAY 2019)

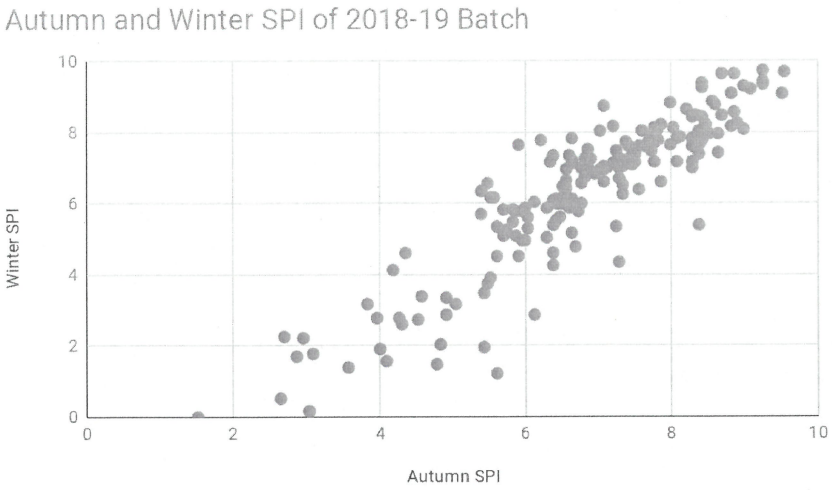
The institute attendance policy requires students to maintain a minimum of 75% attendance to appear for the end-semester examination. However, a considerate view was taken for Winter 2018-19 and the students not meeting the attendance criteria were permitted to appear for the end-semester examination. The graphs below (averaged attendance over all courses in percentages vs. semester performance index) summarizes the performance of 2018-19 B.Tech. in CSE and IT students in Winter 2018-19 semester.



Following is the summary in terms of number of students not meeting the attendance criteria is at least one course in the Winter 2018-19 semester.

Number of students having attendance	2016-17	2017-18	2018-19
<50%	01	00	22
50% - 75 %	19	24	75
>75%	61	67	85

Aside: The following indicates positive correlation between the semester performance Autumn and Winter indices (B.Tech. 2018-19 batch)



The Senate deliberated on the issue. The issue of implementing attendance policy where attendance between 60% and 75% can be permitted with penalty of one grade was also discussed. The Senate resolved to maintain the current attendance criteria for Academic year 2019-20.

SEN:5-3 TO CONSIDER NOT-PERMITTING STUDENTS WITH VERY LOW ATTENDANCE FROM APPEARING IN SUPPLEMENTARY EXAMINATIONS

As per the institute academic regulation, a student must maintain a minimum of 75% attendance in a course to appear for the end-semester examination.

However, students not meeting the attendance criteria (≥ 75%) were permitted to appear for the end-semester examination for Winter 2018-19. The students were intimated about their attendance status in March 2019 (middle of semester). Many students did not approve their attendance status. It is proposed that the student with a very low attendance (< 60%) in a course and not able to achieve a PASS grade in that course should not be permitted to appear in the supplementary examination.

The list of students having a very low (<75%) attendance along with their academic performance for Winter 2018-19 is placed in **Annexure - I** for reference.

Following was approved:

1. As a one-time measure, students with below 75% attendance (the student attendance requirement of institute) also be permitted to appear the supplementary examinations.
2. The above students will have to execute an Undertaking in witness of their parents citing the reasoning and justification of their low attendance. Undertaking without parent signature will not be accepted. Students who forge parent signature if detected will be penalized appropriately.
3. The Undertaking should contain a statement/ undertaking by the student to on maintaining the attendance criteria in future semesters, failing which their specific course registration f will be treated, canceled.

SEN:5-4 TO APPROVE AND CONFIRM THE RESULTS OF B.TECH. (CSE AND IT), M.TECH. CSE AND PH.D. PROGRAMS FOR AUTUMN AND WINTER SEMESTERS 2018-19

The detailed results for Autumn and Winter Semesters 2018-19 are placed in **Annexure - II.**
Summary of the results is tabulated below for reference:

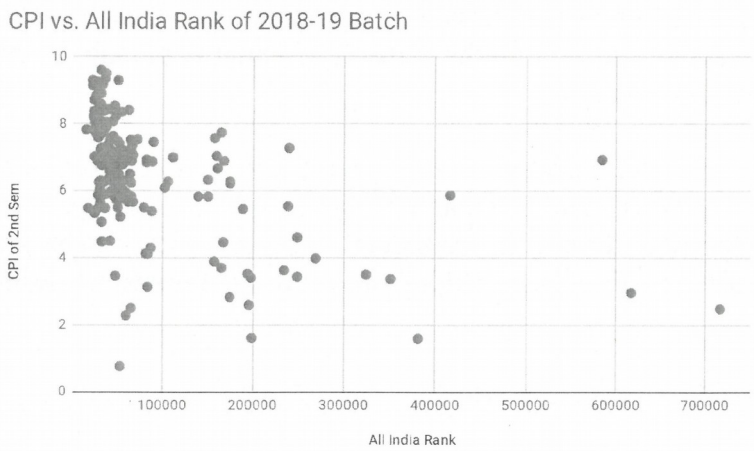
(A) Batch wise summary of student performance:

(i) B.Tech. in CSE and IT programs (Autumn - Winter 2018-19)

Batch (B.Tech.)	Program	Highest CPI		Average CPI		Lowest CPI	
		Autumn	Winter	Autumn	Winter	Autumn	Winter
2015-16	CSE	9.30	9.37	7.34	6.91	4.88	6.11
	IT	8.48	8.64	7.15	6.92	5.22	5.83
2016-17	CSE	9.51	9.45	7.33	7.22	4.54	4.56
	IT	8.40	8.48	6.85	6.90	5.23	5.62
2017-18	CSE	9.62	9.58	7.14	7.27	4.38	4.85
	IT	8.31	8.30	6.88	7.08	5.03	5.38
2018-19	CSE	9.55	9.61	6.74	6.60	0.00	0.76
	IT	9.27	9.30	6.66	6.42	3.18	2.50

Batch (B.Tech.)	Number of Students		CPI ≥9	CPI ≥9	CPI : 6.5-8-99	CPI : 6.5-8.99	CPI: 5-6.49	CPI : 5-6.49	CPI <5	CPI <5
	Autumn	Winter	Autumn	Winter	Autumn	Winter	Autumn	Winter	Autumn	Winter
2015-16	CSE (63)	CSE (63)	3	3	47	48	12	6	1	6
	IT (30)	IT (30)	0	0	23	25	07	3	0	2
2016-17	CSE (61)	CSE (61)	4	5	40	38	16	16	1	2
	IT (20)	IT (20)	0	0	13	13	07	7	0	0
2017-18	CSE (60)	CSE (60)	4	4	36	41	18	14	2	1
	IT (31)	IT (31)	0	0	21	23	10	8	0	0
2018-19	CSE (152)	CSE (150)	6	8	92	81	34	37	20	24
	IT (32)	IT (32)	1	1	19	18	08	8	04	5

(F) Correlation of Student JEE AIR and their CPI



The above graph presents results of 2018-19 batch following Winter 2018-19 semester examinations.

The Senate approves the results of Autumn and Winter 2018-19 semesters.

SEN:5-5 TO APPROVE THE ACADEMIC CALENDAR FOR AUTUMN SEMESTER 2019-20

The academic calendar for Autumn 2019-20 is attached in **Annexure – III.**
The Senate approves the academic calendar for Autumn 2019-20.

SEN:5-6 TO RATIFY THE ORDINANCES OF B.TECH., M.TECH. AND PH.D. PROGRAMS (APPROVED VIDE CIRCULATION AGENDA)

The ordinances of B.Tech., M.Tech. and Ph.D. programs were circulated for approval of the senate. The same is placed before the senate for ratification. The ordinances are placed in **Annexure - IV** for reference.

The Senate has found the ordinances consistent with respect to the approved program guidelines and regulations. The senate approved the ordinances.

SEN:5-7 CONSIDER AND APPROVE THE 2ND, 3RD AND 4TH YEAR COURSE CONTENTS AS PER THE NEW CURRICULUM FOR BTECH BATCH 2018 AND BEYOND

The detailed curriculum for B.Tech. in CSE and IT are placed in **Annexure - V**. Approval on the credit structure was taken in the third senate meeting. The course contents for 2nd, 3rd and 4th year courses have been prepared and put up for approval of the senate. The senate approved the curriculum.

SEN:5-8 CONSIDER AND APPROVE THE INCLUSION OF M.TECH. INFORMATION SECURITY AS A SPECIALIZATION IN M.TECH (CSE)

The rapid growth of computer systems and their interconnections via networks has increased the security risk for data stored and communicated through the network. The M.Tech. (CSE) program with specialization in Information Security aims towards producing the professionals for the high-end jobs in the field of Information Security at academia as well as industries. The program also offers a platform for students to acquire the skill-set essential to pursue the state-of-the-art research in the field of Information Security.

Some of the electives include: Introduction to Cryptography and Network Security, Cloud Security, Modern Cryptography, Blockchain Technology, Web Applications Security, Intrusion Detection and Prevention, Security Protocols, Number Theory and Cryptography, Post-Quantum Cryptography, Security Engineering, Digital and Cyber Forensics, Ethical Hacking, Usable Security.

The specialization is reflected in the curriculum only. The institute grants degree in CSE.

The Senate approves the proposal.

SEN:5-9 CONSIDER AND APPROVE THE PROPOSED PROCESS OF EVALUATION FOR M.TECH. THESIS

The evaluation guidelines for M.Tech Thesis is placed in **Annexure - VI** . The same was put up for perusal and approval of the senate.

The Senate approves the M.Tech Thesis evaluation process.

SEN:5-10 APPROVE ADDITIONAL GUIDELINES FOR PH.D. COMPREHENSIVE EXAMINATION

The guidelines for Ph.D. comprehensive examination is placed in **Annexure - VII.** The same is put up for perusal and approval of the senate.

The Senate proposed following for the Ph.D. Comprehensive examinations:

1. The written examination should be of three hours.
2. Each department will prepare a list of five courses to be included for written examination. All students of the department will spear examination in the said courses only. For Department of Science and Humanities five courses will be provided for each specialization which include Mathematics and statistics, Physics and Humanities.
3. The student will have ample choice in the question paper within the courses for the written examination.
4. Following to the written examination, a student will appear for viva-voce based on the courses of written examination.
5. A student, upon successful completion of written and viva parts, will present a seminar on his area of research interest and to be evaluated by the committee.
6. A student has to pass each component to successfully qualify and complete the comprehensive examination.

SEN:5-11 TO CONSIDER THE PROPOSAL FOR ENDOWMENT FUND POLICY

Draft Endowment Fund Policy is enclosed in **Annexure - VIII** for perusal and approval of senate.

The Senate approves the draft policy.

SEN:5-12 INFORMATION PERTAINING TO SEAT MATRIX FOR B.TECH. AND M.TECH. ADMISSIONS 2019-20

During the first Coordination Forum meeting chaired by Hon'ble HRM on 27th August 2018, it was minuted vide Item 1.6 that IIIT (PPP) Institutes can keep 10% seats as supernumerary seats to compensate for vacant seats. It was further directed that there would be no Spot Round of IIIT (PPP) of local level. These 10% seats will be incorporated in the normal seat matrix. Accordingly the same has been incorporated in the seat matrix forwarded to CSAB.

MHRD vide their Office Memorandum No F No:12-4/2019-U1 dated 17th January 2019 **(refer Annexure IX)** had directed to cater to EWS reservation in admissions (10% reservation with adjustment of seat matrix so that general seats do not reduce). However, they allowed the Institute to implement the reservation by 2020. **Accordingly, the Institute decided to implement 5% EWS reservation in the Academic Year 2019-20 and 10% in Academic Year 2020-21.** In process of introducing reservation the seats availability to general category students should not be affected. This 5% reservation leads to 12.5% increase in total seats.

The sanctioned strength of seats at the Institute in Academic Year 2018 was as under:

	Sanctioned Strength	**Total for Academic Year**
B.Tech CSE	160	200
B.Tech IT	40	
M.Tech CSE	30	30

The final seat matrix for B.Tech admissions incorporating 10% supernumerary seats and EWS reservation is as under:

Branch	GEN EWS	GEN EWS PWD	OPEN	OPEN PwD	ST	ST PwD	SC	SC PwD	OBC	OBC PwD	Total
CSE	10	1	85	4	14	1	28	2	50	3	198
IT	3	0	21	1	4	0	6	1	13	1	50
											248

The final seat matrix for M.Tech admissions incorporating EWS seats only (No supernumerary seats) is as under:

Branch	GEN EWS	GEN EWS PWD	OPEN	OPEN PwD	ST	ST PwD	SC	SC PwD	OBC	OBC PwD	Total
CSE	2	0	16	1	1	0	5	0	8	1	34
											34

The seat matrix was approved by the senate through circulation. The details are placed here for the information of the Senate.

SEN:5-13 PLACEMENT REPORT 2018-19

In A.Y. 2018-19, 96.5% of graduating students were offered jobs through placement cell. A total of 110 offers were received. The highest salary of Rs 15.31 lakh per annum has been offered by Adobe this year.

Other companies that visited the campus for placement and internship include Directi, Amazon, Codenation, Siemens, Mathworks, Mettl, Cognam, MAQ Software, PlaySimple Games, Nucleus Software, ICICI Bank, Gromor Finance, TCS, among others.

A total of 44 companies had registered for placements during academic year 2018-19, offering profiles like software engineering, product management, research and development, research engineering, associate consultant, analyst, business consultant among others. Average package was nearly Rs 6.4 lakh per annum compared to Rs 5.34 lakh per annum last year. For the A.Y. 2019-20, 25 firms have confirmed their participation for placement.

SEN:5-14 REPORTING ON FACULTY RECRUITMENT

Institute had advertised for faculty positions in the month of October 2018. After a thorough screening and interviewed by an expert panel, 9 offer letter were issued. Two of the faculty members have joined and Four are likely to join by 15th July 2019.

The details of faculty members are as under:-

Name of Faculty	Term of Employment	Subject Area
Mr. Amandeep Singh (Ph. D Thesis submitted)	On Consolidated contract	English
Dr Satyendra Singh Yadav	On Consolidated Contract	CSE
Dr Antriksh Goswami	On scaled contract	CSE
Dr Sunil Dutt	On scaled contract	CSE
Dr Soumen Atta	On scaled contract	CSE
Dr. Manojit Ghose	On scaled contract	CSE

This was presented for the information of the Senate.

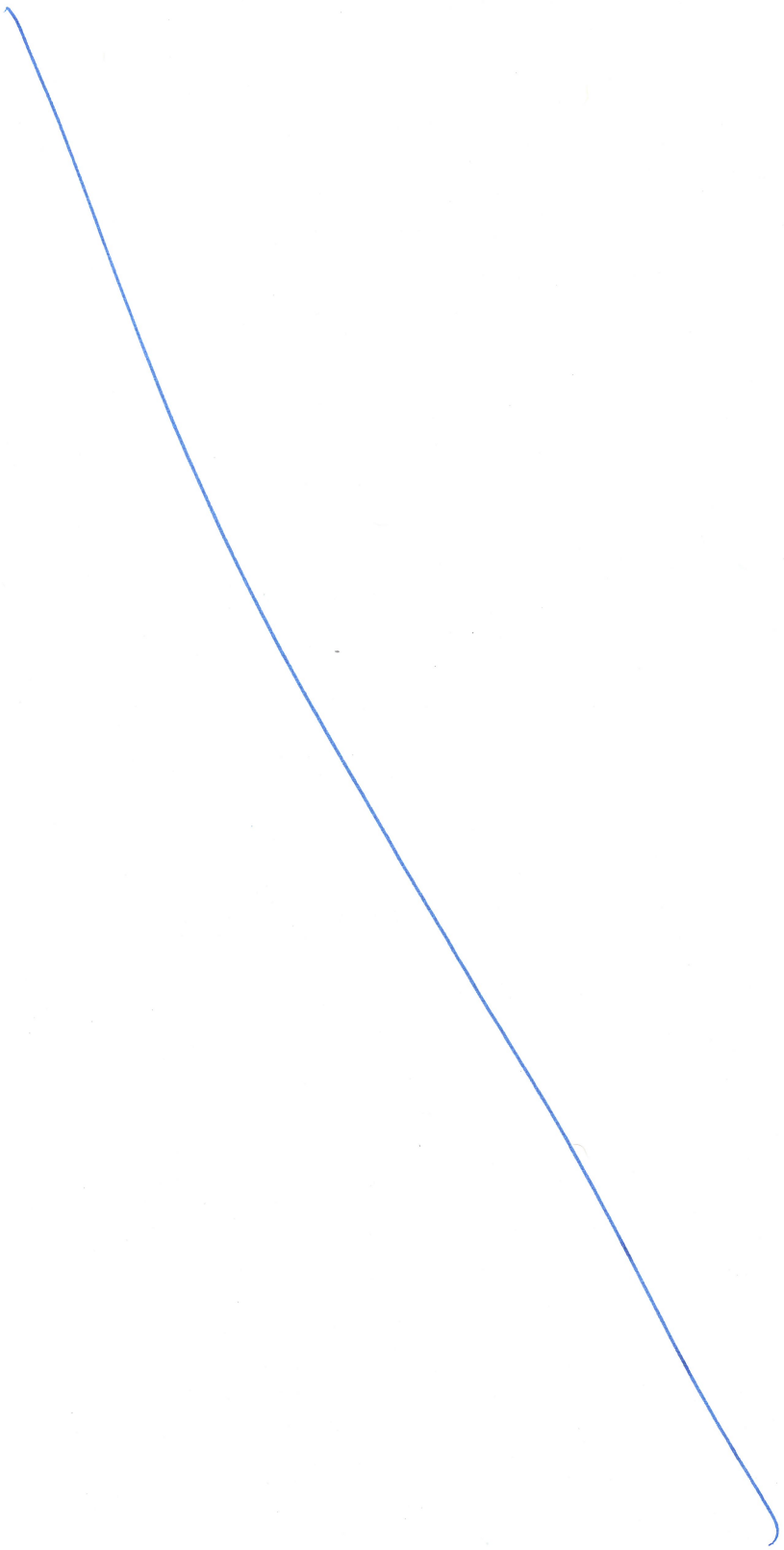
SEN:5-15 CONVOCATION OF THE INSTITUTE

It is proposed to conduct convocations of Institute on 1st Saturday of November every year.

The Senate approves the agenda.

SEN:5-16 ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR

No other items were presented for consideration under this head.



ANNEXURE – 1

(Exempted under Section 8 (1) (g) of RTI Act 2005)

Annx – II

Summary of performance of B.Tech students is placed below:

BTECH (Batch)	Program	Highest CPI	Average CPI	Lowest CPI
2015-16	CSE	9.30	7.34	4.88
	IT	8.48	7.15	5.22
2016-17	CSE	9.51	7.33	4.54
	IT	8.40	6.85	5.23
2017-18	CSE	9.62	7.14	4.38
	IT	8.31	6.88	5.03
2018-19	CSE	9.55	6.74	0.00
	IT	9.27	6.66	3.18

	Number of Students	CPI≥9.00	CPI: 6.50 – 8.99	CPI: 5.00 – 6.49	CPI≤5.00
2015-16	CSE(63)	03	47	12	01
	IT(30)	00	23	07	00
2016-17	CSE (61)	04	40	16	01
	IT (20)	00	13	07	00
2017-18	CSE (60)	04	36	18	02
	IT (31)	00	21	10	00
2018-19	CSE(152)	06	92	34	20
	IT(32)	01	19	08	04

(A) Batch wise Summary of student performance

B.Tech in Computer Science and Engineering

	2015-16	2016-17	2017-18	2018-19
Max CPI	9.30	9.51	9.62	9.55
Avg CPI	7.34	7.33	7.14	6.74
Max SPI	9.27	9.45	9.77	9.55
Avg SPI	7.53	7.01	7.08	6.74
Lowest CPI	4.88	4.54	4.38	0.00

B.Tech in Information Technology

	2015-16	2016-17	2017-18	2018-19
Max CPI	8.48	8.40	8.31	9.27
Avg CPI	7.15	6.85	6.88	6.68
Max SPI	9.21	8.78	8.71	9.27
Avg SPI	6.97	7.25	7.20	6.68
Lowest CPI	5.22	5.23	5.03	3.18

Annx – III

Indian Institute of Information Technology Vadodara

Autumn 2019-20

Academic Calendar

Sr. No.	Event	Date(s)	Day(s)
1	Registration for Returning Students (After Noons)	On or Before 22 July, 2019	--
2	Registration for PG Students (After Noons)	On or Before 22 July, 2019	--
3	Supplementary Exams (Autumn)	15 - 19 July, 2019	Monday - Friday
4	Commencement of Classes for Returning Students	22 July, 2019	Monday
5	Commencement of classes for M.Tech and Ph.D. students	22 July, 2019	Monday
6	Last date of Add-Drop Course	29 July, 2019	Monday
7	Announcement of Results (Supplementary Exam)	29 July, 2019	Monday
8	Orientation for First Year (UG) Students	2 - 6 August, 2019	Friday - Tuesday
9	Commencement of Classes for First Year (UG) Students	5 August, 2019	Monday
10	In-Semester Examination - I	11 - 13 September, 2019	Wednesday - Friday
11	Ph.D. Comprehensive Exam	October 2019	--
12	In-Semester Examination - II	16 - 18 October, 2019	Wednesday - Friday
13	Semester Break for Students	28 October - 1 November, 2019	Monday - Friday
14	Course Feedback	11 - 15 November, 2019	Monday - Friday
15	Pre-registration for Winter Semester	18 November, 2019	Monday
16	End-Semester Examination (First Year UG)	25 - 29 November, 2019	Monday - Friday
17	End-Semester Examination (Returning Students and PG)	21 - 23 and 25 - 29 November, 2019	Thursday - Saturday and Monday - Friday
18	Last Date of Submission of Grades to Registrar's Office	6 December, 2019	Friday
19	Result Coordination Committee Meeting	11 December, 2019	Wednesday
20	Announcement of Results	December Third Week	--
21	Ph.D. Research Progress Seminars	16 - 17 December, 2019	Monday - Tuesday
22	M.Tech. Research Progress Seminars	18 - 20 December, 2019	Wednesday - Friday
23	Vacation Period (For faculty members)	16 - 27 December, 2019	Monday - Friday
24	Rural Internship Duration	2 - 27 December, 2019	Monday - Friday
25	B.Tech. Student Vacation	1 December, 2019 - 1 January, 2020	Monday - Tuesday
26	Design Project Evaluation	2 - 3 January, 2020	Thursday - Friday
27	Winter 2019-20 (Registration and Commencement of Classes for Returning Students)	2 January, 2020	Thursday
28	Supplementary Examinations	30 December, 2019 - 3 January, 2020	Monday - Friday
29	Submission of Grades (Supplementary Exam)	10 January, 2020	Friday
30	Announcement of Results of Supplementary Exams	17 January, 2020	Friday

Approved

28/6/2019

Autumn 2019-20 (For Returning Students)

		Acad/Non-Acad (1/0)					
Week	**Dates**	**M**	**T**	**W**	**Th**	**F**	**Remarks**
1	15-19 July	S	S	S	S	S	Supplementary Exam: 15, 16, 17, 18, 19 July, Registration on or before 22 July for returning students
2	22-26 July	1	1	1	1	1	
3	29 July - 2 Aug	1	1	1	1	1	
4	5-9 Aug	1	1	1	1	1	
5	12-16 Aug	H	1	1	H	1	Holiday: 12 and 15 Aug
6	19-23 Aug	1	1	1	1	1	
7	26-30 Aug	1	1	1	1	1	
8	2-6 Sep	1	1	1	1	1	
9	9-13 Sep	1	H	E	E	E	Holiday: 10 Sep, In-Sem Exam - I: 11, 12 and 13 Sep
10	16-20 Sep	1	1	1	1	1	
11	23-27 Sep	1	1	1	1	1	
12	30 Sep - 4 Oct	1	1	H	1	1	Holiday: 2 Oct
13	7-11 Oct	H	H	1	1	1	Holiday: 7 and 8 Oct
14	14-18 Oct	1	1	E	E	E	In-Sem Exam - II: 16, 17, 18 Oct
15	21-25 Oct	1	1	1	1	1	
16	28 Oct - 1 Nov	B	B	B	B	B	Holiday: 27th Oct, Semester Break for Students: 28 Oct - 1 Nov
17	4-8 Nov	1	1	1	1	1	
18	11-15 Nov	1	H	1	1	1	Holiday: 12 Nov, Course Evaluation: 11-15 Nov, Lab Exam Week
19	18-22 Nov	1	1	1	E	E	End-sem Exam: 21, 22, 23 Nov
20	25-29 Nov	E	E	E	E	E	End-sem Exam: 25, 26, 27, 28, 29 Nov
	Total Days	15	14	14	13	14	

Indian Institute of Information Technology Vadodara			
Autumn 2019-20			
Academic Calendar - UG 2019-20 Batch			
Sr. No.	**Event**	**Date(s)**	**Day(s)**
1	Orientation for First Year Students	2 - 6 August, 2019	Friday - Tuesday
2	Commencement of Classes for First Year Students	5 August, 2019	Monday
3	In-Semester Examination - I	11 - 13 September, 2019	Wednesday - Friday
4	In-Semester Examination - II	16 - 18 October, 2019	Wednesday - Friday
5	Semester Break for Students	28 October - 1 November, 2019	Monday - Friday
6	Course Feedback	11 - 15 November, 2019	Monday - Friday
7	Pre-registration for Winter Semester	18 November, 2019	Monday
8	End-Semester Examination (First Year UG)	25 - 29 November, 2019	Monday - Friday
9	End-Semester Examination (Returning Students and PG)	21 - 23 and 25 - 29 November, 2019	Thursday - Saturday and Monday - Friday
10	Last Date of Submission of Grades to Registrar's Office	6 December, 2019	Friday
11	Result Coordination Committee Meeting	11 December, 2019	Wednesday
12	Announcement of Results	December Third Week	
13	B.Tech. Student Vacation	1 December, 2019 - 1 January, 2020	Monday - Tuesday
14	Vacation Period (For faculty members)	16 - 27 December, 2019	Monday - Friday
15	Winter 2019-20 (Registration and Commencement of Classes for Returning Students)	2 January, 2020	Thursday
16	Supplementary Examinations	30 December, 2019 - 3 January, 2020	Monday - Friday
17	Submission of Grades (Supplementary Exam)	10 January, 2020	Friday
18	Announcement of Results of Supplementary Exams	17 January, 2020	Friday

Approved.
05/6/2019

1. PL upload in CSAB/JOSSA website.

05/6/2019

Autumn 2019-20 (For First Year Students)

		Acad/Non-Acad (1/0)					
Week	**Dates**	**M**	**T**	**W**	**Th**	**F**	**Remarks**
1	29 July - 2 Aug					1	Orientation on 2nd Aug
2	5-9 Aug	1	1	1	1	1	
3	12-16 Aug	H	1	1	H	1	Holiday: 12 and 15 Aug
4	19-23 Aug	1	1	1	1	1	
5	26-30 Aug	1	1	1	1	1	
6	2-6 Sep	1	1	1	1	1	
7	9-13 Sep	1	H	E	E	E	Holiday: 10 Sep, In-Sem Exam - I: 11, 12, 13 Sep
8	16-20 Sep	1	1	1	1	1	
9	23-27 Sep	1	1	1	1	1	
10	30 Sep - 4 Oct	1	1	H	1	1	Holiday: 2 Oct
11	7-11 Oct	H	H	1	1	1	Holiday: 7 and 8 Oct
12	14-18 Oct	1	1	E	E	E	In-Sem Exam - II: 16, 17, 18 Oct
13	21-25 Oct	1	1	1	1	1	
14	28 Oct - 1 Nov	B	B	B	B	B	Semester Break for Students: 28 Oct - 1 Nov, Holiday: 27th Oct
15	4-8 Nov	1	1	1	1	1	
16	11-15 Nov	1	H	1	1	1	Holiday: 12 Nov, Course Evaluation: 11-15 Nov
17	18-22 Nov	1	1	1	1	1	Lab Exam Week
18	25-29 Nov	E	E	E	E	E	End-sem Exam: 25, 26, 27, 28, 29 Nov
	Total Days	13	12	12	12	14	

One of the Friday to be treated as Tuesday. 6th Sep to be treated as Tuesday.

Approved
05/6/2019

Indian Institute of Information Technology Vadodara

Office of Registrar

OO: IIITV/2018-19/20

04.10.2018

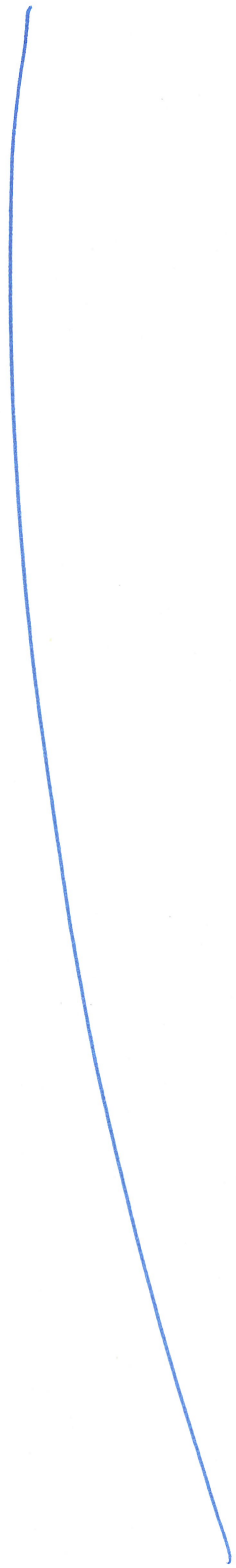
List of Holidays: 2019

Ser No.	Holiday	Date	Day
1	REPUBLIC DAY	26-Jan-19	Saturday
2	MAHA SHIVRATRI	04-Mar-19	Monday
3	HOLI	21-Mar-19	Thursday
4	MAHAVIR JAYANTI	17-Apr-19	Wednesday
5	GOOD FRIDAY	19-Apr-19	Friday
6	BUDDHA PURNIMA	18-May-19	Saturday
7	IDU'L FITR	05-Jun-19	Wednesday
8	IDU'L ZUHA	12-Aug-19	Monday
9	INDEPENDENCE DAY	15-Aug-19	Thursday
10	MUHARRAM	10-Sep-19	Tuesday
11	MAHATMA GANDHI'S BIRTHDAY	02-Oct-19	Wednesday
12	DUSSEHRA (Additional Day)	07-Oct-19	Monday
13	DUSSEHRA (VIJAY DASHMI)	08-Oct-19	Tuesday
14	DIWALI (DEEPAVALI)	27-Oct-19	Sunday
15	PROPHET MOHAMMAD'S BIRTHDAY (ID-E-MILAD)	10-Nov-19	Sunday
16	GURU NANAK'S BIRTHDAY	12-Nov-19	Tuesday
17	Christmas	25-Dec-19	Wednesday

This has the approval of Director

Registrar

Distribution:
Director – for information please.
All Faculty & Staff Members
Personnel Section
Accounts & Audit Section



Bachelor of Technology

Programme Ordinance

Indian Institute of Information Technology, Vadodara
February 2019

EXTRACTS FROM IIIT (PPP), ACT 2017

The following are the extracts from THE INDIAN INSTITUTES OF INFORMATION TECHNOLOGY (PUBLIC-PRIVATE PARTNERSHIP) ACT, 2017 (NO. 23 OF 2017)

Section 33: Subject to the provisions of this Act and the Statutes, the Ordinances of every Institute may provide for all or any of the following matters, namely: —

a. the admission of the students to the Institute;
b. the courses of study to be laid down for all degrees and diplomas of the Institute;
c. the conditions under which students shall be admitted to the degree or diploma courses and to the examinations of the Institute, and shall be eligible for degrees and diplomas;
d. the conditions of award of the fellowships, scholarships, exhibitions, medals and prizes;
e. the conditions and mode of appointment and duties of examining bodies, examiners and moderators;
f. the conduct of examinations;
g. the maintenance of discipline among the students of the Institute; and
h. any other matter which by this Act or the Statutes is to be or may be provided for by the Ordinances.

Section 34:

1. Save as otherwise provided in this section, Ordinances shall be made by the Senate.
2. All Ordinances made by the Senate shall have effect from such date as it may direct, but every Ordinance so made shall be submitted, as soon as may be, to the Board and shall be considered by the Board at its next meeting.
3. The Board shall have power by resolution to modify or cancel any such Ordinance and such Ordinance shall from the date of such resolution stand modified accordingly or cancelled, as the case may be.

INTRODUCTION

1. All Bachelor of Technology (BTech) Programmes offended by IIIT Vadodara shall be governed by the BTech Ordinance.

2. The provisions contained in these regulations will govern the terms and conditions for student registration, course assessment and modes of assessment, minimum requirements of academic performance and evaluation of performance leading to BTech degrees.

3. The Institute shall offer BTech program in following branches

    a. Four-year BTech in Computer Science and Engineering (CSE).
    b. Four-year BTech in Information Technology (IT).

The ordinance shall be applicable to other BTech degree programmes offered in future also.

These ordinances are effective from the date they are approved and published by the Government of India. The ordinance deal only with the post-admission academic activities of the Degree Programs. Eligibility criteria for admission, admission procedures, etc. are outside the purview of these regulations.

BTR 1: ACADEMIC CALENDAR

1.1 Each academic session is divided into two semesters of approximately eighteen weeks duration (with at-least seventy working days for classes in each semester): An Autumn semester and a Winter semester.

1.2 In addition, there may be a semester during the summer break, called a summer semester.

1.3 The Senate approved schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, inter-semester breaks etc, shall be laid down in the Academic Calendar for the session.

BTR 2: ADMISSION

2.1 The number of seats in each branch of the undergraduate programme for which admission is to be made at the IIIT Vadodara will be decided by the Senate of IIIT Vadodara. Seats are reserved for candidates belonging to Other Backward Classes (OBC), Scheduled Castes (SC), Scheduled Tribes (ST), physically challenged (PC) candidates as per the decisions of Government of India from time to time.

2.2 Admission to the B.Tech programme in any year will be as per orders from the Government of India. Currently these are based on performance in the Joint Entrance Examination (JEE) Main and HSC examinations as per Central Board of Secondary Education (CBSE) guidelines through a counselling conducted by the CSAB for the respective year.

2.3 Every student, admitted provisionally or otherwise to any Programme of the Institute, shall submit copies of the qualifying degree/provisional certificate and such other documents as prescribed by the Senate. These documents must be submitted by the prescribed date. The admission, provisional or otherwise, of any student who either does not submit the required documents by the stipulated date or fails to meet any other stipulated requirement for admission can be cancelled by the Institute.

2.4 The admission of any student may also be cancelled by the Senate, at any later time, if it is found that the student had supplied some false information or suppressed some relevant information while seeking admission.

2.5 The Institute reserves the right to cancel the admission of any student and ask him/her to discontinue his/ her studies at any stage of his/her career on the grounds of unsatisfactory academic performance or on disciplinary grounds.

BTR 3: ATTENDANCE AND LEAVE OF ABSENCE

3.1 (a) Students are required to attend all the classes (Lectures, Tutorials, Laboratories, Practical, Workshops etc) for which they have been registered.

(b) Students will have to attend all classes. A student may be debarred from appearing in an end semester examination if his/her attendance falls below 75 percent and will then be awarded an "F" grade in that course.

Leave Of Absence

3.2 (a) Students are not expected to be away from the Institute during a semester.

(b) Students may be granted leave of absence on situations like death in the immediate family circle. Such leave will in no case exceed one week.

(c) Absence due to illness not exceeding three weeks will be allowed after taking due permission. Due to emergencies, such permission may be taken later, and by the guardian if necessary.

(d) If the period of absence in a semester exceeds three weeks, the student will have to drop the semester by dropping all courses he /she has registered for. The Senate may allow longer absences only in special circumstances and only after ascertaining the student's ability to make up for the lost time.

(e) The leave of absence as per Clauses 3.2 (a) to 3.2 (d) will not be condoned for attendance.

3.3 It will be the responsibility of the student to intimate the Warden of the hostel in which he/she is residing, and the concerned instructors regarding his/her absence before proceeding on leave.

BTR 4: CONDUCT AND DISCIPLINE

4.1 Students shall conduct themselves within and outside the precincts of the Institute in a manner befitting the students of an institution of national importance.

4.2 For all issues related to student discipline, the general guidelines are prescribed in the Manual of Student Discipline.

BTR 5: CHANGE OF BRANCH

5.1 Normally a student admitted to a particular branch of the undergraduate programme will continue studying in that branch till graduation.

5.2 In special cases the Institute may permit a student to change branch from one branch of studies to another after the second semester. Such changes will be permitted, in accordance with the provisions laid down hereinafter.

5.3 Only those students will be considered eligible for change of branch/programme after the second semester, who have completed and passed all the common credits required in the first two semesters of their studies in their first attempt.

5.4 Applications for a change of branch/programme must be made by intending eligible students in the prescribed form. The academic section will call for applications at the end of second semester of each academic year and the completed forms must be submitted by the last date specified in the notification.

5.5 Students may enlist their choices of branch/programme, in order of preference, to which they wish to change over. It will not be permissible to alter the choices after the application has been submitted.

5.6 Change of branch/programme shall be made strictly in order of merit of the applicants. For this purpose the CPI obtained at the end of the second semester shall be considered. In case of a tie, the JEE rank of the applicants will be considered.

5.7 The applicants may be allowed a change in branch, strictly in order of merit, subject to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent.

5.8 All changes of branch made in accordance with the above rules will be effective from the third semester of the applicants concerned. No change of branch/programme shall be permitted after this.

5.9 All changes of branch will be final and binding on the applicants. Once considered for change in branch, no student will be permitted, under any circumstances, to refuse the change of branch offered.

BTR 6 COURSE STRUCTURE

Education at the Institute is organized around the semester-based credit system of study. A student is allowed to attend classes in a course and earn credit for it, only if he/she has registered for that course. Prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation and within maximum allowable period for completion of a degree. A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point is calculated. A minimum grade point is required to be maintained for satisfactory progress and continuation in the programme. Also a minimum number of earned credits and a minimum grade point should be acquired in order to qualify for the degree.

6.1 Teaching of the courses shall be reckoned in credits; Credits are assigned to the courses based on the following general pattern:

1 hour Lecture (L) per week	1 Credit
1 hour Tutorial (T) per week	1 Credit
2 hours Laboratory (L) per week	1 Credit
3 hours Laboratory (L) per week	2 Credits

6.2 In order to qualify for a B. Tech. degree of the Institute, a student is required to complete the credit requirement as prescribed in the curriculum for a particular programme.

6.3 Every B. Tech. Programme will have a curriculum and syllabi for the courses approved by the Senate.

6.4 Medium of instruction, examination and project reports will be in English.

6.5 Faculty advisor will help the students in planning their courses of study and getting general advice on the academic programme, the concerned department will assign a Faculty Advisor to each student.

BTR 7 REGISTRATION

At the beginning of each semester, until the completion of the program, a student must register for the semester and for the courses that he/she will study during the semester.

BTR 7.1 Procedure For Registration

The registration schedule is announced in advance, and registration is normally carried out within the first two days of each semester through the prescribed procedure by the Academic Section. Late registration may be permitted for valid reasons on submission of an application to the Registrar, and only on payment of the prescribed late registration fee. In any case, registration must be completed before the prescribed last date for late registration in the Academic Calendar. Students having any outstanding dues to the Institute or hostel will not be permitted to register.

BTR 7.2 Eligibility For Course Registration

A student with no backlog courses (i.e. who has passed all the previous courses) will be eligible to register for all courses prescribed in the curriculum for semester. A student who has backlog course(s) or is on academic probation (BTR 14.1) (may be recommended a different set of courses, by the Dean of Academic Programs).

BTR 7.3 Pre-Requisite Courses

A student registering for a course must have successfully completed the Prerequisite course(s), if any, for that particular course. For hard Prerequisite, a minimum grade of DD is required.

BTR 7.4 Withdrawal from Semester and Discontinued for Failing to Register

a. A student who wishes to withdraw prior to registration for a semester must obtain a formal approval from the Dean (Academic Programs) before the prescribed last date for late registration for the concerned semester. Withdrawal after registration for a semester is permitted only on medical grounds or for other exceptional reasons and formal approval for such withdrawal must be obtained from the Dean (Academic Programs) before the date of commencement of the end-semester examination for the concerned semester. Withdrawal from a semester, either prior to registration or after registration is permitted for only one semester at a time. If a student does not register for a regular semester or does not withdraw with permission from the Dean (Academic Programs) as indicated above, he/she will be discontinued from the Institute.
b. A student who registers for a semester after having withdrawn in the previous semester(s) can register for the available courses as prescribed in the curriculum for that particular semester subject to the pre-requisites, if any.

c. The transcript of a student who has "withdrawn" status would show the appropriate status for the concerned semester(s). The transcript of a student who is suspended for an academic or disciplinary reason would also show "withdrawn" status.

BTR 8 AUDITING OF COURSES

BTR 8.1 Registration of Courses for AUDIT

Auditing of courses allows students to gain exposure to additional subjects without increasing unduly their overall workload. Registration of courses for AUDIT is permitted from fifth semester onwards under the following conditions:

a. A student can audit a maximum of two courses during the entire program.
b. A student has to enter the courses to be audited in the Course Registration Form while registering for the semester. The word "Audit" would be specially mentioned in the remarks column of the student's course registration form.
c. A student can register a course for audit provided the following two conditions are satisfied:
    i. the course instructor permits and approves the registration, and
    ii. the lecture, lab and tutorial time-table strictly permit.
d. An audit course will not be considered as an overload.
e. If the student's performance is satisfactory, a grade of P (Pass) would be awarded. If the performance is not satisfactory, a grade of F (Fail) would be awarded.
f. An audit course will not be considered for the calculation of Semester Performance Index (SPI)/Cumulative Performance Index (CPI). However, the course will be reflected in the Semester Grade Report and Transcript as an Audit Course provided a grade of P was obtained, otherwise the course will not appear in the Semester Grade Report and Transcript.

BTR 9 COURSE LOAD

BTR 9.1 Regular Semesters

A student is permitted to register for additional courses over the prescribed courses in the curriculum for a regular semester provided the total number of courses does not exceed 7 and the total credits do not exceed 26. A student is permitted to under-load his/her prescribed academic load in a regular semester by dropping one or more courses provided the number of courses is at least 4 and the registered credits are not less than 12. However, after completion of his/her seventh regular semester, a student will be permitted to register for less than four courses.

BTR 10 COURSE ASSESSMENT AND MODES OF ASSESSMENT

BTR 10.1 Course Assessment

The assessment of students academic performance include in-semester and end-semester examinations along with other continuous evaluation components. The various components of continuous assessment in a course may include home assignments, tutorial assignments, group assignments, quizzes, tests (open or closed book), viva-voce, mini projects, etc.

Attendance in lectures/labs/tutorials may also be given due weightage in course assessment. The instructor may make attendance in lectures/tutorials/labs compulsory (80% or less) and after consulting the Dean (Academic Programs), award "F" grade to students who do not achieve the prescribed level of attendance in that course.

The distribution of weightage, for the assessment of academic performance of students, through various modes listed above will be communicated by the course instructor at the beginning of the semester after taking due approval from the director.

Note: Academic requirements such as projects and summer assignments, which are prescribed in the curriculum, are regarded as courses for the purpose of assessment.

BTR 10.2 Grading

a. For every course taken by a student, he/ she is awarded a letter grade based on his/ her combined performance in all the assessments. These letter grades are assigned points on a 10-point scale as described in the table below

Letter Grade	Corresponding Points	Explanation
AA	10	Outstanding
AB	9	Excellent
BB	8	
BC	7	
CC	6	
CD	5	
DD	4	
F	0	Fail

I	-	Incomplete
P	-	Passed

b. A student passes the course if he/she gets any grade in the range of AA to DD, but fails if he/she gets the grade F. Certain courses are indicated as Pass/Fail courses, and in these courses a grade of P or F is awarded. F grade may also be awarded in case of malpractice in examination/continuous evaluation process. Pass/Fail courses are not considered for calculation of SPI/CPI.

c. "I" grade will be awarded in a course if the overall performance of the student is satisfactory in the course, but the student either misses the end-semester examination due to illness, accident/death in the family or obtains such an approval from the Dean (Academic Programs) under exceptional circumstances. A student who misses the end-semester examination must apply and his/her application must be supported (i) by proper medical certificate duly approved by the Medical Authority of the Institute in the case of illness, or (ii) by adequate evidence in the event of death in the family. An application not so supported will not be considered. Grade "I" awarded for missing the end-semester examination will be converted into a performance grade (depending on the overall performance of the student in the course) after taking an examination equivalent to the end-semester examination of that particular course. An "I" grade must be converted into a performance grade by the specified date in the academic calendar for the next semester, otherwise it will be converted into "F" grade.

BTR 11 REPEATING A COURSE

BTR 11.1 Backlog Course

A student must repeat a course in which he/she has obtained an F grade in a course taken for credit. Such a course is regarded as a backlog course and is subject to the regulations for registration. A backlog elective course can be replaced by another elective of the same category.

BTR 11.2 Grade Improvement

A student whose CPI is less than 5.0 is allowed to repeat a course in which a DD grade was obtained for the purpose of grade improvement in a regular semester only. The grade obtained in the repeated attempt(s) will be considered for the purpose of calculating the CPI for the semesters thereafter. However, the grade obtained in the first and subsequent attempt(s) will be shown in the Transcript.

BTR 12 B.TECH. PROJECT

12.1 All students are required to complete the B Tech Project (BTP). The total number of credits will be as normally prescribed in the curriculum from time to time.

12.2 The BTP evaluation guidelines approved by senate shall be communicated to the students at the time of registration.

BTR 13 PERFORMANCE INDICES

BTR 13.1 Semester Performance Index (SPI)

The performance of a student in a semester is indicated by the Semester Performance Index (SPI). The SPI is the weighted average of the grade points obtained in all the courses registered by the student during the semester, calculated to two decimal places.

BTR 13.2 Cumulative Performance Index (CPI)

An up-to-date assessment of the overall performance of a student from the time of entering the Institute is obtained by calculating the student's Cumulative Performance Index (CPI). The CPI is weighted average of the grade points obtained in all the courses registered for credit by the student after entering the Institute. The CPI is also calculated to two decimal places.

BTR 13.3 Calculating SPI and CPI

The SPI is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows:

If the grades (numeric values as per BTR 10.2) awarded to student are G_1, G_2,… etc. in courses with corresponding credit units U_1, U_2,... etc., the SPI is given by

$$SPI = (U_1G_1 + U_2G_2 + ...) / (U_1 + U_2 + ...)$$

In the above computation, courses with P grades are ignored. Similarly, the CPI indicates the cumulative academic performance in all the courses taken including those taken in the current semester as

$$CPI = \frac{1}{Total\ Credits} \sum_{i=1}^{8} (SPI \times Total\ credits\ of\ semester\ i)$$

BTR 14 MINIMUM REQUIREMENTS OF ACADEMIC PERFORMANCE

BTR 14.1 Academic Probation

A student will be placed on Academic Probation for his/her second semester with written intimation if his/her SPI at the end of first semester is less than 4.5. In subsequent semesters, a student will be placed on Academic Probation with written intimation if his/her CPI in the previous semester is less than 5.0 or if his/her SPI is less than 4.5 in the previous semester.

For every student placed on Academic Probation, the Dean (Academic Programs) will prescribe a minimum SPI the student must attain in the semester. The minimum SPI so stipulated will be arrived at on the basis of the performance of the student in terms of her/his SPI/CPI as compared to the minimum requirements for graduation.

BTR 14.2 Discontinued from the Institute on Account of Poor Academic Performance

If the performance of a student is poor so that he/she is not likely to benefit from continuing in the program any further, he/she would be required to leave the Institute. For this purpose an assessment of the student's academic performance will initially be made at the end of the second semester of his/her stay at the Institute and thereafter at the end of every subsequent semester. This assessment will be based on the CPI and SPI obtained by the student.

BTR 14.3 Discontinued from the Institute on account of Poor Academic Performance at the end of the Second and Fourth Semester

A student whose CPI is less than 4.0 at the end of second or fourth semester shall be discontinued from the Institute. However, such a student may be allowed to register for the available backlog courses offered in the summer semester, following his/her second or fourth semester. Such a student is permitted to register for a maximum of three of the available summer courses in which he/she is having F or DD grade. In case the student achieves the minimum CPI of 4.0 at the end of the relevant summer semester, he/she should be allowed to re-enter the program.

BTR 14.4 Minimum and Maximum Period for Completion of B Tech Program:

The minimum period to complete the program is four academic years. In any case, a student should fulfill the requirements for her/his degree within a maximum period of six academic years, failing which she/he will be required to leave the Institute. The period of six years excludes any semester in which the student has "withdrawn" status.

BTR 15 AWARD OF DEGREE AND MEDALS

BTR 15.1 The B Tech (CS) and B Tech (IT) Degree will be conferred on a student after he/she has fulfilled the graduation requirements stipulated in the curriculum (as approved by the senate).

BTR 15.2 Final CPI and Class:

For the purposes of computing the CPI at the end of the program, the student's CPI will be computed on the basis of the best CPI obtainable from the courses taken. The grade of B Tech Project (if graded as prescribed in the curriculum) should be included while computing the final CPI of the student.

The Transcript will indicate Distinction if the student obtains a CPI of 9.0 or above and First Class if the student obtains a CPI of 6.5 or above but less than 9.0.

BTR 15.3 Certificate of Academic Accomplishment:

A student who is unable to complete the degree requirements within the stipulated maximum period would be eligible to receive a "Certificate of Academic Accomplishment" by applying for it. The eligibility criteria and procedure for issue of the Certificate would be as laid down by the Institute senate from time to time.

BTR 15.4 Award of Medals

T*he Chairperson's Gold Medal* shall be awarded to graduate(s) meeting the following criteria
The graduate should have

1. the highest CPI in the admission batch (across departments/ branches)
2. minimum CPI of 9
3. not been put on academic probation during the academic program duration
4. not been put on disciplinary probation during the academic program duration
5. no fail 'F' grade in the transcript.

In case of more than one candidates qualify for the award, all candidates will be awarded the medals.

The institute medals

1. The Institute Gold Medals will be awarded to students who have secured first places in their respective programs.
2. The Institute silver medal will be awarded to the second place holders for each program

BTR 16 GLOSSARY

Backlog Course: A course prescribed in the curriculum which has either not been registered or failed by a student.

Course Credit: Weighted sum of number of Lecture hours (L), Tutorial hours (T) and Practical hours (P) associated with the course. The weight for L and T is 1.0, and the weight for P is 0.5.

Grade Points: Product of the credits and points of a letter grade awarded to the course.

Semester: An academic year consists of two regular semesters of approximately 16 weeks duration each, the first (Autumn Semester) extending from July to December and the second (Winter Semester) from January to May. The summer semester is not a regular but a special semester of approximately eight weeks usually between May and July.

Semester Grade Report: Official record of the grades obtained in all the courses registered by a student in a semester.

Transcript: Official record of the grades obtained in all the courses registered by a student and is issued after the completion of the degree requirements.

Master of Technology

Programme Ordinance

Indian Institute of Information Technology, Vadodara

February 2019

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3. The Board shall have power by resolution to modify or cancel any such Ordinance and such Ordinance shall from the date of such resolution stand modified accordingly or cancelled, as the case may be.

MTR 1. PROGRAM OVERVIEW

Master of Technology (M.Tech.) in Computer Science & Engineering program is designed to include advanced coursework along with minor and a major project. The students interested to pursue a research oriented career are provided with an option to take up thesis work for a year in place of projects.

The first semester is aimed at laying down the foundation necessary for the computer science discipline. It gives students an opportunity to tune into the instructional philosophy and pedagogy of learning at IIIT Vadodara. Subsequent semesters provide avenues for specializing in one or more areas of computer science.

MTR 2: ACADEMIC CALENDAR

2.1 Each academic session is divided into two semesters of approximately eighteen weeks duration (with at-least seventy working days for classes in each semester). The Sessions include an Autumn semester (July to November) and a Winter semester (January to April).

2.2 The Senate approved schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, inter-semester breaks etc, shall be laid down in the Academic Calendar for each academic session.

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3.1 The number of seats in the programme for which admission is to be made at the IIIT Vadodara will be decided by the Senate. Seats are reserved for candidates belonging to Other Backward Classes (OBC), Scheduled Castes (SC), Scheduled Tribes (ST), physically challenged (PC) candidates as per Government of India norms.

3.2 Admission to the M.Tech programme in any year will be as per orders from the Government of India. Currently these are based on performance in the Graduate Aptitude Test Engineering (GATE) and qualifying Undergraduate degrees guidelines through a counselling conducted by the CCMT for the respective year.

3.3 Every student, admitted provisionally or otherwise to any M.Tech Programme of the Institute, shall submit copies of the qualifying degree/provisional certificate and such other documents as prescribed by the Senate. These documents must be submitted by the prescribed date. The admission, provisional or otherwise, of any student who either does not submit the required documents by the stipulated date or fails to meet any other stipulated requirement for admission can be cancelled by the Institute.

3.4 The admission of any student may also be cancelled by the Senate, at any later time, if it is found that the student had supplied some false information or suppressed some relevant information while seeking admission.

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4.1 (a) Students are required to attend all the classes (Lectures, Tutorials, Laboratories, Practical, Workshops etc) for which they have been registered.

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5.1 Students shall conduct themselves within and outside the precincts of the Institute in a manner befitting the students of an institution of national importance.

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2 In order to qualify for a M. Tech. degree of the Institute, a student is required to complete the credit requirement as prescribed in the curriculum for a particular programme.

3 M. Tech. Programme will have a curriculum and syllabi for the courses approved by the Senate.

4 Medium of instruction, examination and project reports will be in English.

5 Faculty Supervisor: To conduct thesis/ project (in the final year) every student will be allotted a faculty supervisor and a Co-supervisor (if required).

MTR 6.1 Areas of Specialization

(a) Computer Vision, Graphics and Multimedia

The fields of graphics, vision and imaging increasingly rely on one another. This specialization provides advanced training in computer graphics, computer vision, geometric processing and multimedia, enabling students to specialize in any of these areas and gain grounding in the others.

Students will understand the basic mathematical principles underlying the development and application of new techniques in computer graphics and computer vision and will become aware of the range of algorithms and approaches available, and be able to design, develop and evaluate algorithms and methods for new problems, emerging technologies and applications.

(b) Data Analytics

It is an interdisciplinary specialization designed to meet the huge manpower shortage in the area of data analytics. The specialization trains students in computational techniques and systems to draw insights from data in a variety of application domains.

(c) Signal and Information Processing

The program has been specially designed to meet the increasing need of professionals who would be able to respond to the need of modern day signal and data processing/analysis tasks. It is meant for students who wish to build a professional career oriented towards research and development, working at the cutting edge technology in the area of Signal and Information Processing. The curriculum is developed keeping in view the convergence of signal and information processing paradigm with data analytics. It is a step forward towards data processing and analysis for signal processing background students.

The Institute will include other specialization as and when the academic programmes expand.

MTR 6.2 Credit Structure of M. Tech (Project Mode)

Semester	Course Code	Courses	Credit Structure (L-T-P-C)	Credits
I		Core Course - I	3-0-0-3	3/4
		Core Course - II	3-1-0-4	3/4
		Core Course - III	3-0-2-4	3/4
		Programme Elective Course I	3-0-0-3	3/4
		HS Course	2-0-0-2	2
			Total	**16-18**
II		Core Course IV	3-0-2-4	3/4
		Core Course V	3-0-0-3	3/4
		Core Course VI	3-0-2-4	3/4
		Programme Elective Course II	3-0-0-3	3/4
		Technical Writing	2-0-0-2	2
			Total	**16-18**
III		Program Elective – III	3-0-0-3	3/4
		Program Elective – IV	3-0-0-3	3/4
		Program Elective – V	3-0-0-3	3/4
		Program Elective – VI	3-0-0-3	3/4
		Minor Project		3
			Total	**15-18**
IV		Major Project		15
			Total	**15**
			Grand Total	**62**

MTR 6.3 Credit Structure of M. Tech (Thesis Mode)

Semester	Course Code	Courses	Credit Structure (L-T-P-C)	Credits
I		Core Course - I	3-0-0-3	3/4
		Core Course - II	3-1-0-4	3/4
		Core Course - III	3-0-2-4	3/4
		Programme Elective Course I	3-0-0-3	3/4
		HS Course	2-0-0-2	2
			Total	**16-18**
II		Core Course IV	3-0-2-4	3/4
		Core Course V	3-0-0-3	3/4
		Core Course VI	3-0-2-4	3/4
		Programme Elective Course II	3-0-0-3	3/4
		Technical Writing	2-0-0-2	2
			Total	**16-18**
III		Program Elective – III	3-0-0-3	3/4
		Program Elective – IV	3-0-0-3	3/4
		Program Elective – V	3-0-0-3	3/4
		Program Elective – VI	3-0-0-3	3/4
		Minor Project		3
			Total	**15-18**
IV		Major Project		15
			Total	**15**
			Grand Total	**62**

MTR 7 REGISTRATION

At the beginning of each semester, until the completion of the program, every student must register for the semester and for the courses that he/she will study during the semester.

MTR 7.1 Procedure for Registration

The registration schedule is announced in advance, and registration is normally carried out within the first two days of each semester through the prescribed procedure by the Registrar. Late registration may be permitted for valid reasons on submission of an application to the Registrar, and only on payment of the prescribed late registration fee. In any case, registration must be completed before the prescribed last date for late registration in the Academic Calendar. Students having any outstanding dues to the Institute or hostel will not be permitted to register.

MTR 7.2 Eligibility for Course Registration

A student with no backlog courses (i.e. who has passed all the previous courses) will be eligible to register for all courses prescribed in the curriculum for that semester, inclusive of the specified number of electives. A student who has backlog course(s) or is on probation may be recommended a different set of courses, by the Dean (Academic Programs).

MTR 7.3 Pre-Requisite Courses

A student registering for a course must have successfully completed the Prerequisite course(s), if any, for that particular course. For Hard Prerequisite, a minimum grade of DD is required; for a Soft Prerequisite, minimum grade of DD is required (see Section 4.2 below).

MTR 7.4 Withdrawal from Semester and Discontinued for Failing to Register

a. A student who wishes to withdraw prior to registration for a semester must obtain a formal approval from the Dean (Academic Programs) before the prescribed last date for late registration for the concerned semester. Withdrawal after registration for a semester is permitted only on medical grounds or for other exceptional reasons and formal approval for such withdrawal must be obtained from the Dean (Academic Programs) before the date of commencement of the end-semester examination for the concerned semester. Withdrawal from a semester, either prior to registration or after registration is permitted for only one semester at a time. If a student does not register for a regular semester or does not withdraw with permission from the Dean (Academic Programs) as indicated above, he/she will be discontinued from the Institute.

b. A student who wishes to withdraw prior to registration for a semester must obtain a formal approval from the Dean (Academic Programs) before the prescribed last date for late registration for the concerned semester. Withdrawal after registration for a semester is permitted only on medical grounds or for other exceptional reasons and formal approval for such withdrawal must be obtained from the Dean (Academic Programs) before the date of commencement of the end-semester examination for the concerned semester.

Withdrawal from a semester, either prior to registration or after registration is permitted for only one semester at a time. If a student does not register for a regular semester or does not withdraw with permission from the Dean (Academic Programs) as indicated above, he/she will be discontinued from the Institute.

c. A student who registers for a semester after having withdrawn in the previous semester(s) can register for the available courses as prescribed in the curriculum for that particular semester subject to the pre-requisites, if any.

d. The transcript of a student who has "withdrawn" status would show the appropriate status for the concerned semester(s). The transcript of a student who is suspended for an academic or disciplinary reason would also show "withdrawn" status

MTR 8 COURSE ASSESSMENT AND MODES OF ASSESSMENT

MTR 8.1 Course Assessment

The various modes of assessment used for rating students performance in a course include home assignments, tutorial assignments, laboratory work, group assignments, quizzes, tests (open or closed book), viva-voce, mini projects, etc. and the end-semester examination. Attendance in lectures/labs/tutorials may also be given due weightage in course assessment. The instructor may make attendance in lectures/tutorials/labs compulsory (80% or less) and after consulting the Dean (Academic Programs), award "F" grade to students who do not achieve the prescribed level of attendance in that course.

The distribution of weightage for the assessment (continuous evaluation) through the various modes listed above will be as indicated by the course instructor at the beginning of the semester after taking due approval from the director. Note: Academic requirements such as projects and summer assignments, which are prescribed in the curriculum, are regarded as courses for the purpose of assessment.

MTR 8.2 Grading

a. For every course taken by a student, he/she is awarded a letter grade based on his/her combined performance in all the assessments. These letter grades are assigned points on a 10-point scale as described in the table below

Letter Grade	Corresponding Points	Explanation
AA	10	Outstanding
AB	9	Excellent
BB	8	
BC	7	
CC	6	
CD	5	
DD	4	
F	0	Fail
I	-	Incomplete
P	-	Passed

b. A student passes the course if he/she gets any grade in the range of AA to DD, but fails if he/she gets the grade F. Certain courses are indicated as Pass/Fail courses, and in these courses a grade of P or F

is awarded. F grade may also be awarded in case of malpractice in examination/continuous evaluation process. Pass/Fail courses are not considered for calculation of SPI/CPI.

c. "I" grade will be awarded in a course if the overall performance of the student is satisfactory in the course, but the student either misses the end-semester examination due to illness, accident/death in the family or obtains such an approval from the Dean (Academic Programs) under exceptional circumstances. A student who misses the end-semester examination must apply and his/her application must be supported (i) by proper medical certificate duly approved by the Medical Authority of the Institute in the case of illness, or (ii) by adequate evidence in the event of death in the family. An application not so supported will not be considered. Grade "I" awarded for missing the end-semester examination will be converted into a performance grade (depending on the overall performance of the student in the course) after taking an examination equivalent to the end-semester examination of that particular course. An "I" grade must be converted into a performance grade by the specified date in the academic calendar for the next semester, otherwise it will be converted into "F" grade.

MTR 9 REPEATING A COURSE

MTR 9.1 Backlog Course

A student must repeat a course in which he/she has obtained an F grade in a course taken for credit. Such a course is regarded as a backlog course and is subject to the regulations for registration. A backlog elective course can be replaced by another elective of the same category.

MTR 9.2 Grade Improvement

A student whose CPI is less than 5.0 is allowed to repeat a course in which a DD grade was obtained for the purpose of grade improvement in a regular semester only. The grade obtained in the repeated attempt will be considered for the purpose of calculating the CPI. The grade obtained in the first attempt will be shown in the Transcript, but will not be considered for calculating the CPI.

MTR 10 PERFORMANCE INDICES

MTR 10.1 Semester Performance Index (SPI)

The performance of a student in a semester is indicated by the Semester Performance Index (SPI). The SPI is the weighted average of the grade points obtained in all the courses registered by the student during the semester, calculated to two decimal places.

MTR 10.2 Cumulative Performance Index (CPI)

An up-to-date assessment of the overall performance of a student from the time of entering the Institute is obtained by calculating the student's Cumulative Performance Index (CPI). The CPI is weighted average of the grade points obtained in all the courses registered for credit by the student after entering the Institute. The CPI is also calculated to two decimal places.

MTR 10.3 Calculating SPI and CPI

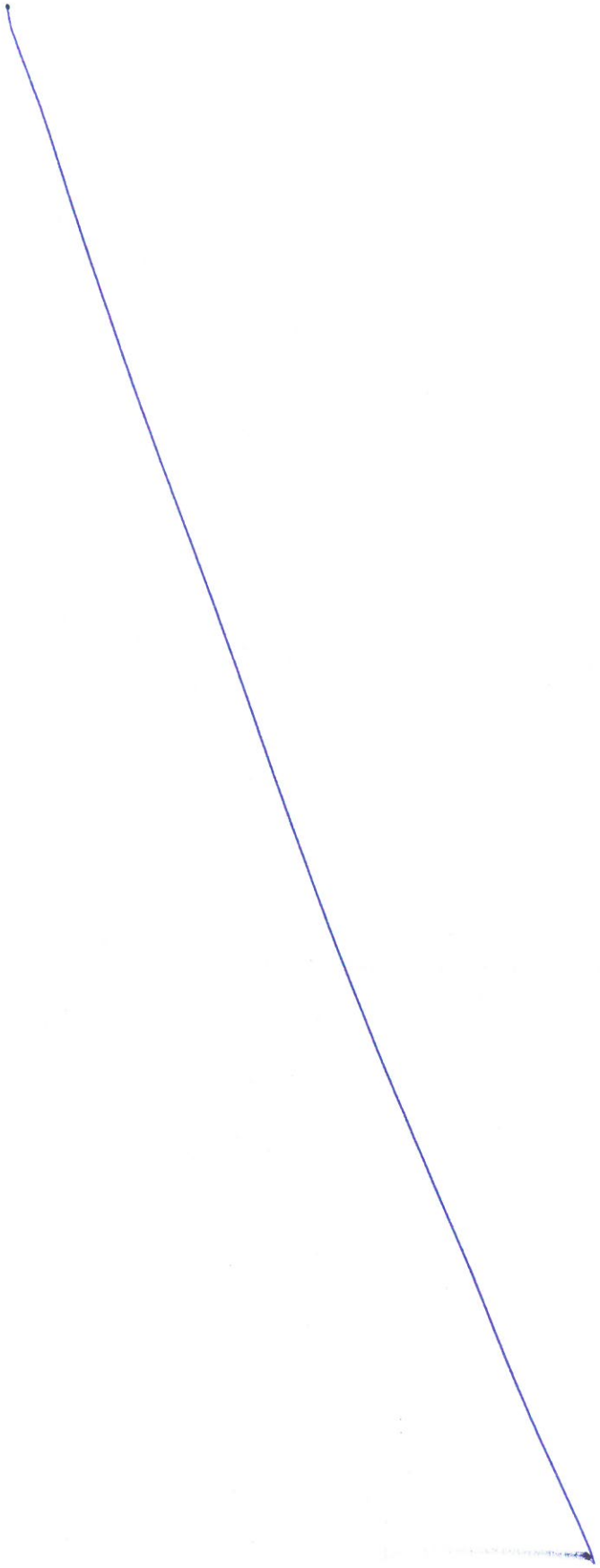
The SPI is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows:

If the grades (numeric values as per MTR 10.2) awarded to student are G_1, G_2,… etc. in courses with corresponding credit units U_1, U_2,... etc., the SPI is given by

$$SPI = (U_1G_1 + U_2G_2 + ...) / (U_1 + U_2 + ...)$$

In the above computation, courses with P grades are ignored. Similarly, the CPI indicates the cumulative academic performance in all the courses taken including those taken in the current semester as

$$CPI = \frac{1}{Total\ Credits} \sum_{i=1}^{8} (SPI \times Total\ credits\ of\ semester\ i)$$



MTR 11. ACADEMIC REQUIREMENT

11.1 Typical duration of the M. Tech programme is 02 years. A student has to complete all the academic requirement to earn an M. Tech degree within a maximum of 03 years.

11.2 A student has to secure minimum CPI of 6.0 for the graduation.

11.3 A student needs to maintain minimum CPI of 5.0 for the continuation in programme.

11.4 Students have to earn minimum of 62 credits in either M. Tech (Project Mode) or M. Tech (Thesis Mode)

11.5 A semester load is defined as equivalent of 12 credits. A student registered for a full semester load solely by course work would typically take 4 courses. Depending on the merits of the case, the Post Graduate Committee (PGC) may permit a student to register for a maximum of 20 credits or a minimum of 9 credits.

MTR 12 PROJECT/THESIS REQUIREMENTS

MTR 12.1 M. Tech. with Project

1. Minor and Major projects are in the area of specialization adding to 18 credits. The supervisor certifies that the project is in the area of specialization.
2. Minimum 12 credits are earned from the basket of specialization specific program electives.
3. Students may opt for an industrial project as major project.

MTR 12.2 M. Tech. by Thesis

Student entering the M. Tech by Thesis program is expected to carry out research during the second year, beginning in the Summer semester (around May, i.e., end of second semester) and ending around the next Summer semester (around June/July). The student will carry out research under the supervision of a faculty member at IIIT, Vadodara.

On completion of first year, three member Research Progress Committee will be formulated for each student based on his/her area of research.

Students will have to present the status of their research work continuously in the form of Research Progress Seminars scheduled in July/August, November/December and March/April in front of the committee. Finally, at the time of thesis evaluation, a thesis examination committee will be constituted by the Director in consultation with the Dean Academic Program. A Public Thesis Defense will be scheduled after successful completion of research progress seminars and thesis evaluation by the thesis examination committee.

MTR 12.3 Switching Programs

It is possible to switch program of study mid-way. Interested students who have demonstrated excellent research potential have the opportunity to convert to the PhD program.

MTR 13 FINANCIAL DETAILS

MTR 13.1 Fee Structures

The fee structure for M Tech Programme will be provided by institute every year with approval of BoG.

MTR 13.2 Financial Assistance

Eligible students will be provided financial assistance in terms of teaching assistantship (TAship). The eligibility criteria and the amount of TAship are as follows:

A student securing minimum CPI of 6.5 is eligible for full TA/RA ship as per the guidelines by Government of India. A Student with CPI 6.0 is restricted to half TA/RA ship. Full TA ship will be equal to TA Provided to MTech students at CFTIs decided by MHRD from time to time.

*Note that, CPI is not the only criteria for availing Full/Half TAship from the second semester onward.

MTR 13.3 TA Evaluation

There will be "TA Evaluation Form" for performance evaluation of a TA by the Course Instructor. For every subsequent semester, TAs CPI and Feedback from Course Instructor will be considered as criteria for deciding on next semester TAship.

MTR 14 LEAVE RULES

Leave rule for MTech students those who are receiving Institute scholarship:

14.1 The following rules are applicable with respect to receiving scholarship. The attendances for the courses will be governed by the academic regulations.

14.2 Total number of days of leaves per year is 30 days.

14.3 During the period of academic session (not defined as vacation for faculty), the student can avail at most 7 days of leaves in a semester. Remaining days of the leaves can be availed during the vacation period.

14.4 M. Tech students are not eligible for vacation.

14.5 Longer duration of leaves (beyond 7 days) can be permitted with the approval of the Director.

14.6 Female students will be eligible for maternity leaves at par with regular employee of the Institute.

MTR 15. DISSERTATION

15.1. The oral examination for students will be conducted before close of academic calender for the academic year. If a student does not appear in the oral examination within this time period, his/her programme would be deemed to have been terminated. Request for reinstatement in the programme by such a student should be addressed to the PGC, Dean (AP), and the Director.

15.2. The thesis supervisor / PGC will intimate the date of the oral examination.

15.3. The oral examination committee will evaluate the thesis/project, conduct the oral examination and send a report of the examination to the Convener, PGC.

15.4. A thesis will be considered to have been accepted if all members of the oral examination committee recommend its acceptance. A thesis, which is not accepted, will be considered to have been rejected.

15.5. If a thesis is rejected along with a recommendation for resubmission after incorporating any modification/correction suggested by the oral examination committee, oral examination of the re-submitted thesis/project will be conducted by the original committee unless a different committee is approved by the Convener, PGC. If the re-submitted thesis is rejected, the matter will be reported to the Dean (AP) and the Director.

15.6. Acceptance of thesis/project will be reported to the Dean (AP) for approval.

MTR 16 AWARD OF DEGREE

MTR 16.1 The M Tech (CSE) Degree will be conferred on a student after he/she has fulfilled the graduation requirements stipulated in the curriculum (as approved by the Senate).

MTR 16.2 Final CPI and Class:

For the purposes of computing the CPI at the end of the program, the student's CPI will be computed on the basis of the best CPI obtainable from the courses taken. The Transcript will indicate Distinction if the student obtains a CPI of 9.0 or above and First Class if the student obtains a CPI of 6.5 or above but less than 9.0.

MTR 16.3 Certificate of Academic Accomplishment:

A student who is unable to complete the degree requirements within the stipulated maximum period would be eligible to receive a "Certificate of Academic Accomplishment" by applying for it. The eligibility criteria and procedure for issue of the Certificate would be as laid down by the Institute senate from time to time.

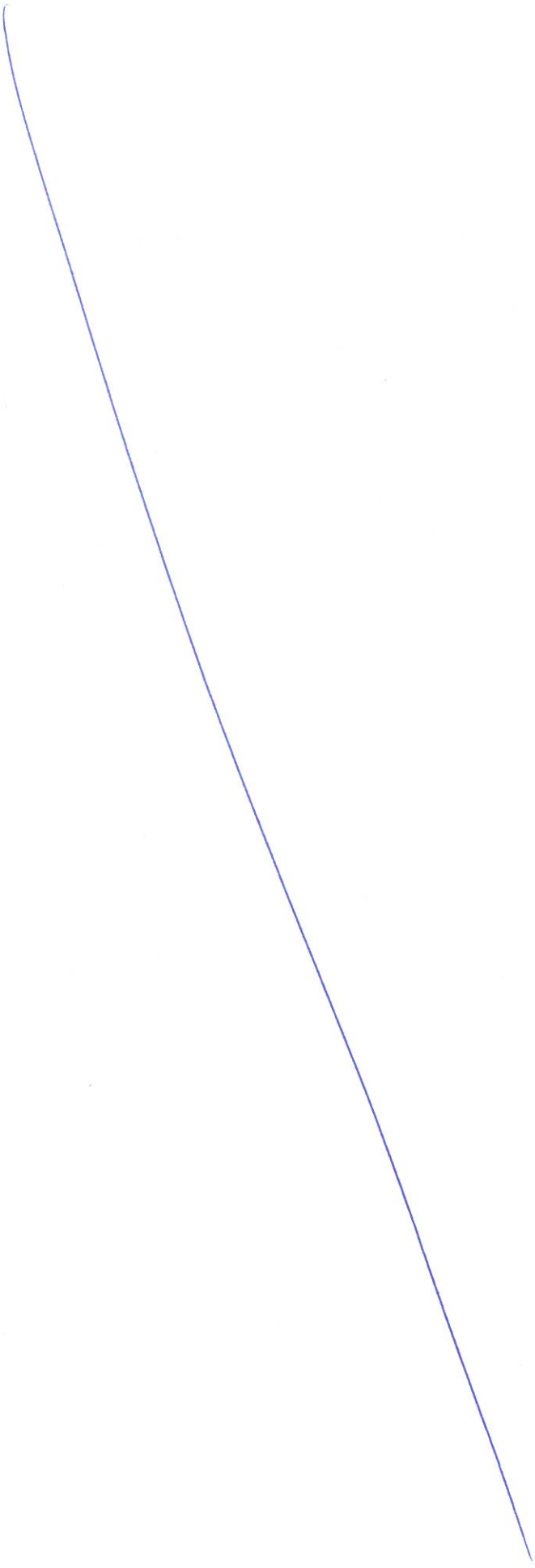
MTR 17. CODE OF CONDUCT

IIITV is an institute of academic excellence. A positive learning environment provides opportunities for students to practice good citizenship in the larger society and to practice respectful dissent. These are the practices and qualities that the Student Code of Conduct encourages.

The Student Code of Conduct serves as a reference and working guide when attempting to resolve student disciplinary issues. The student discipline manual is approved from time to time will provide the frame work for code of conduct for students. .

Disciplinary Action Committee (DAC)

Dean (Students), Convener (ex-officio)
Hostel Executive Committee (HEC) members
Registrar, Member (ex-officio)
Faculty Member (nominated by Director, IIITV)
Two Students (Boy & Girl) Representatives (nominated by DAC)



Doctor

of

Philosophy

Programme Ordinance

Indian Institute of Information Technology Vadodara

February 2019

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EXTRACTS FROM IIIT (PPP), ACT 2017

The following are the extracts from THE INDIAN INSTITUTES OF INFORMATION TECHNOLOGY (PUBLIC-PRIVATE PARTNERSHIP) ACT, 2017 (NO. 23 OF 2017)

Section 33: Subject to the provisions of this Act and the Statutes, the Ordinances of every Institute may provide for all or any of the following matters, namely: —

a. the admission of the students to the Institute;
b. the courses of study to be laid down for all degrees and diplomas of the Institute;
c. the conditions under which students shall be admitted to the degree or diploma courses and to the examinations of the Institute, and shall be eligible for degrees and diplomas;
d. the conditions of award of the fellowships, scholarships, exhibitions, medals and prizes;
e. the conditions and mode of appointment and duties of examining bodies, examiners and moderators;
f. the conduct of examinations;
g. the maintenance of discipline among the students of the Institute; and
h. any other matter which by this Act or the Statutes is to be or may be provided for by the Ordinances.

Section 34:

1. Save as otherwise provided in this section, Ordinances shall be made by the Senate.
2. All Ordinances made by the Senate shall have effect from such date as it may direct, but every Ordinance so made shall be submitted, as soon as may be, to the Board and shall be considered by the Board at its next meeting.
3. The Board shall have power by resolution to modify or cancel any such Ordinance and such Ordinance shall from the date of such resolution stand modified accordingly or cancelled, as the case may be.

PHR 1 PROGRAM OVERVIEW

Doctor of Philosophy (PhD) program at the Indian Institute of Information Technology, Vadodara (IIITV) is intended for students who wish to conduct high quality research in the selected areas. The structure involves intensive course work followed by quality research work demonstrated with strong publications.

The program aims at shaping the students to engage into the research work leading to excellence. The design of the program is devised inculcation of discipline in the research while exploring the new frontiers of selected faculties.

Research Groups:

- Signal Processing & Computer Vision
- Electronics & Physics
- Linguistics
- Mathematics

PHR 2 ELIGIBILITY CRITERIA AND ADMISSIONS

Eligibility

Eligibility criteria for admission will be laid down by the Senate from time to time. These criteria may be discipline specific.

The minimum requirement is a B.E/ B.Tech. for Engineering disciplines and a Master's degree for other disciplines.

Applicants must possess any one of the following degrees:

Engineering: M.Tech./ME in CS/IT/ECE or related areas.

OR

M.Sc. Applied Mathematics/Computer Science and related areas. Exceptional candidates with B.E/B.Tech. in relevant areas can also be considered.

Science: M.Tech. Material Science/Nano-Technology/Applied Optics/Engineering Physics/Scientific Computing, M.Sc. in Mathematics/Physics/Statistics/Electronics/Computer Science and related areas

OR

Exceptional candidates with B.E/B.Tech. in relevant areas can also be considered.

Humanities: MA/M.Phil in Linguistics/ English and related areas.

ADMISSION

Students can be admitted two times in a year. Admission will be grated on the basis of interview/admission test held by Institute. Admission will be normally made at beginning of semester (autumn and winter)- Advertisement for admission will be widely circulated.

ASSISTANTSHIP

Institute assistantships will be available to eligible students as per prevailing norms.

Assistantships from external funding organizations will be available as per terms and conditions of the concerned funding organizations.

Students receiving assistantships from the Institute or fellowships from any other funding agencies are required to perform academic duties as per prevailing norms.

PHR 3 RESEARCH GROUPS

PHR 3.1 Signal Processing & Computer Vision

Core Courses: Essential Mathematics, Random Process & Simulations, Advance Signal Processing.

Electives: Computer Vision, Pattern Recognition & Machine Learning, Image Analysis, Convex Optimization, Vector Space Projections, Remote Sensing Data Analysis, Inverse Problems in Imaging, Medical Image Processing, Multiview Geometry, Statistical Signal Processing, Natural Language Processing, Speech Processing.

PHR 3.2 Electronics & Physics

Core Courses: Essential Mathematics, Quantum Mechanics, Statistical Mechanics, Physics of Semiconductor Devices, VLSI Design, Digital IC Design, Numerical Methods.

Electives: Condensed Matter Physics, Nano & Molecular Electronics, Information Displays, Nano Scale Devices & Circuits, Flexible Electronics, Non Linear Systems, Advanced Embedded Systems, Mixed Analog & Digital Design, Bose Einstein Condensate System.

PHR 3.3 Linguistics

Core Courses: Sociolinguistics, Applied Linguistics, Semiotics, Semantics.

Electives: Computational Linguistics, Second Language Acquisition, Language & Gender, Phonetics & Phonology, Morphology.

PHR 3.4 Mathematics

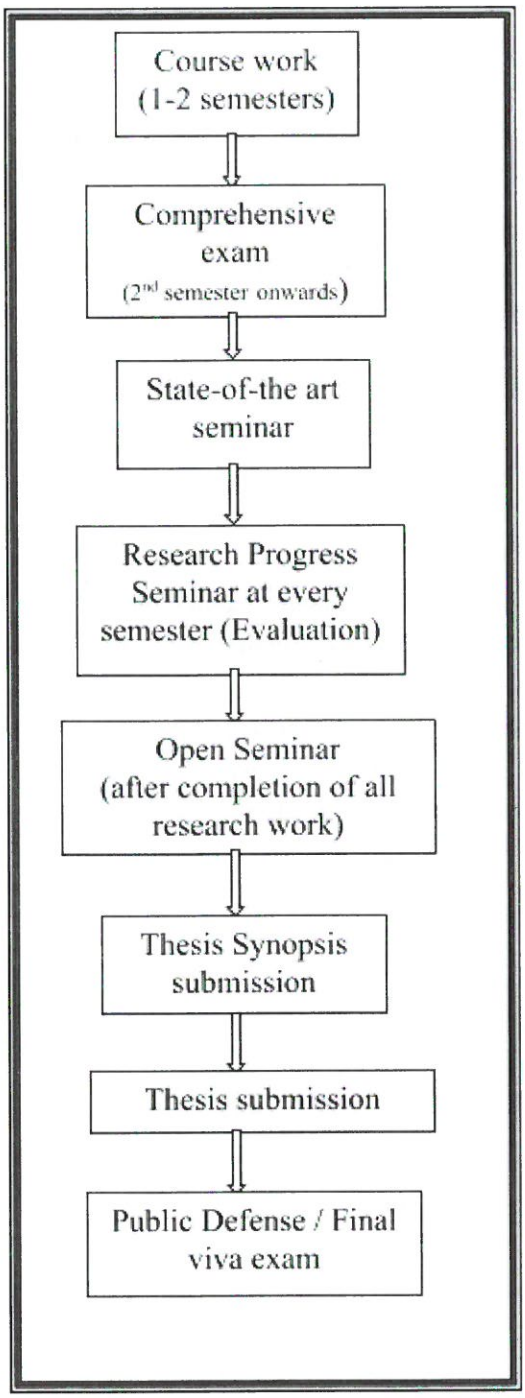
Linear Algebra, Abstract Algebra, Analysis and Topology, Commutative Algebra, Algebraic Geometry, Representation Theory.

PHR 4 PROGRAM STRUCTURE

PHR 4.1 Detailed Outline of PhD Program

1. The program is full-time. Students are expected to be in the Institute for the entire tenure of PhD program.
2. Students are required to take courses offered by respective research group and research courses in consultation with mentor/supervisor.
3. Student is required to appear for PhD qualifying exam (Comprehensive Exam) between (beginning of) 2nd and (end of) 4th semester. This will include a written exam and viva to be conducted by designated committee members. Students will be allowed to appear for Comprehensive Exam only twice.
4. If a student is not able to qualify Comprehensive Exam before end of 4th semester, the candidature of a student will be terminated automatically.
5. It is expected that the student will carry out at least 4 semesters of research work under the supervision of a faculty at IIITV.
6. Research Progress Committee (RPC) will evaluate the work done by student each semester. RPC will be constituted by Director/Dean-AP in consultation with supervisor.
7. Students may take maximum two self study courses.
8. After completion of minimum credit requirements, student will have to submit a synopsis of his work. On approval from the RPC, candidate will have to submit thesis within six months from the date of synopsis presentation.
9. Thesis will be sent to examiners for reviews. Thesis examiners will be identified by the Institute.
10. On receipt of reviews, based on the feedback received, candidate will have to appear for a public defense.
11. We encourage the students to undertake research internship.

PHR 4.2 PhD Program flow



PHR 5. CREDIT STRUCTURE AND ACADEMIC REQUIREMENT

- Students will undergo credits referring to courses, i.e., Course credits, and credits referring to research, i.e., Research credits.
- At the beginning of the program, a student will typically undergo courses related to his/her area of research. This is called course work period.
- Every student has to appear for PhD comprehensive examination towards the end of his/her course work.
- After successful completion of the course credits and the PhD comprehensive examination, a student will formally allow to pursue research on a topic by registering for Research credits.
- Research credits are evaluated in research progress seminar (RPS) presented by the students at the end of every semester.
- A student will register 12 units of Research credits in each semester until submission of the Thesis.
- After Thesis submission, the student may go for leave and will have to register with zero units at the Institute.

ACADEMIC REQUIREMENT

- A student is allowed to complete the research work and submit the thesis within maximum of 05 years of duration from the date of admission.
- A student needs to have minimum CPI of 7.0 for the award of degree.
- A student should maintain minimum CPI of 6.0 for continuation in program.
- Minimum CPI of 6.5 is required for full TA/RA-ship and minimum of 6.0 CPI is mandatory for the Half TA/RA-ship.
- A semester load is defined as equivalent of 12 credits. A student registered for a full semester load solely by course work would typically take 4 courses. Depending on the merits of the case, the PGC may permit a student to register for a minimum of 9 credits.
- Following are minimum credit requirements for the graduation: a) minimum course credit: 12, b) minimum research credit: 48, and c) minimum credit requirement for degree: 72

PHR 6 APPOINTMENT OF SUPERVISOR (S)

The Institute will appoint Supervisor(s) to a student. The Supervisor(s) will be identified and appointed on successful completion of Comprehensive examination and Seminar.

CHANGE/ ADDITION OF SUPERVISOR(S)

The Chairman, Senate on recommendation of doctoral scrutiny committee may permit to change his/her Supervisor(s). Mutual consent of the student and supervisor(s) will be needed for the same.

PHR 7 FINANCIAL DETAILS

PHR 7.1 Fee Structures

The fee structure for PhD Programme will be provided by institute every year with approval of BoG, IIIT Vadodara.

PHR 7.2 Financial Assistance

Eligible students will be provided financial assistance in terms of teaching assistantship (TAship). The eligibility criteria and the amount of TAship are as follows:

A student securing minimum CPI of 6.5 is eligible for full TA/RA ship as per the guidelines by Government of India. A Student with CPI 6.0 is restricted to half TA/RA ship. Note that, CPI is not the only criteria for availing Full/Half TAship from the second semester onward.

PHR 7.3 TA Evaluation

There will be **TA Evaluation Form** for performance evaluation of a TA by the Course Instructor. For every subsequent semester, TAs CPI and Feedback from Instructor will be considered as criteria for next semester TAship.

PHR 8. LEAVE RULES

Leave rules for PhD students those who are receiving Institute scholarship:

8.1 The following rules are applicable with respect to receiving scholarship. The attendances for the courses will be governed by the academic regulations.

8.2 Total number of days of leaves permitted is 30 days in a year.

8.3 During the period of academic session (not defined as vacation for faculty), the student can avail at most 7 days of leaves in a semester. Remaining days of the leaves can be availed during the vacation period.

8.4 These students are not eligible for vacation.

8.5 Longer duration of leaves (beyond 7 days) can be permitted with the approval of the Director.

8.6 Female students will be eligible for maternity leaves at par with regular employee of the Institute.

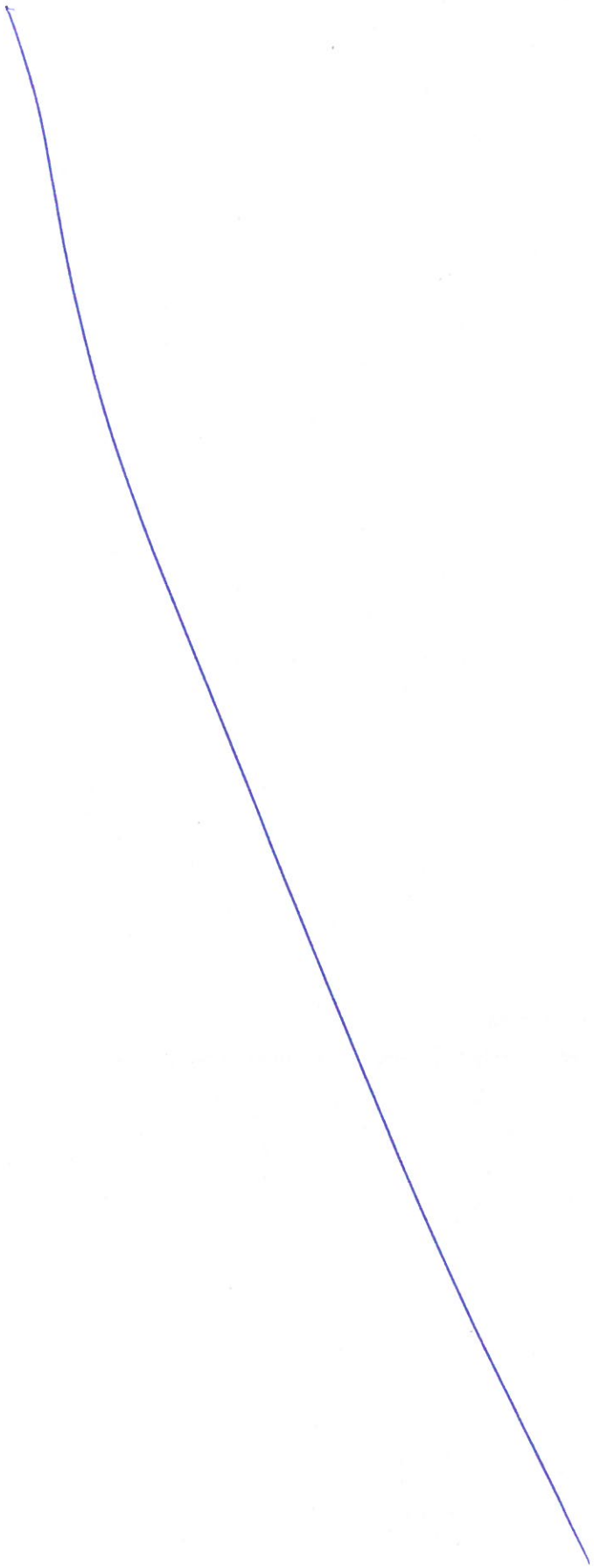
PHR 9. CODE OF CONDUCT

IIITV is an institute of academic excellence. A positive learning environment provides opportunities for students to practice good citizenship in the larger society and to practice respectful dissent. These are the practices and qualities that the Student Code of Conduct encourages.

The Student Code of Conduct serves as a reference and working guide when attempting to resolve student disciplinary issues. The student discipline manual is approved from time to time will provide the framework for code of conduct for students. .

Explanation of Punishments

1. Expulsion from the Institute:
   The offender is asked to permanently leave the institute; the parents are called and the student is handed over to them.
2. Academic Suspension for a Semester(s):
   The offender is suspended for a specified number of academic semester(s).
3. Expulsion from Hall of Residence (HoR):
   The offender is asked to vacate the room from HoR. In such cases, the student is allowed to continue academics but is not allowed to stay in the HoR. He/she can visit the Institute premises only between 0800 to 2100 hrs on all days (including weekends/holidays). Entry is to be made at the register (kept with the security at the main gate) while coming/leaving IIITV campus. The student is not allowed to enter the HoR for any reason at any time.
4. Restitution:
   This is typically done if a student is found guilty in any kind of infrastructure damage. In such cases, student may be asked to repair or replace the damaged thing, in addition to some other penalty/punishment.
5. Suspension of Privileges:
   Certain privileges are withdrawn like TA, if any.
6. Community Service:
   The offender is assigned a specific number of hours of community/social service at IIITV under a mentor. The idea behind this is to make the student realize the offence while not penalizing the parents due to consequent financial burden, otherwise.
7. Counseling:
   A student under Disciplinary Probation can be mandated to meet the counselor.



Annx - V

Curriculum-2018

Bachelor of Technology

in

Computer Science and Engineering

&

Information Technology

Indian Institute of Information Technology Vadodara

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B. Tech. Program

The Institute offers 4-years B. Tech. program in the following two branches:

1. Computer Science and Engineering (CSE)
2. Information Technology (IT)

Academic Session

Each academic session is divided into two semesters of approximately eighteen weeks duration (with at-least seventy working days for classes in each semester):

1. Autumn Semester (July-November)
2. Winter Semester (January-April)

In addition, there may be a semester during the summer break, called a Summer Semester (May-June). The Senate approves schedule of academic activities for a session, inclusive of dates for registration, mid-semester and end-semester examinations, inter-semester breaks etc. The schedule is laid down in the Academic Calendar for the session.

Registration

At the beginning of each semester, until the completion of the program, a student must register for the semester and for the courses that he/she will study during the semester.

Eligibility for Course Registration

A student with no backlog courses (*i.e.* who has passed all the previous courses) will be eligible to register for all courses prescribed in the curriculum for semester. A student who has backlog course(s) or is on academic probation may be recommended a different set of courses by the Dean of Academic Programs (Dean-AP).

Prerequisite Courses

A student registering for a course must have successfully completed the prerequisite course(s), if any, for that particular course. For hard prerequisite, a minimum grade of 'DD' is required.

Auditing of Courses

Auditing of courses allows students to gain exposure to additional subjects without increasing their overall workload. Registration of courses for Audit is permitted from fifth semester onwards under the following conditions:

1. A student can audit a maximum of two courses during the entire program.
2. A student has to enter the courses to be audited in the Course Registration Form while registering for the semester. The word 'Audit' would be specially mentioned in the remarks column of the student's course registration form.
3. A student can register a course for audit provided the following two conditions are satisfied: (*i*) the course instructor permits and approves the registration, and (*ii*) the lecture, lab and tutorial time-table strictly permit.
4. An audit course will not be considered as an overload.
5. If the student's performance is satisfactory, a grade of 'P' (Pass) would be awarded. If the performance is not satisfactory, 'F' (Fail) would be awarded.
6. An audit course will not be considered for the calculation of Semester Performance Index (SPI) / Cumulative Performance Index (CPI). However, the course will be reflected in the Semester Grade Report and Transcript as an Audit Course provided a grade of 'P' was obtained, otherwise the course will not appear in the Semester Grade Report and Transcript.

Course Load in Regular Semesters

A student is permitted to register for additional courses over the prescribed courses in the curriculum for a regular semester provided the total number of courses does not exceed 7 and the total credits do not exceed 26. A student is permitted to under-load his/her prescribed academic load in a regular semester by dropping one or more courses provided the number of courses is at least 4 and the registered credits are not less than 12. However, after completion of his/her seventh regular semester, a student will be permitted to register for less than four courses.

Course Assessment

The assessment of students' academic performance include in-semester and end-semester examinations along with other continuous evaluation components. The various components of continuous assessment in a course may include home assignments, tutorial assignments, group assignments, quizzes, tests (open or closed book), viva-voce, mini projects, etc. Attendance in lectures/ tutorials/ labs may also be given due weightage in course assessment. The instructor may make attendance in lectures/ tutorials/ labs compulsory (80% or less). The instructor may, in due consultation with the Dean-AP, award 'F' grade to students who do not achieve the prescribed level of attendance in that course.

The distribution of weightage, for the assessment of academic performance of students in a course, through various modes listed above will be communicated by the course instructor at the beginning of the semester with due approval from the Director.

[***Note:*** *Academic requirements such as projects and summer assignments, which are prescribed in the curriculum, are regarded as courses for the purpose of assessment.*]

Letter Grade (10-point Scale)

For every course registered by a student, he/she is awarded a letter grade based on his/her combined performance in all the assessments. These letter grades are assigned points on a 10-point scale as described in the table below:

Letter Grade	Points	Remark
AA	10	Outstanding
AB	9	Excellent
BB	8	Very Good
BC	7	Good
CC	6	Average
CD	5	Below Average
DD	4	Poor
F	0	Fail
P	-	Pass
I	-	Incomplete

A student passes the course if he/she gets any grade in the range of 'AA' to 'DD', but fails if he/she gets the grade 'F'. Certain courses are indicated as Pass/Fail courses, and in these courses a grade of 'P' or 'F' is awarded. 'F' grade may also be awarded in case of malpractice in examination/continuous evaluation process. Pass/Fail courses are not considered for calculation of SPI/CPI.

'I' grade will be awarded in a course if the overall performance of the student is satisfactory in the course, but the student either misses the end-semester examination due to illness, accident/death in the family or obtains such an approval from the Dean-AP under exceptional circumstances. A student who misses the end-semester examination must apply for permission with reasoning and proof. An application not so supported will not be considered. Grade 'I' awarded for missing the end-semester examination will be converted into a performance grade (depending on the overall performance of the student in the course) after taking an examination equivalent to the end-semester examination of that particular course. An 'I' grade must be converted into a performance grade by the specified date in the academic calendar for the next semester, otherwise it will be converted into 'F' grade.

Performance Indices

[A] Semester Performance Index (*SPI*)

The performance of a student in a semester is indicated by the *SPI*. The *SPI* is the weighted average of the grade points obtained in all the courses registered by the student during the semester, calculated to two decimal places.

[B] Cumulative Performance Index (*CPI*)

An up-to-date assessment of the overall performance of a student from the time of entering the Institute is obtained by calculating the student's *CPI*. The *CPI* is weighted average of the grade points obtained in all the courses registered for credit by the student after entering the Institute. The *CPI* is also calculated to two decimal places.

Calculation of *SPI* and *CPI*

Let the course credits are U_1, U_2….and the numeric values of the corresponding grade awarded in the courses are G_1, G_2….., respectively, the SPI is given by

$$SPI = \frac{U_1G_1 + U_2G_2 + \cdots}{U_1 + U_2 + \cdots}$$

In the above computation, the courses with 'P' grade are not considered. Similarly, the *CPI* indicates the cumulative academic performance in all the courses taken including those taken in the current semester as

$$CPI = \frac{1}{Total\ Credits}\sum_{i=1}^{8}(SPI \times Total\ credits\ of\ i^{th} semester)$$

Graduating *CPI* and *Class*

For the purposes of computing the *CPI* at the end of the B. Tech. program, the student's *CPI* will be computed on the basis of the best *CPI* obtained from the courses taken. The grade of B. Tech. Project (if graded as prescribed in the curriculum) will be included while computing the final *CPI* of the student. The minimum *CPI* for eligible to graduate the B. Tech. program is 5.00. The Transcript of a graduating student will indicate

1. *Distinction* when $CPI \geq 9.00$,
2. *First Class* when $6.50 \leq CPI < 9.00$ and
3. *Pass* when $5.00 \leq CPI < 6.50$.

Repeating a Course

[A] As a Backlog Course

A student must repeat a course taken for credit in which he/she has obtained 'F' grade. Such a course is regarded as a backlog course. A backlog elective course can be replaced by another elective of the same category. A student can appear examinations (In-Semester and End-Semester) components only as a backlog course. The component of continuous evaluation will be carried forward from earlier evaluation.

[B] For Grade Improvement

A student whose *CPI* is less than 5.00 can be permitted to reappear in the courses in which a 'DD' grade was obtained. This is for the purpose of grade improvement

in a regular semester only. The grade obtained in the repeated attempt(s) will be considered for the purpose of calculating the *CPI* for the semesters thereafter. However, the grade obtained in the first and subsequent attempt(s) will be shown in the Transcript.

Award of Degree

The B. Tech. (CS) and B. Tech. (IT) degree will be conferred on a student after he/she has fulfilled the graduation requirements stipulated in the curriculum (as approved by the senate).

Award of Medals

[A] The Chairperson's Gold Medal shall be awarded to graduate(s) meeting the following criteria:

1. Secured the highest *CPI* in the admission batch (across departments/ branches),
2. Secured minimum *CPI* of 9.00,
3. Not been put on academic probation during the academic program duration,
4. Not been put on disciplinary probation during the academic program duration and
5. No fail 'F' grade in the transcript.

In case of more than one candidates qualify for the award, all candidates will be awarded the medals.

[B] The Institute Medals

1. The Institute *Gold Medals* will be awarded to students who have secured first places in their respective programs.
2. The Institute *Silver Medals* will be awarded to the second place holders for each program.

Poor Academic Performance

[A] Academic Probation

A student will be placed on Academic Probation during his/her second semester with written intimation if his/her *SPI* at the end of first semester is less than 4.50. In subsequent semesters, a student will be placed on Academic Probation with written intimation if his/her *CPI* in the previous semester is less than 5.00 or if his/her *SPI* is less than 4.50 in the previous semester. For every student placed on Academic Probation, the Dean-AP will prescribe a minimum *SPI* the student must attain in the semester. The minimum *SPI* so stipulated will be arrived at on the basis of the performance of the student in terms of her/his *SPI*/*CPI* as compared to the minimum requirements for graduation.

[B] Discontinued from the Institute on Account of Poor Academic Performance

If the performance of a student is consistently poor and that he/she is not likely to benefit from continuing in the program, he/she would be required to leave the Institute. For this purpose an assessment of the student's academic performance will initially be made at the end of the second semester of his/her stay at the Institute and thereafter at the end of every subsequent semester. This assessment will be based on the *CPI* and *SPI* obtained by the student.

[C] Discontinued from the Institute on account of Poor Academic Performance at the end of the Second and Fourth Semester

A student whose *CPI* is less than 4.00 at the end of second or fourth semester shall be discontinued from the Institute. However, such a student may be allowed to register for the available backlog courses if offered in the summer semester following the second or fourth semester. Such a student is permitted to register for a maximum of three of the available summer courses in which he/she is having 'F' or 'DD' grade. In case the student achieves the minimum *CPI* of 4.00 at the end of the relevant summer semester, he/she will be allowed to continue the program.

Minimum and Maximum Period for Completion of B. Tech. Program

The minimum period to complete the program is four academic years. In any case, a student should fulfil the requirements for her/his degree within a maximum period of six academic years, failing which she/he will be required to leave the Institute. The period of six years excludes any semester in which the student has availed "withdrawn" status.

Certificate of Academic Accomplishment

A student who is unable to complete the degree requirements within the stipulated maximum period would be eligible to receive a "Certificate of Academic Accomplishment" by applying for it. The eligibility criteria and procedure for issue of the Certificate would be as laid down by the Institute senate from time to time.

B. Tech. Program

Course Categories and Distribution of Credits

Definition of Credits

Teaching of the courses shall be reckoned in credits; Credits are assigned to the courses based on the following general pattern:

1 hour of Lecture (L) per week	1 Credit
1 hour of Tutorial (T) per week	1 Credit
2 hours of Laboratory (P) per week	1 Credit
3 hours of Laboratory (P) per week	2 Credits

Range of Credits for B. Tech. degree

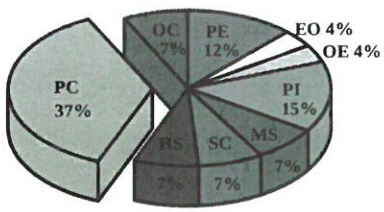
For a student to be eligible to get B. Tech. degree, a range of credits earned should be in between 160-180.

Course Categories and Distribution of Credits

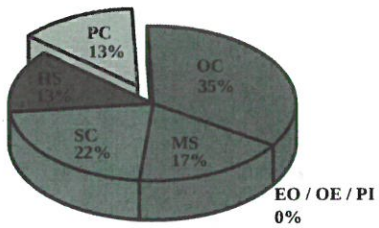
Code	Course Categories	Credits
MS	Mathematics & Statistics	12
SC	Natural Science (Physics, Chemistry, Biology), Environmental Science	12
HS	Humanities, Social Science, Literature, Management & Soft-skills (including Electives)	12
PC	Core Engineering Courses (from the branch of study)	60
OC	Core Engineering Courses (from the other branch of Engineering)	12
PE	Program Elective (from the branch of study)	20
EO	Elective (from other branch of Engineering)	6
OE	Open Elective (Science / Humanities / Engineering: not more than one from each)	6
PI	Projects, Internships (Research/Industrial)	24
Total Credits		**164***

**Minor variation is allowed as per need of the respective disciplines.*

B. Tech. Program: Distribution of Credits (in %)



Distribution of Credits in 1st Year (in %)



Distribution of Credits in 1st year of B. Tech. (CSE/IT) Program:

Code	Course Categories	Credits
MS	Mathematics & Statistics	8
SC	Basic Sciences (Physics, Chemistry, Biology), Environmental Science.	10
HS	Humanities, Social Science, Literature, Management, Soft-skills	6
PC	Core Engineering Courses (from the branch of study)	6
OC	Core Engineering Courses (from the other branches of Engineering)	16
PE	Program Electives (from the branch of study)	0
EO	Electives (from other branches of Engineering)	0
OE	Open Electives (Science / Humanities / Engineering: Not more than one from each)	0
PI	Projects, Internships (Research/Industrial)	0
Total Credits		**46**

Distribution of Credits in 2nd to 4th years of B. Tech. (CSE) Program:

Code	Course Categories	Credits
MS	Mathematics & Statistics	6
SC	Basic Sciences (Physics, Chemistry, Biology), Environmental Science.	2
HS	Humanities, Social Science, Literature, Management, Soft-skills	6
PC	Core Engineering Courses (from the branch of study)	56
OC	Core Engineering Courses (from the other branches of Engineering)	0
PE	Program Electives (from the branch of study)	20
EO	Electives (from other branches of Engineering)	6
OE	Open Electives (Science / Humanities / Engineering: Not more than one from each)	6
PI	Projects, Internships (Research/Industrial)	24
Total Credits*		**126**

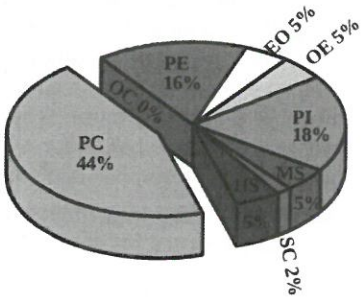
**Total Credits for Degree is 172.*

Distribution of Credits in 2nd to 4th years of B. Tech. (IT) Program:

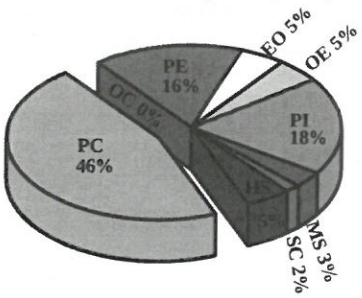
Code	Course Categories	Credits
MS	Mathematics & Statistics	4
SC	Basic Sciences (Physics, Chemistry, Biology), Environmental Science.	2
HS	Humanities, Social Science, Literature, Management, Soft-skills	6
PC	Core Engineering Courses (from the branch of study)	57
OC	Core Engineering Courses (from the other branches of Engineering)	0
PE	Program Electives (from the branch of study)	20
EO	Electives (from other branches of Engineering)	6
OE	Open Electives (Science / Humanities / Engineering: Not more than one from each)	6
PI	Projects, Internships (Research/Industrial)	24
Total Credits*		**125**

**Total Credits for Degree is 171.*

Distribution of Credits in 2nd to 4th years of B. Tech. (CSE) Program (in %)



Distribution of Credits in 2nd to 4th years of B. Tech. (IT) Program (in %)



Courses Structure: First Year

(Common to all branch of studies)

Semester-I

Course Code	Course Name	L	T	P	C
MA101	Mathematics-I (Linear Algebra and Matrices)	3	1	0	4
PH100*	Mechanics and Thermodynamics	3	1	0	4
PH160*	Mechanics and Thermodynamics Lab	0	0	2	1
IT101	Computer Programming and Problem Solving	3	0	0	3
IT161	Computer Programming and Problem Solving Lab	0	0	3	2
EC100*	Basic Electronic Circuits	3	1	0	4
EC160*	Basic Electronic Circuits Lab	0	0	3	2
HS101	Spoken and Written Communication	2	0	2	3
Total		**14**	**3**	**10**	**23**

**These Courses may be offered in both Autumn and Winter Semesters.*

Semester-II

Course Code	Course Name	L	T	P	C
MA102	Mathematics-II (Discrete Mathematics)	3	1	0	4
PH110*	Waves and Electromagnetics	3	1	0	4
PH170*	Waves and Electromagnetics Lab	0	0	2	1
EE100*	Basic Electrical Engineering	3	1	0	4
EE160*	Basic Electrical Engineering Lab	0	0	3	2
CS102	Introduction to Data Structures	3	0	0	3
CS162	Introduction to Data Structures Lab	0	1	2	2
HS102	Science Technology and Society	3	0	0	3
Total		**15**	**4**	**7**	**23**

**These Courses may be offered in both Autumn and Winter Semesters.*

Semester-I: Courses and Contents

Course Code	Course Name	L-T-P: C
MA101	**Mathematics-I (Linear Algebra and Matrices)**	**3-1-0: 4**

Description: The course aims at introducing the fundamental concepts of linear algebra culminating in abstract vector spaces and linear transformations. The course starts with systems of linear equations, matrices, matrix algebra, eigenvalues and eigenvectors. The course then goes on to introduce some basic concepts of the theory of vector spaces in the concrete setting of real n-dimensional vector space and linear transformations. At the end, numerical methods are introduced to apply the theory to real life problems. The subject material is of vital importance in all fields of mathematics and sciences in general.

Objective: Students will be able to apply the concepts and methods described in the syllabus and solve problems using linear algebra.

Contents:

Matrices and Linear systems: Matrix operations (addition, multiplication), Block-Partitioned Matrices and Block Operations, Elementary Row and Column Operations, Determinant of a Square Matrix, Properties of the Determinant Function , Cofactor Expansion, Rank of a Matrix, The System of Linear Equations: Ax=b

Canonical Factorizations: Eigenvalues and Eigen-vectors, Companion Matrices and Characteristic Polynomial, Method of Danilevsky for Characteristic Polynomial, diagonalization-Matrices with a Full-Set of Eigenvectors, The Cayley-Hamilton Theorem, Triangulization and Unitary Diagonalization of a Matrix, Schur's Lemma and the Spectral Theorem, QR-Decomposition, QR-Algorithm for Hessenberg Matrices, Singular Value Decomposition.

Vector Spaces: Vector Space over the set real numbers (Field), Linear Independence of Vectors, Bases in a Vector Space, Dimension of a Vector Space, Direct Sum Decomposition of a Vector Space, Linear Transformations, Change of Bases, Canonical forms, Rank of a Linear Transformation.

Numerical methods: Iterative methods (Jacobi, Gauss-Seidel, Relaxation) for solving linear systems, computing of eigenvalues and eigenvectors.

Text Book:

1. *Introduction to Linear Algebra*, Gilbert Strang, 5th Ed, SIAM, 2016.

Reference Books:

1. *Linear Algebra*, Kunze Ray, Hoffman Kenneth 2nd Ed, Phi Learning, 2014.
2. *Fundamentals of Matrix Computations*, David S. Watkins, 3rd ed, Wiley.

Course Code	Course Name	L-T-P: C
PH100	**Mechanics and Thermodynamics**	**3-1-0: 4**

Description: The course provides engineering students with important foundational knowledge about mechanics, and thermodynamics and its application to common engineering systems. The course also includes weekly small-group problem-solving tutorial session.

Learning Outcomes: On successful completion of this course, students should be able to:

1. Demonstrate knowledge of the physical principles that describe mechanics, materials, heat transfer, and thermodynamics;
2. Apply physics principles to common physical systems;
3. Use the methods of algebra, vectors and calculus in quantitative and qualitative predictions of behavior of physical systems and
4. Associate the correct unit with different physical quantity they use.

Contents:

Mechanics: *Review of Newtonian Mechanics*-Vectors and their time derivatives, Inertial and non-inertial frames of reference, Centrifugal and Coriolis forces; Work-Energy Theorem; Conservation Principles, Collision problem in laboratory and centre of mass frame, Motion under Central Force and its universal features, Oscillatory Motion-Free, Damped and Driven.

Introduction to Quantum Mechanics: Double-slit experiment, de Broglie's hypothesis. Uncertainty Principle, Wave-Function and Wave-Packets, Phase- and Group-velocities. Schrödinger Equation. Probabilities and Normalization. Expectation values. Eigenvalues and Eigen-functions. Applications of Schrödinger Equation: Particle in a box, Finite Potential well, Harmonic oscillator, Hydrogen Atom problem.

Thermodynamics: Temperature and Zeroth Law of Thermodynamics, Work, Heat and First Law of Thermodynamics, Ideal Gas and Heat Capacities, Second Law of Thermodynamics, Carnot Cycle, Entropy, Thermodynamic variables and energies.

Text Books:

1. *An Introduction to Mechanics*; D. Kleppner and R. Kolenkow, Second Edition.*Concepts of Modern Physics*; A. Beiser, Sixth Edition.
2. *Heat and Thermodynamics*; M. W. Zemansky and R. H. Dittman, Seventh Edition.

Course Code	Course Name	L-T-P: C
PH160	**Mechanics and Thermodynamics Lab**	**0-0-2: 1**

List of recommended experiments:

1. Motion on Linear Air-Track (Virtually Frictionless Surface).
2. Centripetal Force and Moment of Inertia.
3. Damped oscillation with spring-mass system.
4. Oscillations in Coupled Pendulum.
5. Photoelectric effect and Determination of Planck's constant.
6. Franck Hertz Experiment.
7. Balmer Series and Determination of Rydberg constant.
8. Determination of Heat capacity of gases.
9. Determination of Specific Heat of Solids.
10. Mechanical Equivalent of Heat.

Course Code	Course Name	L-T-P: C
IT101	**Computer Programming and Problem Solving**	**3-0-0: 3**

Objectives: The course provides concepts of computer programming and its roles in problem solving. It also introduces how to develop well-structured programs.

Contents:

Introduction to Computers: Computer Systems, Computing Environments.

Introduction to Programming: Programming methods, paradigms, problem solving techniques, algorithm development, flow charts, Editor, compiler, debugger, Software development.

Basics of Procedural Programming: Constants, variables, expressions, operators, assignment, basic input and output, built-in functions, program debugging.

Variables and Operators: Basic data types, precedence and order of evaluation, pointers, memory allocation of variables.

Control Structures: Selection statements, iteration statements.

Functions and Program Structure: Return values, actual and formal parameters, parameter passing: call by value versus call by reference, external variables, scope rules, header files, and recursion.

Arrays: Character arrays, one and two dimensional arrays; pointer arrays, command-line arguments.

I/O: ASCII data files, file pointers, end-of-file.

Basic Data Structures: Structures, defining new types, enumerations, dynamic memory allocation, dynamic arrays, linked lists and other pointer-based structures.

Text Book:

1. *C How to Program*, 7th Ed, P Deitel and H Deitel, Prentice Hall of India, 2012.

Reference Books:

1. *C programming language*, 2nd Ed, Kernighan, Brian W. & Ritchie, Dennis M, New Delhi. Prentice Hall of India, 1998.
2. *A Book on C*, 4 th Ed, Kelley, A.L. and Pohl Ira, Pearson India, 2002.
3. *A Structured Programming Approach Using C*, 1st Ed.,Forouzan, Behrouz, Course Technology, 2012.
4. *Practical C Programming*, 3rd Ed, Oualline, Steve, Shroff Publishers, 2000.
5. *C programming: The essentials for engineering and scientists*, Brooks, David R. New York. Springer, 1999.
6. *Programming In ANSI C* by E Balagurusamy.

Course Code	Course Name	L-T-P: C
IT161	**Computer Programming and Problem Solving Lab**	**0-0-3: 2**

Objectives: The course provides a platform to enhance the analyzing and problem solving skills and learn to implement a list of programs in C or Python programming language. A possible list of assignments are as follows.

Part A (10 weeks):

1. Program to find area and circumference of circle.
2. Program to convert temperature from degree centigrade to Fahrenheit.
3. Program to calculate sum of 5 subjects and find percentage.
4. Program to show swap of two no's without using third variable.
5. Program to reverse the digits of a given number.
6. Program to print a table of any number.
7. Program to find greatest in 3 numbers.
8. Program to find that entered year is leap year or not.
9. Program to shift input data by two bits to the left.
10. Program to display arithmetic operator using switch case.
11. Program to print stars Sequences (right triangular, Isosceles triangle, etc.).
12. Program to print Fibonacci series up to 100.
13. Program to find factorial of a number.
14. Program to find whether given no. is a prime no. or not.
15. Program to add two number using pointers.
16. Program to find the largest number in an array.
17. Program for removing the duplicate element in an array.
18. Program to add two matrices.
19. Program to multiply two matrices.
20. Program to find transpose of a matrix.
21. Program to swap two numbers using functions.
22. Program to show call by reference.
23. Program to find whether a string is palindrome or not.
24. Program to find occurrences of vowels, consonants, words, spaces and special characters in the given statement.
25. Program to create enumerated data type for 12 months. Display their values in integer constants.
26. Program for linear and binary search.
27. Program for bubble sort and insertion sort.
28. Program that would sort a list of names in alphabetical order.
29. Program to use (++,--) operator with return value of function.
30. Program to read characters from a text file and print number of vowels, consonants and other characters in the file. Assume that the file will consist of mostly English-language letters.

Part B (4-6 weeks)

A small project will be given in groups (at most 4 persons in each group). The objective is to apply knowledge of programming language primitives such as functions, structures and/or files in day-to-day applications.

Course Code	Course Name	L-T-P: C
EC100	**Basic Electronic Circuits**	**3-1-0: 4**

Objectives: The course presents the principles of analog circuit analysis and design. It introduces the basic concepts and characteristics of the electronic devices and circuits. The tutorials helps to develop the ability of analyzing actual electronic circuits that implements the basic circuits presented.

Contents:

Introduction to Passive Circuit Elements & Sources: Resistor, Capacitor, Inductor, Voltage and Current sources, Controlled Sources, Thevenin and Norton Theorem.

Basics of Semiconductors: Semiconducting Materials, Intrinsic and Extrinsic Semiconductors, Charge-carrier Density and Distribution, Fermi level.

Diodes: *p-n* Diode, Zener Diode, *I-V* Characteristics, Diode Models, Rectifiers and Voltage Regulators, Clippers and Clampers, Introduction to Special Purpose

Diodes: Varactor Diode, LEDs, Solar Cells, Photo-diodes, Tunnel Diode, Schottky Diode.

Bipolar Junction Transistors (BJTs): BJT structure, Basic BJT operation mechanism, Input and Output characteristics of common-emitter configuration, Transistor Bias Circuits-Base Bias, Emitter Bias, Voltage-Divider Bias, Emitter Feedback Bias, Collector Feedback Bias, Emitter-Collector Feedback Bias, ac Models, Voltage Amplifiers, Common Collector and Common Base Amplifiers, Power Amplifiers, and Frequency Response.

Field Effect Transistors: JFETs-Device structure, Drain Curves, Transconductance Curve, Biasing Circuits, JFET Amplifiers, MOSFETs-Device structure, Depletion-Mode MOSFET, D-MOSFET Curves, Amplifiers, Enhancement-Mode MOSFET, Digital Switching, CMOS, Power FETs.

Operational Amplifier: Differential Amplifiers, Op-Amp pin configuration, Ideal and Practical Characteristics of Op-Amp, Inverting and Non-Inverting Amplifiers, Active Filters, Summing Amplifier, Differential and Integrating Amplifiers, Comparators, Frequency response of an Op-Amp.

Oscillators: Amplifier with feedback, Condition of harmonic oscillation, Wein Bridge Oscillator, RC Oscillators, Colpitts Oscillators, 555 Timer and Circuits.

Text Books:

1. *Electronic Principles*, 7th Ed, Albert Malvino, and David Bates, Tata McGraw-Hill, 2007.
2. *Electronic Devices*; 9th Edition, Thomas L. Floyd, Pearson.
3. *Op-Amps and Linear Integrated Circuits*, Ramakant A. Gayakward, 4 Edition, Pearson.
4. *Microelectronic Circuits: Theory and Applications*, A.S. Sedra and K.C. Smith, Oxford University Press, Sixth Edition.

Course Code	Course Name	L-T-P: C
EC160	**Basic Electronic Circuits Lab**	**0-0-3: 2**

Objectives: The objective of the laboratory is to provide experimental hand-on experiences to the topics covering the course 'Basic Electronic Circuits'. The experiment modules are designed to construct circuits and verify theoretical relationships involving devices and circuits. In this lab, students also become familiar with basic electrical measurements using laboratory instruments. By the end of the lab, students should be able to design, assemble, build and test simple electronic circuits.

List of Experiments:

1. Introduction to circuit elements and basic equipments: Resistors, Capacitors, Inductors, Diodes, Transistors, Oscilloscope, Function generator, Power supply, Cables and Switches.
2. Transient- and steady-state response of RC circuits and design RC Filters.
3. Current-voltage characteristics of a *p-n* junction and Zener diode at room temperature.
4. Design a regulated power supply using Zener diode and verify its characteristics.
5. Input and output current-voltage characteristics of *n-p-n* bipolar junction transistors in common-emitter configuration and determine transistor parameters.
6. Design a Common-Emitter transistor (*n-p-n*) amplifier circuit, obtain the frequency response curve of the amplifier and determine the mid-frequency gain, A_{mid}, lower and higher cut-off frequencies.
7. Design Inverting and Non-Inverting Operational Amplifiers for a given specification.
8. Design two stage RC coupled common emitter transistor (*n-p-n*) amplifier circuit and determine its frequency response curve.
9. Design Integrator and Differentiator using Operational Amplifier.
10. Design an active low pass and high pass filter of different orders using Op-Amplifier.

Course Code	Course Name	L-T-P: C
HS101	**Spoken and Written Communication**	**2-0-2: 3**

Objectives: This course aims to equip students with the ability to express their thoughts effectively and in an accurate and precise manner by developing their oral and written skills in the English language. The course intends to expose the learner to various components of effective communication in the English language in order to provide a comprehensive understanding of what constitutes a communicative act.

Course Outcomes: At the end of the course, the students shall be able to acquire the following skills:

1. *Spoken Communication*: Develop the ability to clearly and precisely state ideas, questions, arguments and other communication ranging from informal discussion to formal presentations. Develop the ability to participate in group communication through the ability to condense large amount of information into a concise speech act. Learn and understand the dynamics of effective turn-taking and listening in order to engage in fruitful and constructive oral communicative acts. Developing focused reading skills.
2. *Written Communication*: Develop the ability to reduce thought to writing by effectively condensing large amounts of information. Acquire the skill of effective listening strategies in order to capture and

demonstrate the core ideas through written mode of communication. Develop the faculty for critical thinking so as to enhance written English skills.

Contents:

Elements of Communication: Course instructor should make the students aware of the elements of communication, the role of English language for effective communication, the process of communication and factors that influence communication (sender, receiver, channel, code, topic, message, context, feedback, noise, filters & barriers), importance of audience and purpose, the information gap principle, verbal and non-verbal communication: body language, general communication and business communication. An ability to communicate well is a key soft skill. Many other skills depend on good communication skills. By learning the processes involved in communication, the students shall be able to appreciate the importance of good communication skills in becoming a successful professional.

Articulatory Phonetics: Course instructor should introduce the students to the science of Articulatory Phonetics. It would be a basic training for mastering English sound system, particularly putting emphasis on British English, as well as basic knowledge on the Phonetics of English language. The focus shall be on IPA (International Phonetic Alphabet) symbols, the anatomy of speech organs, production and organization of speech sounds and phonetic transcriptions. Understanding the phonetics of English shall help students in using dictionaries effectively and pronouncing words correctly.

Multimedia and Discursive Communication-I: Course Instructor should make an optimal use of cinema for increasing the students' familiarity with English. Testing be done on the basis of the student's comprehension of the plot and their ability to describe scenes from the film. Classroom exercise of asking students to comment on the plot or scenes of a given film – not in writing but by standing before the entire class and speaking in English — be frequently carried out. The aim of this unit is to make the student feel confident about her/his ability to form sentence in English for discursive communication.

Multimedia and Discursive Communication-II: Course Instructor should use audio tapes, Ted Lectures, radio news broadcast or celebrated speeches, etc. for exposing the students' to a real time' and good spoken English. Class room tests be set to check the students' ability to respond to their listening experience in writing. This will help the Course Instructor to continually assess the requirements of the students and provide corrective advice. Testing the writing skills of students will require setting several questions of very short composition tasks, from 50 words to 150 words. The topics chosen for the composition tasks should be selected from the topics covered in the classroom discussions or from the life on the campus.

Literature and Communication Skills: Students should be provided four to five extended samples of written English such as short stories or newspaper editorials for them to mark their difficulties – words, idioms, sentence structures, etc. This will help the students in improving their ability to do focused reading of serious written literature. Testing of the reading comprehension skills be tested by giving them in advance of the test several passages for reading. The Course Instructor may select one or more of those seen passages' for the examination purpose.

Text Books:

1. *Prism: Spoken and Written Communication*, Prose & Poetry published by Orient Longman, 2008.
2. *Technical Communication: Principles and Practice*, Second Edition by Meenakshi Raman and Sangeeta Sharma, Oxford Publications, 2009.

Recommended Books, Essays and Short Stories:

1. *English and Communication Skills for Students of Science and Engineering*. Dhanavel, S.P. Units 1-5, Chennai: Orient, .Blackswan Ltd., 2009.
2. *Scientific English: A Guide for Scientists and Other Professionals*. 2 nd ed. Day, R A., Hyderabad: Universities Press, 2000.
3. *A Course in Phonetics*, Fifth Edition, Ladefoged, Peter (Harcourt, Brace, Jovanovich: Fort Worth), 2006.
4. Of Ambition- Francis Bacon
5. Of Innovations- Francis Bacon
6. With the Photographer – Stephen Leacock
7. Speech on Indian Independence – Jawaharlal Nehru
8. Socrates and the Schoolmaster – F. L. Brayne
9. The Bet – Anton Chekov
10. An Astrologer's Day – R. K. Narayan
11. The Gift of the Magi – O' Henry
12. The Monkey's Paw- W.W. Jacobs

Semester-II: Courses and Contents

Course Code	Course Name	L-T-P: C
MA102	Mathematics-II (Discrete Mathematics)	3-1-0: 4

Description: This course covers the basic concepts of discrete mathematics used in computer science that involve formal reasoning. It also includes counting, relations, graphs, trees, and number theory.

Objective: To develop logical thinking and its application to computer science and understand the basic principles of sets, functions and counting. The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument.

Contents:

Foundation: Propositional and predicate logic, logical equivalences, predicates and quantifiers, translation from language to logical expressions, nested quantifiers, set theory, set operations, set identities and functions, inverse and composition functions, graph of functions.

Number Theory: Division operator, prime factorization, properties of prime numbers, prime number theorem, GCD and LCM, modular arithmetic and applications, sequences and summations.

Counting: Permutation and combinations, pigeonhole principle, inclusion-exclusion principle, binomial theorem, Pascal identity and triangle.

Mathematical Reasoning and Induction: Rules of inference, direct proof, proof by contradiction, proof by contrapositive, mathematical induction and second law of mathematical induction.

Recursion: Definition, recursive algorithm, recurrence relations, solving recurrence relations.

Relations: Relations and their properties, applications and representations, equivalence relations, partial ordering, Hasse diagram.

Graphs: Introduction and terminology, representation, isomorphism, connectivity, Warshall's algorithm, Euler and Hamilton path, shortest path.

Text Book:

1. *Discrete Mathematics and its Application*, 7th Ed, K. Rosen, Tata McGraw Hill, **2011.**

Reference Books:

1. *Discrete Mathematical Structure*, 4th Ed, B. Kolman, R.C. Busby and S. C. Ross, PHI, 2000.
2. *Discrete Mathematics*, Richard Johnsonbaugh, Prentice Hall, 2007.
3. *Mathematics: A Discrete Introduction*, 3rd Ed., Edward R. Scheinerman, Cengage Learning, 2006.
4. *Mathematical Structure for Computer Science*, 6th Ed, J. Gersting, Freeman, 2006.

Course Code	Course Name	L-T-P: C
PH110	Waves and Electromagnetics	3-1-0: 4

Description: The objective of this course is to introduce the behavior of electromagnetic waves. This also provides an understanding of theories of electrostatics, magnetism and electrodynamics with their applications. The course also includes weekly small-group problem-solving tutorial session.

Contents:

Mathematical Foundations: Vector Calculus, Gradient, Divergence and Curl. Line, Surface and Volume integrals. Gauss's divergence theorem and Stokes' theorem in Cartesian, Spherical polar and cylindrical polar coordinates, Continuity equation.

Review of Electrostatics: Electrostatics in Vacuum-Discrete and Distributed Charges, Electrostatic Force, Scalar & Vector Potentials, Electrostatic Energy, Poisson and Laplace equation and its applications; Electrostatics in Dielectric Medium-Electric Polarization; Electric Displacement Vector, Dielectric Susceptibility, Energy in Dielectric Medium.

Review of Magnetostatics: Magnetic Fields and Forces, Biot-Savart law and Ampere's law, Magnetic Vector Potential, Magnetization- Diamagnetism, Paramagnetism and Ferromagnetism, Ampere's Law in Magnetized Materials-Auxiliary Field H, Magnetic permeability and susceptibility.

Review of Electrodynamics: Electromotive force, Time-varying fields, Faraday's' law of electromagnetic induction, Self and Mutual Inductance, Displacement Current, Maxwell's equations in Free Space & Inside Matter, Energy and Momentum in Electrodynamics.

Electromagnetic Waves: Wave equation, Propagation of Electromagnetic waves in Free Space and in Conducting Medium-Reflection and Refraction, Transmission and Dispersion.

Text Book:

1. *Introduction to Electrodynamics*, Griffiths. D. J, Prentice Hall, 2007.

Reference Books:

1. W. H. Hayt and J. A. Buck, *Engineering Electromagnetics*, Tata McGraw Hill Education Pvt. Ltd, 2006.
2. Purcell. E.M, *Electricity and Magnetism*, Berkley Physics Course, V2, Tata McGraw Hill, 2008.

3. Feynman. R.P, Leighton. R.B, Sands. M, *The Feynman Lectures on Physics*, Narosa Publishing House, Vol. II, 2008. Hill, 2008.
4. G. B. Arfken, H. J. Weber and F. E. Harris, *Mathematical Methods for Physicists*, Academic Press, 2013.

Course Code	Course Name	L-T-P: C
PH170	**Waves and Electromagnetics Lab**	**0-0-2: 1**

List of Experiments:

1. Measurement of elementary charge using Millikan oil drop experiment.
2. To draw electric field lines and equipotential lines.
3. Measurement of Dielectric constant of dielectric materials.
4. Measure Magnetic field of a paired coils in a Helmholtz arrangement with a Teslameter.
5. Verify Faraday Law and Induced *e.m.f.*
6. Hysteresis in Ferromagnetic Materials.
7. Microwave optic system to study properties of electromagnetic waves.
8. Experiments on Solar-Cell Trainer kit.
9. Dispersion of light in Prism Spectrometer.
10. Measurement of Permeability and Permittivity of Air and determination of speed of Light.

Course Code	Course Name	L-T-P: C
EE100	**Basic Electrical Engineering**	**3-1-0: 4**

Objectives: The course introduces basics of electric and magnetic circuits, single-and three-phase ac circuits. It describes the principle of operation of electrical machines and let a student to identify the type of electrical machines for a given application. The course also introduces the power generation, transmission, distribution and power converters.

Contents:

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Transformers: Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Electrical Machines: Single-phase induction motor: Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction and working of synchronous generators.

Power Systems: Power generation techniques, Transmission, Distribution, Grid, and Cost of Electricity.

Power Converters: DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Text Books:

1. S. J. Chapman, "*Electric Machinery Fundamentals*, 4th Edition, McGraw Hill Education, 2005.
2. D. P. Kothari and I. J. Nagrath, "*Basic Electrical Engineering*", 3rd Edition, Tata McGraw Hill, 2010.
3. D. P. Kothari and I. J. Nagrath, "*Electric Machines*", 4th Edition, Tata McGraw Hill, 2010.

Reference Books:

1. D. C. Kulshreshtha, "*Basic Electrical Engineering*", McGraw Hill, 2009.
2. L. S. Bobrow, "*Fundamentals of Electrical Engineering*", Oxford University Press, 2011.
3. E. Hughes, "*Electrical and Electronics Tec*hnology", Pearson, 2010.
4. V. D. Toro, "*Electrical Engineering Fundamen*tals", Prentice Hall India, 1989.

Course Code	Course Name	L-T-P: C
EE160	**Basic Electrical Engineering Lab**	**0-0-3: 2**

List of Experiments:

1. The magnetization characteristics of ferromagnetic material of two coils connecting them in series, parallel and to determine their effective mutual inductance.
2. Determine the real and reactive powers in a load consisting of resistor and inductor. Improve the power factor by connecting an appropriate capacitor in parallel to the load.
3. The load regulation and efficiency characteristics of the given single phase Transformer by direct loading

method and to learn the parallel operation of the Transformers and their load sharing behavior.
4. Determine the three phase power consumed using 2-wattmeters for different types of connections (star or delta) and loadings (balanced and unbalanced).
5. Perform load test on the induction motor by loading the motor using mechanical loading arrangement. Plot torque vs slip (%) and performance characteristics vs output power.
6. To conduct an Open circuit test on a separately excited dc generator and to determine the Open circuit characteristics at rated speed of the machine. To Conduct Load Test on the separately excited DC Generator and determine the efficiency and Regulation.
7. Output waveform of the single phase bridge rectifier and to design a filter capacitor to improve the dc output.
8. Three phase controlled rectifier and output waveform of the rectifier with different firing angle.
9. The working principle of the Insulated-Gate Bipolar Transistor (IGBT) based three phase Inverter and study the gate trigger circuit, their timing sequence and the output waveform.

Course Code	Course Name	L-T-P: C
CS102	**Introduction to Data Structure**	3-0-0: 3

Objectives: The course familiarizes the basic data structures such as arrays, linked lists, stacks, queues, heaps, binary trees, and graphs. The students will be able to learn to develop generic data structure classes containing operations such as insertion, deletion, searching, and sorting of each data structure. In addition, the students also learn to design and analyze efficiency of similar kind of algorithms using Big-O notation.

Contents:

Introduction: Representation of data on a computer, data types & array and linked list representations ways of representing programs and associated data on computers.
Analysis Tools: Notion of the running time of an algorithm, recurrences, parameters of performance.
Dictionary Operations: Find, max, min, successor, predecessor (query operations); insert, delete (modify operations) LIST DATA: Stacks, queues, variants implementation using arrays and linked lists.
Sorting: Comparison based sorting algorithms, other sorting algorithms, lower bounds for comparison-based sorting algorithms best-case, worst-case and average-case running times; quicksort, heap Sort, insertion sort, bubble sort etc.
Disjoint set data structure: Make-set, Union and Find Operations.
Trees: Heaps, Binary search trees (BST), heights of BST BALANCED BSTs: Red Black trees, AVL Trees, 2,3,4-trees, B Trees.
Graphs: Representation using adjacency matrices and adjacency lists, Graph searching algorithms BFS and DFS.

Text Book:
1. *Data Structures and Algorithms*, Aho, Hopcroft and Ullman, Addison-Wesley, 1999.

Reference Book:
1. *Introduction to Algorithms*, 3th Ed, Cormen, Lieserson and Rivest, PHI, 2011.

Course Code	Course Name	L-T-P: C
CS162	**Introduction to Data Structure Lab**	0-1-2: 2

Lab and take home assignments based on the course "Data Structures". Possible set of assignments may include the following list of experiments.

List of Experiments:
1. Design and Implement List data structure using i) array ii) singly linked list.
2. Design and Implement basic operations on doubly linked list.
3. Design and Implement stack using i) array ii) singly linked list.
4. Design and Implement Queue using i) array ii) singly linked list.
5. Design and Implement basic operations on Circular Queue.
6. Implementation of Searching algorithms (Linear search, Binary search).
7. Implementation of various sorting algorithms (Insertion sort, Bubble sort, Quick sort, Heap sort, Merge sort, counting sort, radix sort etc.).
8. Design and Implement basic operations (insertion, deletion, search, findmin and findmax) on Binary Search trees.
9. Design and Implement basic operations of various balanced BSTs, e.g., AVL tree, 2-3 Trees.
10. Implementation of Breadth First Search Techniques.
11. Implementation of Depth First Search Techniques.

Course Code	Course Name	L-T-P: C
HS102	Science, Technology and Society	3-0-0: 3

Objectives:

1. To acquaint students the interdisciplinary nature of the course.
2. To enlighten them about the history and philosophy of Science, Technology and Society in India.
3. To help students socialize and develop critical thinking skills.
4. To familiarize students with the changing nature cum interrelation of science, technology and society.

Contents

Introduction:

Introduction to STS as a field of study and research in the twentieth century: STS as Quest for Knowledge, Nature of Science, Distinct Characteristics of Science, Science in Twentieth Century, Science and Technology in Societal Context, and Key Concepts and Theorists in Cyberculture Studies.

Philosophical, Historical and Sociological Approaches to STS: Philosophy of Science and its Interconnection with Technology and Society, Social Role and Function of Science, Science and Western Civilization, Social Theorists, Literature and Science, Culture of STS, Scientific/Technological and Sociological Literacy, Society and Culture, Sociology of Society to STS, Social world, Science and Technology a Social Institution, Technoscience and Globalizations, Life After STS.

The growth and identity of Modern Science and Technology in India: History, key themes, Turn to technology and Beyond, Professional associations, Journals, Deliberative Democracy, Modernism and Postmodernism, Pace of Innovation, Privileged Positions of Business and Science, STS Social Construction, and Technoscience.

Science Communication: Institutions, Ideologies, Practices

The diversity of science communication in colonial India Communication in India: Historical Perspective, Current State of Affair, Science Policy and Science Communication, Modes and Means of Science Communication in India, Role of Various Organizations, Role of Public Funded Institutions, and Challenges.

Science Communication and the Nehruvian Agenda: Jawaharlal Nehru and Mahatma Gandhi, Concept of Scientific Temper, Nature of Nehruvian Science, Features of Nehru's Developmental Strategy, Nehru and STS, Nehruvian Science and Postcolonialism, Scientific Policy Resolution, and Problems Plaguing Practice of Science in India.

The ideology and image of developmental science: Role of Technical Education, Engineering Profession, Wealth and Engineering, Engineering Institutions, Quality Assurance, Engineering Education, and Role of Various Agencies in Technical Education.

The agenda of People's Science: Educational Technologies and Pedagogy, History and Pedagogical Discussions, Computers and Learning, Constructivist Theory, Educational Use of Computers, Technology and Teaching, Affordances for Learning and Teaching, and Online Learning Environments.

Liberalization and the commoditization of science and technology: Impact of Science on Society, Globalization, Lifelong learning and the Learning Society, Privatization, Learning Science Outside the Classroom, ICT as Secondary Science, Innovation in Instructional Technology, Ethics, and Cybercrime.

Text Books:

1. *Science, Technology and Medicine in Colonial India* – David Arnold (Cambridge, 2004).
2. *Western Science in Modern India, Metropolitan Methods, Colonial Practices* – Pratik Chakrabarti, (Permanent Black, 2004).
3. *Cyberculture: The Key Concepts* by David Bell.
4. *Cyberculture Theorists* by David Bell.
5. *Science, Technology and Society: A Sociological Approach* by Wenda K. Bauchspies.
6. *Philosophy of Science: A Contemporary Introduction* by Allen Rosenberg.

Reference Books:

1. *A Concise History of Science in India* – D. M. Bose, S. N. Sen, and B.V. Subarayappa (Universities Press, 2009).
2. *Science and Society in Twentieth Century* by Wendy R. Sherman.
3. *Nature of Science in Science Education* by William F. McComas

Course Structure: Second Year

Semester-III

Common to CSE and IT Branch

Course Code	Course Name	L	T	P	C
SC201	Environmental Science	2	0	0	2
MA201	Probability and Statistics	3	1	0	4
HS201	Technical Writing	1	1	2	3
CS201	Object Oriented Design & Programming	3	0	0	3
CS261	Object Oriented Design & Programming Lab	0	0	3	2
CS203	Design and Analysis of Algorithms	3	0	0	3
CS263	Design and Analysis of Algorithms Lab	0	0	3	2
EC201	Digital Logic Design	3	0	0	3
EC261	Digital Logic Design Lab	0	0	2	1
Total		**15**	**2**	**10**	**23**

Semester-IV

[A] CSE Branch

Course Code	Course Name	L	T	P	C
MA202	Numerical Techniques	0	1	2	2
HS202	Economics	3	0	0	3
CS202	System Software	3	0	0	3
CS204	Database Management System	3	0	0	3
CS262	Database Management System Lab	0	0	3	2
CS206	Operating Systems	3	0	0	3
CS266	Operating Systems Lab	0	0	3	2
CS208	Computer Organization and Architecture	3	0	0	3
CS268	Computer Organization and Architecture Lab	0	0	2	1
Total		**15**	**1**	**10**	**22**

[B] IT Branch

Course Code	Course Name	L	T	P	C
HS202	Economics	3	0	0	3
IT202	Web Technology	3	0	0	3
IT262	Web Technology Lab	0	0	2	1
CS204	Database Management System	3	0	0	3
CS262	Database Management System Lab	0	0	3	2
CS206	Operating Systems	3	0	0	3
CS266	Operating Systems Lab	0	0	3	2
CS208	Computer Organization and Architecture	3	0	0	3
CS268	Computer Organization and Architecture Lab	0	0	2	1
Total		**15**	**0**	**10**	**21**

Semester-III: Courses and Contents

Course Code	Course Name	L-T-P: C
SC201	Environmental Science	2-0-0: 2

Objectives: The course on Environment Science is expected to give information about the environment that will lead to a concern for environment. When one develops this concern, he/she will begin to act at his/her own level to protect the environment.

Contents:

Multidisciplinary nature of environmental studies: Definition, Scope and Importance, Need for public awareness.

Natural Resources: Renewable and non-renewable resources; Natural resources and associated problems:

1. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
2. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
3. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
4. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
5. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
6. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems:

1. Forest ecosystem
2. Grassland ecosystem
3. Desert ecosystem
4. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: Introduction– Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution: Definition, Cause, effects and control measures of:

1. Air pollution
2. Water pollution
3. Soil pollution
4. Marine pollution
5. Noise pollution
6. Thermal pollution
7. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns-case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-case studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health-case studies.

Field work:

1. Visit to a local area to document environmental assets: river/ forest/ grassland/ hill/ mountain.
2. Visit to a local polluted site-Urban/ Rural/ Industrial/ Agricultural.
3. Study of common plants, insects, birds.
4. Study of simple ecosystems-pond, river, hill slopes, etc.

Text Books:

1. *Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher*

Education, Erach Bharucha for University Grants Commission, 2004.
2. Trivedi R. K. and P.K. Goel, *Introduction to Air Pollution*, Techno-Science Publication.
3. Miller T.G. Jr. *Environmental Science*, Wadsworth Publishing Co.
4. Townsend C., Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science.
5. Mhaskar A.K., *Matter Hazardous*, Techno-Science Publication.

Course Code	Course Name	L-T-P: C
MA201	Probability and Statistics	3-1-0: 4

Objectives: Students will learn fundamental rules of Probability, discrete and continuous distributions, and statistical methods most commonly used in Computer Science and Software Engineering. They will be introduced to stochastic processes, Markov chains, statistical inference, and Monte Carlo methods and will apply the theory and methods to the evaluation of queuing systems and computation of their vital characteristics.

Prerequisite: MA101.

Contents:

Introduction: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' theorem and independence.

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality.

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems.

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution.

Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables.

Sampling Distributions: Mean, median, variance, standard deviation, The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions.

Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions.

Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi square goodness of fit test and its applications.

Text Book:

1. *Probability and Statistics for Computer Scientists*, by Michael Baron, CRC Press, second edition (2013).

Course Code	Course Name	L-T-P: C
HS201	Technical Writing	1-1-2: 3

Objectives: The objectives of this course include understanding the concepts, terms and tools of technical writing; and applying them on various forms of representation like technical reports, projects, research papers, dissertation and thesis. Students will read, analyze, and interpret material from technical fields, and will practice research and writing skills appropriate for technical topics.

Learning Outcomes:

1. Students will learn to follow the steps of writing process, i.e., pre-writing, writing, rewriting, and editing, and apply them to technical and workplace writing tasks.
2. Students will be able to prepare technical documents including project reports, manuscript preparation for conferences and journals, and drafting reports for availing grants for technical projects.
3. Students will be exposed to various software tools (say, LaTeX) for preparing technical documentation and presentation.
4. Students will understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.
5. Students will have an appreciation for some of the ideas, issues, and problems involved in writing about technology and in workplace writing.

Contents:

Structure of sentences, paragraphs, and documents. using stress for emphasis, and sequencing topics to create forward flow, writing for the reader; Formats of technical documents; the experimental report; the

technical report, the proposal; workshop on published documents; Discussion and workshop on term paper proposals; Graphics; emphasis without distortion; visual illusions; a minimalist approach to data representation; univariate and multivariate displays; Discussion and workshop on term papers; elements of oral presentations; oral presentations.

Text Books:

1. *The Elements of Style*, W. Strunk, E B White, New York: Macmillan, 1972.
2. *The Mayfield Handbook of Technical and Scientific Writing*, L. Perelman, Mayfield Publishing Company, 1998.
3. *The Science of Scientific Writing*, G. D. Gopen, J. A. Swan, American Scientist, 78(6):550-558, Nov-Dec 1990.

Course Code	Course Name	L-T-P: C
CS201	Object Oriented Design & Programming	3-0-0: 3

Objective: This course introduces basic concepts of object-oriented programming principles, design techniques, and analysis tools.

Learning Outcomes: On completion of this course the student should be able to design and analyze real-world problems based on object-oriented principles.

Prerequisite: IT101.

Contents:

Introduction: Principles of OOD; programming Paradigms; benefits of OOD&P, applications of OOD; Classes and objects; access qualifiers; instance creation; constructors, parameterized constructors, overloaded constructors, constructors with default arguments, copy constructors, static class members, and static objects.

Functions and Operators: Function prototyping, function components, passing parameters, inline functions, default arguments, overloaded function; array of objects, pointers to objects, dynamic allocation operators, dynamic objects; Operator overloading, overloading a unary and binary operator, overloading the operator using friend function, stream operator overloading, data conversion.

Inheritance: Defining derived classes, single inheritance, protected data with private inheritance, multiple inheritance, multi-level inheritance, hierarchical inheritance, hybrid inheritance, multi-path inheritance, constructors in derived and base class, abstract classes, virtual function and dynamic polymorphism, virtual destructor.

Exception Handling: Principle of exception handling, exception handling mechanism, multiple catch, nested try, re/throwing the exception.

Object Oriented Design: Requirements modeling, business modeling, component based development; Rational Unified Process (RUP), process overview, phases and iterations, static structure of the process, core workflows; UML history, building blocks of UML, structural modeling, behavioral modeling; Use Case Diagrams, Modeling Ordered Interactions: Sequence Diagrams; case studies.

Text Books:

1. *Introduction to object-oriented programming*, B. Timothy, Pearson, 2001.
2. Applying UML and Patterns: *An Introduction to Object-Oriented Analysis and Design and Iterative Development*, C. Larman , Prentice Hall, 2004.

Reference Books:

1. *Object Oriented Design and Patterns*, C. Horstmann, John Wiley & Sons, 2005.
2. *Unified Modeling Language User Guide*, G. Booch, J. Rumbaugh, I. Jacobson, Pearson Education, 2001.
3. *Object-Oriented Systems Analysis and Design using UML*, Bennett, McRobb, Farmer, McGraw-Hill, 2002

Course Code	Course Name	L-T-P: C
CS261	Object Oriented Design & Programming Lab	0-0-3: 2

Objective: This course equip students with object-oriented programming skills required to build reusable, robust and maintainable softwares using Java.

Learning Outcomes: On completion of this course the student should be able to design and implement real world applications based on object-oriented principles using Java.

Contents:

Lab and take home assignments based on the course 'Object Oriented Design and Programming'. Emphasis on following topics:

1. Eclipse (or NetBeans) IDE introduction.
2. Compiling & running programs on IDE.
3. Object oriented coding conventions.
4. Simple example of object-oriented design and message passing.
5. Problems on object based iteration.
6. Problems on object based arrays, matrices, and strings.
7. Design oriented problems on object polymorphism.
8. Design oriented problems on object inheritance & overriding.
9. Object-oriented designing of advanced data

structures (linked list, trees, graphs, tables).
10. Problems on object based linked lists.
11. Problems on object based trees.
12. Problems on object based graphs.
13. Mini Projects.

Text/Reference Books:

1. *Big Java/Big C++*, *Horstmann*, Cay S., John Wiley & Sons
2. *Object-Oriented Analysis and Design with Applications*, Brooch, Grady, Addison Wesley.

Course Code	Course Name	L-T-P: C
CS203	**Design and Analysis Algorithms**	**3-0-0: 3**

Objectives: Algorithms are at the core of computer science, and this course intends to provide a rigorous introduction to fundamental techniques in the design and analysis of algorithms. The course will be divided into five major components namely,

1. Foundations,
2. Sorting and Order Statistics,
3. Advanced Design and Analysis Techniques,
4. Graph Algorithms and
5. Special Topics.

Prerequisites: IT101 and CS102.

Learning Outcomes: On successful completion of this course, students should be able to:

1. Apply existing algorithms and analyze their strengths and weaknesses.
2. Design, implement, and analyze new algorithms.

Contents

Introduction and asymptotic notations: The role of algorithms in computing, Insertion sort, Analysing algorithms (Random-access machine (RAM) model), Designing algorithms, Asymptotic notations.

Divide and Conquer Techniques: Divide and conquer algorithms such as the maximum-subarray problem, Strassen's algorithm for matrix multiplication, etc., Solving recurrences -- The substitution method, The recursion-tree method, The master method, Proof of the master theorem.

Heapsort and Quicksort: Heaps, Maintaining the heap property, Building a heap, the heapsort algorithm, Priority queues, Quicksort.

Dynamic Programming: Dynamic programming algorithms such as the rod cutting, matrix-chain multiplication, Longest common subsequence, etc., Elements of dynamic programming – Optimal Substructure, Overlapping sub-problems.

Greedy Algorithms: Greedy algorithms such as activity-selection problem, huffman codes, etc., Elements of the greedy strategy - Optimal Substructure, Greedy choice property.

Graph Algorithms: Representations of graphs, Depth First search, Breadth First Search, Topological sort, Minimum Spanning Trees - The algorithms of Kruskal and Prim, Shortest Paths - The Bellman-Ford algorithm, Dijkstra's algorithm.

NP-Completeness and Approximation Algorithms – Introduction to NP-Completeness, Approximation algorithms such as the traveling-salesman problem, the subset-sum problem, etc.

Text Book:

1. Cormen *et al.*, *Introduction to Algorithms*, Third Edition, Publisher: The MIT Press, 2009.

Reference Books:

1. Goodrich and Tamassia, *Algorithm Design and Applications*, First Edition, Publisher: Wiley, 2014.
2. Sedgewick and Wayne, *Algorithms*, Forth Edition, Publisher: Addison-Wesley Professional, 2011.

Course Code	Course Name	L-T-P: C
CS263	**Design and Analysis Algorithms Lab**	**0-0-3: 2**

Contents:

Laboratory assignments should be given from the following topics (or any other state-of-the-art topic) to develop creativity and analytical abilities of students. The assignments should be in the form of hands-on experience of algorithms in one (or more) of the programming language(s).

1. Divide and conquer algorithms.
2. Sorting techniques such as Merge sort, Quick sort, etc
3. Heap sort and Priority Queues.
4. Greedy algorithms.
5. Graph representation techniques.
6. Graph search. (DFS, BFS, etc.)
7. Minimum spanning trees. (Prim, Kruskal, etc.)
8. Shortest paths algorithms. (Bellman-ford algorithm, Dijkstra's algorithm)
9. Dynamic programming-Algorithms.

Course Code	Course Name	L-T-P: C
EC201	**Digital Logic Design**	**3-0-0: 3**

Objectives:

1. To familiarize the students with the basic concept of digital logics.
2. To familiarize the students with the hardware description language (VHDL).
3. To design digital hardware for a given application.

Prerequisite: EC100.

Contents:

Number Systems: Representations, signed, 1's complement, 2's complement, saturation and overflow in fixed point arithmetic.

Boolean Algebra: Axioms and theorems, De Morgan's law, universal gate, duality, expression manipulation using axioms and theorems.

Combinational Logic: Introduction to switching algebra, canonical forms, two-level simplification, Boolean cube, logic minimization using K-map method, QuineMcCluskey tabular method, minimization for product-of-sum form, minimization for sum-of-product form, multiplexers, demultiplexers, decoders, encoders, hazard free synthesis, Arithmetic circuits, adders, half adder, full adder, BCD adder, ripple carry adder, carry-look ahead adder, combinational multiplier.

Sequential Logic: Simple circuits with feedback, basic latches, clocks, R-S latch, master- slave latch, J-K flip flop, T flip-flop, D flip-flop, storage registers, shift register, ripple counter, synchronous counters, Finite State Machine (Moore/Mealy Machines), FSM with single/multiple inputs and single/multiple outputs, RAM, ROM, EPROM.

Hardware Description Language: Programming and simulation, structural specification, behavioral specification, dataflow modelling, test bench, testing using test vectors, testing using waveforms, design of basic blocks to build larger circuits, case studies, adder, ALU, counters, shift registers, register bank, FSM design example etc.

Text Books:

1. *Digital Design*, Morris Mano, Prentice Hall, 2002.
2. *Digital Fundamentals*, 10th Ed, Floyd T L, Prentice Hall, 2009.

Reference Books:

1. *Digital Circuits and Design*, S Salivahanan, Vikas Publication House Pvt. Ltd.
2. *A VHDL Primer*, 3rd Edition, J. Bhaskar, Pearson.
3. *Digital Design-Principles and Practices*, 4th Ed, J F Wakerly, Prentice Hall, 2006.

Course Code	Course Name	L-T-P: C
EC261	**Digital Logic Design Lab**	**0-0-2: 1**

List of Experiments:

1. Verification and interpretation of truth tables for logic gates.
2. Realization of logic functions with the help of universal gates-NAND Gate & NOR Gate.
3. Construction of half adder, full adder and full subtractor using XOR and NAND gates and verification of its operation.
4. Construction of a SR and JK flip flop and verification of its operation, convert SR to JK, JK to D, SR to T, J-K to T flip flop.
5. Verification of truth table for 7 segment decoder/ driver ICs.
6. Verification of truth table for 2:1, 4:1, 8:1 multiplexer/ Demultiplexer and implement 16:1 using 4:1 multiplexer.
7. Construction of 4 bit SISO, SIPO, PISO, PIPO shift registers and verification of their operation.
8. Construction and verification of operation of 4-bit ring counter.
9. Write VHDL programme for the following, analysis the output waveform and the hardware generated (*a*) Arithmetic logic unit (ALU), (*b*) Finite state machine (FSM).

Semester-IV: Courses and Contents

Course Code	Course Name	L-T-P: C
MA202	Numerical Techniques	0-1-2: 2

Objective: This course provides insights in to implementation of numerical computing methods that are practical, efficient, and elegant.

Prerequisite: MA101.

Learning Outcomes: On successful completion of this course, students should be able to:
1. Implement numerical algorithm for specific problem.
2. Apply algorithm with analysis of cost benefits.

List of Experiments:

1. **Solving system of linear algebraic equation:** Gauss Elimination Method, LU Decomposition, Iterative Methods, Singular Value Decomposition, Ill Conditioned System, Eigen Value Computation (Jacobi Method for Symmetric Matrices)
2. **Interpolation and Curve Fitting:** Polynomial interpolation, Extrapolation, Cubic Spline, Least Square fit.
3. **Finding roots of an Equation:** Incremental Search method, Bisection Method, Newton Raphson Method, Regula-Falsi method.
4. **Numerical Differentiation:** Finite Difference Approximation, Derivatives by Interpolation (Using Forward/ Backward/central difference formula)
5. **Numerical Integration:** Trapezoidal and Simpson's rules for integration.
6. **Solution of first order and second order ordinary differential equations:** Euler method, Euler modified method, Runge-Kutta methods, Milne PC method, Boundry Value Problem.

Text/Reference Books:
1. *Numerical Methods in Engineering with Python*, Jaan Kiusalaas, 2nd Ed. Cambridge University Press.
2. *Numerical Recipes in C*, W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, 3rd Ed., Cambridge University Press.
3. *Elementary Numerical Analysis*, S. D. Conte and C. De Boor, Mc Graw Hill Publisher.
4. *Applied Numerical Analysis*, E. V. Krishnamurthy & S. K. Sen, East West Publication.
5. *Numerical Methods*, B. Ram, Pearson Education.

Course Code	Course Name	L-T-P: C
HS202	Economics	3-0-0: 3

Contents:
The Problems of Economic Organization; Demand and Supply; Price Determination; Elasticity of Demand and Supply; Theory of Production; Production function; Law of diminishing returns; Analysis of Cost; Fixed and variable costs; Marginal cost; Market Structure and Various Types of Markets; Perfectly Competitive Market; Monopolistic Markets; Aggregate Demand and Aggregate Supply; Determination Of National Income and criticisms; Consumption, Saving and Investment; Business Cycle and remedies; International Trade; Balance of Payment; Case for and against free trade; Economics of banking; Interest rates and demand for money; Role of Central Bank; Inflation: measurement, causes and index numbers.

Text Books:
1. *Economics*, P. Samuelson & Nordhaus, Tata-McGraw Hill.
2. *Indian Economy*, Ruddar Datt & Sundaram, S. Chand & Co.

Course Code	Course Name	L-T-P: C
CS202	System Software	3-0-0: 3

Objective: This course introduces design and implementation of various types of system software and their relationship with machine architecture.

Learning Outcomes: On successful completion of this course, students should be able to:
1. List relationship between machine architecture and system software.
2. Analyze different types of software processors viz. assemblers, compilers, loaders.
3. Able to differentiate between top down and bottom up parsing and understand syntax directed translation techniques.

Prerequisites: CS102.

Contents:

Introduction: Overview and history, Language Processors, Introduction to CISC and RISC machine architecture.

Assembler: Basic Assembler Functions, Machine Dependent Features, Machine Independent Features, One pass and Multi pass Assembler.

Linkers, Loaders and Macro Processors: Basic Loader Function, Loader Design Options, Relocation and Linking Concepts, Design of a Linker, Case study

for Linker and Loader, Basic Macro Processor Functions and Features, Macro Processor Design Options, Implementation example for Macro Processor.

Compilers: Aspects of Compilation, Compiler Features, Memory Allocation, Grammar, Parsing Techniques, Compiler Design Options, Intermediate Code Generation and Optimization Techniques.

Software Tools: Text Editors, Debuggers, Data Base Management System, User Interfaces.

Text/Reference Books:

1. *System Software – An introduction to System Programming*, Leland L. Beck, 3rd Edition, Pearson Education.
2. *Systems Programming and Operating Systems*, D. M. Dhamdhere, Tata McGraw Hill Publication.
3. *System Programming*, John Donovan, McGraw Hill Publication.
4. System Software, Santanu Chattopadhyay, Prentice Hall India Publication.

Course Code	Course Name	L-T-P: C
IT202	Web Technology	3-0-0: 3

Objectives: Students will learn to use web technology for building web applications. They will develop a case study where they will be able to understand and demonstrate use of web technology for a particular application domain.

Prerequisites: CS201.

Contents:

Introduction Web Services: Web services architecture; overview of web services; service oriented roles and architecture; architectural process; three tier web based architecture.

XML: Introduction to XML; XML fundamentals; well-formed XML documents; components of XML document; XML tools; XML style sheets; XSL; CSS; XML namespaces; EDI fact; message definition; segments; message structure and electronic enveloping.

Java Web Services Architecture: J2EE and web services-Introduction to JSP and java servlets; servlets; overview of Java server pages.

Active Server Pages: HTML and VBScript fundamentals; ASP concepts, using request, response, application, session, server objects; cookies.

.Net Framework: Overview of .NET framework; building blocks of .NET platform; role of .NET class libraries; understanding CTS, CLR, CLS; deploying .NET; building C# applications.

Text Book:

1. *Web Application Architecture: Principles, Protocols, & Practices*, L. Shklar, R. Rosen.

Reference Books:

1. *Web Technologies: A Computer Science Perspective*, Jeffrey Jackson.
2. *Web Technology: Theory and Practice*, M. Srinivasan.
3. *Java Servlet Programming*, J. Hunter, W. Crawford, O'Reilly Publications, USA, 1998.

Course Code	Course Name	L-T-P: C
IT262	Web Technology Lab	0-0-2: 1

Objectives: Students will apply web technology for building web applications. They will develop a case study where they will be able to understand and demonstrate use of web technology for a particular domain.

Contents:

Web technology tools, XML, SOAP, CORBA, RMI with emphasis on following:

Project/Assignment-1 (Information Flow): Implementation of complete website; PHP backend; MySQL Database; front-end Form development (text, email, radio, checkbox, select/data list)

Project/Assignment-2 (Validation and Structure): Client-side validation of project/assignment 1; Server-side validation of project/assignment 1; Object-oriented designing of PHP backend (following MVC architecture); Unit testing; Using Git; Using GitHub.

Project/Assignment-3 (Session Management): Session Management addition to project/assignment 2; User login addition to project/assignment 2; Styling & Layout addition project/assignment 2.

Course Code	Course Name	L-T-P: C
CS204	Database Management System	3-0-0: 3

Objectives: The course aims the students will be able to list and understand the basic concepts of a relational database system. They can analyze database requirements, determine the entities involved and relationships among them. The students are able to efficiently and effectively organize, maintain and retrieve information from a database system.

Learning Outcomes: On completion of this course the student should be able to:

1. List the basic concepts of relational database model, relational algebra, entity-relationship model, and

SQL.
2. Convert the entity-relationship model to relational database and formulate SQL queries on it.
3. Optimize database design through different processes.

Prerequisites: CS102.

Contents:

Introduction and Conceptual Modeling: Databases and database users; database system concepts and architecture; data modeling using the entity-relationship (ER) model; enhanced entity relationship.

Data Storage and Indexing: Introduction, record storage, and primary file organization index structures for files; single level indexing; multilevel indexing.

Relational Model: The relational data model; relational database constraints; relational algebra; relational calculus; relational database design by ER and EER; relational mapping; SQL; the relational database standard; examples of relational database management systems; Oracle.

Database Design Theory and Methodology: Functional dependencies and normalization for relational databases, relational database design algorithms and further dependencies.

System Implementation Techniques: Query processing and optimization, transaction processing concepts, concurrency control techniques, database recovery techniques.

Object and Object Relational Databases: Object database concepts, the ODMG standard for object databases, object-relational systems, and SQL.

Emerging Applications: Distributed databases and client/server models, XML Database (DTD, XML Schema), Query for XML Database, NoSQL.

Text Book:
1. *Fundamentals of Database Systems*, R. Elmasri, S. B. Navathe, Prentice Hall, New Delhi, 2007.

Reference Books:
1. *Database System Concepts*, A. Silberschatz, H. F. Korth, S. Sudharshan, Tata McGraw Hill, New Delhi, 2005.
2. Introduction to Database Systems, C. J. Date, Prentice Hall, New Delhi, 2004.

Course Code	Course Name	L-T-P: C
CS262	Database Management System Lab	0-0-3: 2

Objective: This course aims to develop an in-house project using the fundamentals of Database Management System design process discussed in the course "Database Management System".

Learning Outcomes: On completion of this course the student should be able to:
1. Design and implement a database schema.
2. Use normalization techniques in a real-time DBMS application.
3. Formulate SQL commands such as create, insert, update, delete, etc. to a relational DBMS.

Contents:

Lab and take home assignments based on the course "DBMS". Emphasis on following topics:
1. **ER Modeling Tool (ERWin):** Introduction to ERWin; Adding Entity types & relations; Forward generation.
2. **Abstract Query Language Interpreter** (JCup & JFlex): Relational Algebra (syntax, RA interpreter); Domain Relational Calculus (syntax, DRC interpreter); Datalog (syntax, Datalog interpreter).
3. **Relational Database Management System (Oracle):** SQL* Plus Utility; SQL* Loader Utility; Programming with Oracle using JDBC API.
4. **Relational Database Management System (MySQL):** MySQL Utility; Bulk loading of data; MySQL and PHP programming; Making an online Address Book.
5. **Database Design Toolkit (DBD):** Coding Relational Schemas & Functional Dependencies; Invoking SWI-Prolog Interpreter; DBD system predicates (xplus, finfplus, fplus, implies, equiv, superkey, candkey, mincover.
6. **Object-Oriented Database Management System (db4o):** db4o Installation & Introduction; Simple database creation exercise; Database updates & deletes; Database Querying (queryByExample, Native Queries, SODA Queries); Company database application exercise; Web application exercise (client-server configuration).XML DATABASE: XML basics; Creating a company database in XML; XML Editor (EditiX); XPath; XQuery; FLWOR expressions; XML Schema

Course Code	Course Name	L-T-P: C
CS206	Operating Systems	3-0-0: 3

Objective: This course provides undergraduate students with knowledge about contemporary operating system design and its relationship between memory, processor, file interface and processes.

Learning Outcomes: On successful completion of this course, students should be able to:
1. Describe process management and concepts of threading, multitasking, IPC.

2. Differentiation of various scheduling algorithms and identify the reasons of deadlock and their remedial measures in an operating system.
3. Describe various memory management techniques, file system interfacing and disk scheduling algorithms.
4. Conceptualize the components involved in designing a contemporary OS.

Prerequisites: MA102 and IT101.

Contents:

Introduction: Overview and history, multi-programming, functions of an OS, device drivers, I/O interrupts, and system call interface.

Process Management: Process Abstraction, Process States, Implementing Processes (PCB), Threads, Classical Synchronization Problems; Synchronization Primitives; Semaphores; Monitors; Deadlocks, Deadlock Avoidance. CPU Scheduling, Real Time Scheduling.

Memory Management: Segmentation, Demand Paging, Hardware Support, Page Fault Handling; Page Replacement Algorithms; Shared Memory.

Files Systems: Disks Structure, Disk Scheduling, Disk Management, RAID Structure, File Organization and Mounting, File descriptor, Directory Structure and Implementation, I/O Systems.

Text/Reference Books:

1. *Operating Systems: internals and design principles*, William Stallings, Pearson Education.
2. *Modern Operating Systems*, Andrew Tanenbaum, Prentice Hall Publication.
3. *Operating System Concepts*, A. Silberschatz, P. Galvin, & G. Gagne, John Wiley & Sons.
4. Operating System – A Concept based Approach, D. M. Dhamdhare, McGraw Hill Publication.

Course Code	Course Name	L-T-P: C
CS266	Operating Systems Lab	0-0-3: 2

List of Experiments:

1. Review of Pointers and File Handling using C.
2. Understanding of Shell Scripting.
3. Understanding of System Calls.
4. Implementation of Producer-Consumer Problem using Stack & Queue.
5. Multithreaded Programming.
6. Implementation of basic CPU Scheduling algorithms like FCFS, SJF, Round Robin.
7. Implementation of Banker's Algorithm.
8. Implementation of basic Page Replacement Algorithm like LRU, Optimal Page Algorithm.

Course Code	Course Name	L-T-P: C
CS208	Computer Organization and Architecture	3-0-0: 3

Objectives: To study the basic organization and architecture of digital computers (CPU, memory, I/O, software, pipelining and parallelism). Discussions will include digital logic, microprogramming and performance enhancement of processor. Such knowledge leads to better understanding computer organization and architecture, can be used in the design and implementation of computer systems or as foundation for more advanced computer-related studies.

Learning Outcomes:

1. To familiarize the students with the computer resources as designer and user point of view.
2. To provide the hands on experience of software and hardware.
3. To familiarize the students with the processor interaction with other hardware and time management.
4. To familiarize the students with pipeline architecture and instruction level parallelism.
5. To familiarize the students with dynamic instruction scheduling and thread level parallelism.
6. To familiarize the students with memory system and its interaction with processor.

Prerequisite: EC201

Contents:

Von Neumann: Functional units, ALU, data paths architecture, registers, instruction set architecture (ISA), addressing modes.

Data representation and arithmetic: Overview of integer data, fixed, floating point systems, representation of non-numeric data (characters, strings, records, and arrays), integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, division, floating point arithmetic.

Pipelining and Parallelism: An overview of pipelining, throughput and speedup, pipelined data path and control, data dependency and hazard, control hazard and structural hazard, instruction level parallelism (ILP) concepts and challenges, basic compiler techniques for exposing ILP, ILP using dynamic scheduling, VLIW, super scaler architecture, overview of thread level parallelism.

Memory system and I/O: Principles of temporal and spatial locality; cache memories (address mapping, block size, replacement and store policy); virtual memory (page table, TLB); disk organization and data

access from disk drive, programmed I/O, interrupt-driven I/O, Handshaking, DMA, interrupts.

Text Books:

1. *Introduction to Computing Systems: From Bits and Bytes to C and Beyond*, 2th Ed, Yale Patt and Sanjay Patel, Tata McGraw-Hill, 2001.
2. *Computer Architecture: A Quantitative Approach*, 5th Edition By John L Hennessy & David A Patterson.

Reference Books:

1. *Computer Organization and Design: The hardware/software Interface* (ARM edition) by John L Hennessy & David A Patterson.
2. *Computer Organization and Architecture*, 8th Ed, Stallings, Pearson, 2010.
3. B. Parhami, *Computer Architecture: From Microprocessors to Supercomputers*, Oxford Univ. Press, New York, 2005.

Course Code	Course Name	L-T-P: C
CS268	**Computer Organization and Architecture Lab**	**0-0-2: 1**

List of Experiments:

1. Design and implementation of data path architecture and program counter.
2. Design and implementation of arithmetic logic unit (ALU).
3. Design and implementation of ripple carry adder and carry-look-ahead adder.
4. Design and implementation of Booth's multiplier and combinational multipliers.
5. To understand the basic principles of pipeline design for single instruction, including the problems of data and branch hazards.
6. To understand pipeline design for multiple instructions, including the problems of data and branch hazards.
7. To understand the multiple instructions (beq, lw and st) working using pipelined processors.
8. To understand the arithmetic instruction (add, mult, div, sub) working using instruction level parallelism.
9. To understand the implementation of instruction level parallelism using Score Board algorithm.
10. To understand the implementation of instruction level parallelism using Tomasulo algorithm.

Course Structure: Third Year

Semester-V

[A] CSE Branch

Course Code	Course Name	L	T	P	C
CS301	Computer Networks	3	0	0	3
CS361	Computer Networks Lab	0	0	2	1
CS303	Software Engineering	3	0	0	3
CS363	Software Engineering Lab	0	0	3	2
CS305	Formal Language and Automata Theory	3	0	2	4
-	Program Elective (PE1)*	3	0	2	4
-	Program Elective (PE2)*	3	0	0	3
CS391	Design Project	0	0	0	3
Total		**15**	**0**	**9**	**23**

**List of Program Electives is provided in Appendix-I*

[B] IT Branch

Course Code	Course Name	L	T	P	C
CS301	Computer Networks	3	0	0	3
CS361	Computer Networks Lab	0	0	2	1
CS303	Software Engineering	3	0	0	3
CS363	Software Engineering Lab	0	0	3	2
IT301	Information Security	3	0	0	3
IT361	Information Security Lab	0	0	2	1
-	Program Elective (PE1)*	3	0	2	4
-	Program Elective (PE2)*	3	0	0	3
IT391	Design Project	0	0	0	3
Total		**15**	**0**	**9**	**23**

**List of Program Electives is provided in Appendix-I*

Semester-VI

[A] CSE Branch

Course Code	Course Name	L	T	P	C
CS302	Artificial Intelligence	3	0	0	3
CS362	Artificial Intelligence Lab	0	0	2	1
CS304	Introduction to Cryptography and Network Security	3	0	0	3
CS364	Introduction to Cryptography and Network Security Lab	0	0	2	1
-	Program Elective (PE3)*	3	0	2	4
-	Program Elective (PE4)*	0	1	2	2
-	Elective from other Branch of Engineering (EO1)#	3	0	0	3
-	Open Elective (OE1)$	3	0	0	3
Total		**15**	**1**	**8**	**20**

**List of Program Electives is provided in Appendix-I.*
#List of Electives from other Branch of Engineering is provided in Appendix-II.
$List of Open Electives is provided in Appendix-III.

[B] IT Branch

Course Code	Course Name	L	T	P	C
IT302	Software Project Management	3	0	0	3
IT362	Software Project Management Lab	0	0	3	2
IT304	Management Information System	3	0	0	3
-	Program Elective (PE3)*	3	0	2	4
-	Program Elective (PE4)*	0	1	2	2
-	Elective from other Branch of Engineering (EO1)#	3	0	0	3
-	Open Elective (OE1)$	3	0	0	3
Total		**15**	**1**	**7**	**20**

**List of Program Electives is provided in Appendix-I.*
#List of Electives from other Branch of Engineering is provided in Appendix-II.
$List of Open Electives is provided in Appendix-III.

Semester-V: Courses and Contents

Course Code	Course Name	L-T-P: C
CS301	Computer Networks	3-0-0: 3

Objective: This course develops an understanding of modern network architectures from a design and performance perspective. It clarifies network terminology and provides an opportunity to do network programming using TCP/IP. The course exposes students to emerging technologies and their potential impact.

Learning Outcomes: On completion of this course the student should be able to:

1. Relate the TCP/IP layered model with real-life data communication.
2. Analyze the requirements for an organizational network layout and give the most appropriate networking architecture and technologies suited.
3. Have a working knowledge of connection-less and connection-oriented protocols.

Contents:

Introduction: Overview of an internet, internet as a service, internet architecture, circuit switching, packet switching, network performance metrics (delay, packet loss, and throughput), layered approach (TCP/IP and OSI models).

Link layer: Multiple access protocols (channel partitioning protocols, random access protocols, and CSMA protocols), Ethernet – IEEE 802.3, Token ring – IEEE 802.5, WiFi – IEEE 802.11, reliable link layer protocols (stop and wait, sliding window protocols), switches and bridges.

Network layer: IP addressing: IPv4, IPv6, and ICMP header formats; intra-domain routing: distance vector and link state routing protocols; inter-domain routing: BGP; routing for multicasting and broadcasting.

Transport layer: principles of reliable data transfer; connection-oriented transport: TCP connection establishment, TCP timeout estimation, TCP RTT estimation, TCP congestion control; connectionless transport: UDP.

Application layer: network applications, hypertext transfer protocol, domain name system, simple mail transfer protocol, socket interface, client-server programming.

Text Books:

1. *Computer Networks: A Systems Approach* (Fifth Edition) by L. L. Peterson and B. S. Davie, publisher: Morgan Kaufmann.
2. *Computer Networking: A Top-Down Approach* (Fifth Edition) by J. F. Kurose and K. W. Ross, publisher: Pearson

Reference Book:

1. *TCP/IP Illustrated Volume 1: The Protocols*, Second edition, K. R. Fall and W. Richard Stevens, publisher: Pearson.

Course Code	Course Name	L-T-P: C
CS361	Computer Networks Lab	0-0-2: 1

Objective: This course makes students aware of various cabling technologies used in different types of network. Give exposure to various network commands. To implement various network and transport level protocols. Give exposure to Wireshark and packet tracer to simulate different types of network.

Learning Outcomes: On completion of this course the student should be able to:

1. Describe the functions of common networking devices and their role in data communication.
2. Implement various networking commands.
3. Implement various networking protocols such as flow and error control.
4. Have a working knowledge of socket programming.
5. Have a working knowledge of Wireshark and Cisco Packet Tracer.

Students are expected to create an internet-based application such as e-mail application, chat application, etc. In the third week, the students should finalize their application title and communicated it to their respective TA. The students can form groups with at most four students in each group. Mid-term evaluation of the project will be held in the 7th week and end-term evaluation in the last week.

List of Experimental Tasks:

1. Analyze the IIITV Network structure and basic networking hardware devices such as Hub, Switch, Router, Firewall, NIC, Modem, Gateway, etc. Write down and submit the difference between various networking devices.
2. Study various types of network cables and their usage. Construct the cross and straight cables using a crimping tool. Install and configure wired and wireless NIC.
3. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration). Transfer files between machines in LAN using FTP. Configuration and install a Print server in a LAN and share the printer.
4. Understand and implement basic networking commands such as Ping, Ipconfig, Traceroute, Arp, Netstat, Whois, SSH, etc.
5. Implement standard error detection and correction methods.
6. Study and implement Socket Programming using any

preferred internet-based programming language.
7. Study and implement flow control protocols: sliding window and go-back-n protocols.
8. Configure Internet connection and use IPCONFIG, PING / Tracer, and Net stat utilities to debug the network issues.
9. Configure a Network topology using packet tracer software. Hands-on with Wireshark.
10. Hands-on with Cisco Packet Tracer.

Course Code	Course Name	L-T-P: C
CS303	Software Engineering	3-0-0: 3

Objectives: The following are the objectives of the course:
1. Provides an understanding of the foundations of software engineering.
2. Provides a foundation for students who want to develop their career in the broad field of computing and specifically in the areas of Information and Communication technology.
3. Apply key engineering principles and mathematical models to application development projects.
4. Emphasize the complete lifecycle of the software development process and design, develop, test, and deploy software using rigorous software engineering practices.
- Develop the skills and abilities of applying the fundamental concepts of computing in industrial, business and other problems, in order to produce software solutions.
- Introduce the role of software tools in the process of software development.

This course has been designed to provide the students with the opportunity to apply the software engineering principles learned in the course to a project, that is also a part of this course. Students will work on a significant software development project that may include any or all activities associated with creating a software solution to a client/customer problem. They would be taken through all the software engineering activities that are typically experienced from the initiation to the completion of a software development project. Special emphasis has been placed on defining the client/customer problem and determining requirements by either working with real clients on real world problems. Teams are encouraged to work autonomously following good software engineering practices, with guidance in the form of lectures and tutorials, from the course instructor and teaching assistants. In addition, issue based assistance is provided as and when required or as and when the same is sought by the team members.

Prerequisite: CS201.

Contents:

Introduction to Software Engineering

Software life cycle models

Software Project Phases
1. Pre-development phase-Feasibility & Proposal.
2. Development phase: Requirements analysis & specification, Design, Coding & Unit Testing, Testing.
3. Post-development phase: Maintenance

Software Project Management
1. Software Project Estimation
2. Software Project Scheduling
3. Risk Management
4. Configuration Management
5. Software Reliability and Quality Assurance

Computer Aided Software Engineering (CASE)

Agile Methodologies

Expected Learning Outcomes: Upon completion of this course the student should be able to:
1. Enumerate and define the phases in the software development process.
2. Describe the activities performed in each of the phases and how each phase relates to the others.
3. Develop a coherent set of software requirements for a particular application.
4. Convert a set of requirements into a set of specifications that can be validated.
5. Apply any of several design methodologies to the design of a software work product.
6. Develop and implement a test plan that will adequately exercise a software work product with the purpose of discovering defects.
7. Enumerate and define the steps in the post-implementation phases.
8. Describe the activities associated with corrective, adaptive, and perfective maintenance.
9. Describe the activities associated with the configuration management process and relate its importance during software development and maintenance.
10. Perform an impact analysis for a change request as it applies to a software work product.
11. Perform all software engineering tasks associated with developing a software system or product requiring a team of software engineers.
12. At the end of the project, assess a software development effort to determine the appropriate principles and practices that will maximize the probabilities for success.

Additional Expectations: The student should be able to:
1. Analyze a software development project and determine the most appropriate software engineering principles and practices for the given situation.

2. Evaluate the effectiveness of a given set of software engineering practices and make recommendations for changes that can improve the software development project.
3. Analyze a software development project to determine missing or inappropriate software engineering practices.
4. Assess the quality of software engineering processes, practices, products, and artifacts associated with a software engineering development effort.
5. Demonstrate interpersonal and team skills that support maximizing their team's effectiveness.

Special Expectations: The student should be able to:
1. Work collaboratively and cooperatively with others as a team that produces the required software engineering work products.
2. Create and deliver a quality presentation (individually and as part of a team presentation) related to selected aspects of software engineering processes, practices and work products associated with a software engineering project.

Books & References:

1. Roger S Pressman, "*Software Engineering – A practitioner's Approach*", McGraw Hill Higher Education, 5th, 6th and 7th Edition, 2010.
2. Pankaj Jalote, "*An Integrated Approach to Software Engineering*", Narosa Publication, 2001.
3. Eric Braude (Ed.), "*Software Engineering – Selected Readings*", IEEE, 2000.
4. Ivor Jacobson, "*Object Oriented Software Engineering: A Use Case Driven Approach*", Pearson Education Asia, 2001.
5. Carlo Ghezzi, "*Fundamentals of Software Engineering*". Prentice Hall of India, 2001.
6. Ian Sommerville, "*Software Engineering*", 8th Edition, Addison-Wesley, 2006.
7. Richard Fairley, "*Software Engineering Concepts*", Tata McGraw-Hill, 2001.
8. Ali Behforooz, "*Software Engineering Fundamentals*", Oxford University Press, 1996.
9. Richard Thayer (ed.), "*Software Engineering Project Management*", IEEE Computer Society, 1997.
10. Rajib Mall, "*Fundamentals of Software Engineering*", Prentice Hall of India, 2003.

Course Code	Course Name	L-T-P: C
CS363	Software Engineering Lab	0-0-3: 2

Contents:

1. Practical implementation of various aspects of software design life cycle.
2. Work on various projects in team/group.
3. Study and hands-on various CASE tools that are used by IT Industry.

Course Code	Course Name	L-T-P: C
CS305	Formal Languages and Automata Theory	3-0-2: 4

Objective: This course introduces students to the various types of regular languages, their equivalences to finite automata, Turing machines and Undecidability.

Learning Outcomes: On successful completion of this course, students should be able to:
1. Apply Languages and their principles.
2. Differentiate various computational models in theoretical computer science.
3. Analyze complexity of computational models.

Prerequisite: MA102.

Contents:

Mathematical Preliminaries: Review of Set theory, Functions and Relations, Graphs, Proof Techniques.

Finite Automata and Regular Languages: Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (NDFA), Equivalence between DFA and NDFA, Regular Language and their relationship with Finite Automata, Regular Grammar, Properties of Regular Languages, Arden's Theorem, Minimization of Finite Automata, Pumping Lemma for Regular Languages.

Push Down Automata and Context Free Languages: Push Down Automata, Context Free Languages (CFL) and Grammar (CFG), Simplification of CFG, Properties of CFG, Pumping Lemma for CFL.

Turing Machine and Undecidability: Introduction to Turing Machine (TM), Variants of TM, Context Sensitive Languages and Linear Bounded Automata, Recursive and Recursive Enumerable Languages, Halting Problem, Post Correspondence Problem, Undecidable Problem, Complexity Analysis.

Text Books:
1. *An Introduction to Formal Languages and Automata*, Peter Linz, Jones and Bartlett Publication.
2. *Introduction to Theory of Computation*, Micheal Sipser, Cengage Learning Publication.

Reference Books:
1. *Elements of the Theory of Computation*, H. Lewis and C. Papadimitrou, Prentice Hall Publication.
2. *Introduction to Languages and Theory of Computation*, John C. Martin, McGraw Hill Publication.
3. *Introduction to Automata Theory, Langauges and Computation*, John E. Hopcraft, Rajeev Motwani,

Jeffrey D. Ullman, Pearson Publication.
4. *Introduction to Formal Languages, Automata Theory and Computation*, Kamala Kirtivasan and Rama R., Pearson Publication.

Course Code	Course Name	L-T-P: C
IT301	**Information Security**	**3-0-0: 3**

Objectives: The course intends to provide the basic foundations of information security and its impact on the IT infrastructure. The course includes not only the cryptographic techniques used in information security, but it also focuses on the hands-on experience with tools and techniques used to ensure network security.

Learning outcomes: On successful completion of this course, students should be able to:

1. List the importance of information security of IT infrastructure.
2. Use the cryptographic algorithms to ensure the confidentiality, integrity, availability, etc. of information.
3. Analyze the security strengths of cryptographic algorithms.
4. Learn the network security protocols used to ensure the web application security.
5. Identify network security threats and the means to prevent attacks thorough tools/techniques such as firewalls, PGP, etc.

Prerequisites: MA102 and IT101.

Contents:

Symmetric-key Cryptography: Classical ciphers, Feistel structure, Modern block ciphers such as Data Encryption Standard (DES) and Advanced Encryption Standard (AES), Cryptographic hash functions, Message authentication codes (MAC).

Asymmetric-key Cryptography: Applications of asymmetric-key cryptosystem, RSA cryptosystem, Diffie-Hellman key exchange protocol, Digital signature.

User Authentication and Access Control: Password-Based/Token-Based/Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Access Control Principles, Subjects, Objects, and Access Rights, Linux/UNIX Filesystem Access Control, Role-Based/Attribute-Based Access Control, Identity, Credential, and Access Management.

Network Security: Secure socket layer (SSL)/ Transport layer security (TLS), Firewalls, Packet filtering firewall, Stateful inspection firewalls, E-Mail security, Pretty good privacy (PGP), Secure Multipurpose Internet Mail Extensions (S/MIME), IP security overview, IP security policy, Encapsulating security payload (ESP).

Management Issues: Security Risk Assessment, Security Risk Analysis, Security Plan, Monitoring Risks, Security Awareness/Training/Education, Security policies, Standards, Ethics.

Text Books:
1. Stallings and Brown, *Computer Security: Principles and Practice*, Third Edition, Publisher: Pearson, 2014.
2. M. Bishop, *Computer Security: Art and Science*, Reprint Edition, Addison-Wesley Professional, 2015.
3. Kaufman et al., *Network Security*, Second Edition, Publisher: Prentice Hall, 2002.

Reference Books:
1. Trappe and Washington, *Introduction to Cryptography with Coding Theory*, Second Edition, Publisher: Pearson, 2009.
2. Bruce Schneier, *Applied Cryptography: Protocols, Algorithms, and Source Code in C*, Second Edition, Publisher: Wiley, 1996.

Course Code	Course Name	L-T-P: C
IT361	**Information Security Lab**	**0-0-2: 1**

Contents:

Laboratory assignments will consist of following topics to develop creativity and analytical abilities of students. The assignments should be in the form of hands-on experience of cryptosystems, in one (or more) of the programming language(s), and network security protocols.
1. Classical ciphers to understand encryption, decryption, cryptanalysis.
2. Data Encryption Standard.
3. Advanced Encryption Standard.
4. Cryptographic hash algorithm such as SHA-512.
5. Message authentication codes such as HMAC.
6. RSA cryptosystem, Diffie-Hellman key exchange, Elgamal cryptosystem (1024/2048-bits).
7. Secure socket layers (SSL)/Transport layer security (TLS).
8. Firewalls (e.g. iptables).
9. Pretty good privacy (PGP).
10. Wireshark.
11. Nmap (Network Mapper), Metasploit

Course Code	Course Name	L-T-P: C
CS391/ IT391	**Design Project#**	**0-0-0: 3**

#The Design Project is a Pass/Fail course. It is

conducted during summer vacation between 4th and 5th semester. The evaluation of project work is carried out in 1st week of 5th semester and its grade will appear in the 5th semester grade sheet.

Scope of the Project: To provide an opportunity to second year undergraduate students to apply individual efforts involving the knowledge of Information Technology, Computer Science, Embedded Systems or related areas in designing/ developing/ implementing complete systems.

Students are expected to carry out design project either individually or in a group of 2 – 4 students. The duration of the project work is between 6 – 8 weeks. Followings are the broad areas in which a student may work:

1. Software Development.
2. Software Maintenance.
3. Software Tools and Techniques.
4. Hardware Development/Implementation.
5. Robotics.
6. Embedded System (Software & Hardware combine) Development/Implementation.

Semester-VI: Courses and Contents

Course Code	Course Name	L-T-P: C
CS302	**Artificial Intelligence**	**3-0-0: 3**

Objective: The use of computer to solve complex problems is the fundamental theme of this course. The notion of intelligence being captured by problem solving ability reflects throughout the course. Understanding the difficult problems in computation and interpreting software as intelligent agents is important. Modeling the problems in a way that can be solved using computer programs is very crucial to understanding artificial intelligence.

Learning Outcomes:

1. Student will be able to model a real world problem in a formal way with appropriate specifications, for example: search problems, multiplayer games and strategies, expert systems etc.
2. Student will be able to select suitable search strategy for the given problem.
3. Student will be able to design expert systems and be able to decouple the domain specific knowledge and decision/ inference engine.
4. Student will be able to program computer to solve logical inference problems with uncertainty.

Prerequisites: MA102, IT101 and CS102.

Contents:

Introduction and History: The state of art; intelligent agents; structure; environment.

Problem Solving and Game Playing: Configuration and Planning Problems, State space representation, Breadth-first search; uniform cost search; depth-first search; depth-limited search; iterative, deepening search; bi-directional search; heuristic search techniques; comparing search strategies.

Knowledge, Logic and Reasoning: Propositional logic; predicate logic; rules; forward and backward chaining; strong and weak slot fillers. The meaning of knowledge, production, semantic nets, schemata, frames; propositional logic; The first Order Predicate Logic; The Universal Quantifier; The Existential Quantifier.

Planning: Goal stack planning; non-linear planning; hierarchical planning; reactive systems.

Reasoning Under Uncertainty: Non-monotonic reasoning; logics; implementation; probability and Bayes theorem; certainty factors; Bayesian networks; Dempster Shafer theory.

Introduction to and Design of Expert Systems: What is an Expert System; advantages of Expert System; general concepts of Expert system, characteristics of Expert System; Expert System application and domain. Introduction, rule-based system architecture, non-production system architecture, dealing with uncertainty; knowledge acquisition and validation; knowledge system building tools; selecting the appropriate problem; stages in the development of Expert system; errors in development stages; software engineering and expert systems.

Text Books:

1. *Artificial Intelligence – A Modern Approach*, S. Russell, P. Norvig, Pearson Education, New Delhi, 2002.
2. *A First Course in Artificial Intelligence*, Khemani D., Tata McGraw Hill, 2014.

References:

1. *Artificial Intelligence: A guide to intelligent systems*, Negnevitsky M., Pearson Education, 2005.
2. *The Quest for Artificial Intelligence: A history of ideas and achievements*, Nilsson N., Cambridge University Press, 2008.

Course Code	Course Name	L-T-P: C
CS362	**Artificial Intelligence Lab**	**0-0-2: 1**

Laboratory Assignments:

1. State Space Search: Modeling and BFS.
2. State Space Search: Heuristic search, Best First Search, Hill Climbing.
3. Non-deterministic Search: Genetic Algorithm.
4. Path Finding: A* on Visibility Graph.
5. Game Playing: Min-Max and Alpha-Beta Algorithm.

6. Sudoku: Constraint Satisfaction Problem.
7. K-means clustering.
8. Neural Network.
9. Decision Tree.
10. Fuzzy Expert System

Course Code	Course Name	L-T-P: C
CS304	**Introduction to Cryptography and Network Security**	**3-0-0: 3**

Objectives: The course intends to provide a theoretical knowledge and hands-on experience of cryptographic algorithms, cryptanalysis, and network security protocols, used to ensure the security of data.

Learning Outcomes: On successful completion of this course, students should be able to:
1. Understand the role of cryptography and cryptanalysis in security.
2. Effectively use the cryptographic algorithms to ensure the confidentiality, integrity, availability, etc. of information.
3. Effectively analyze the security strengths/ weaknesses of cryptographic algorithms.
4. Learn the network security protocols used to ensure the web application security.

Prerequisites: IT101, MA102, and CS301.

Contents:

Secret Key Cryptography: Substitution-Permutation network, Feistel structure, Block ciphers, Data encryption standard (DES), Advanced encryption standard (AES), Stream ciphers.

Modes of Operation: Electronic code book mode (ECB), Cipher block chaining mode (CBC), Cipher feedback mode (CFB), Output feedback mode (OFB), Counter mode (CTR).

Concepts of Number Theory and Finite Fields: Euclidian algorithm, Modular arithmetic, Groups, Rings, Finite fields, Polynomial arithmetic, Fermat's theorem, Euler's theorem, Chinese remainder theorem (CRT), Integer factorization problem, Discrete logarithm problem, Elliptic curve discrete logarithm problem (ECDLP).

Data Integrity: Cryptographic Hash functions, Secure hash algorithm (SHA2 or SHA3); Message authentication codes (MAC).

Public Key Cryptography: RSA cryptosystem, Rabin's cryptosystem, Diffie-Hellman key exchange, Elgamal cryptosystem, Digital signature algorithm (DSA), Elliptic curve arithmetic, Elliptic curve digital signature algorithm (ECDSA).

Security Models: Ciphertext-only attacks, Known-plaintext attacks, Chosen plaintext attacks (CPA), Chosen ciphertext Attacks (CCA), Adaptive chosen ciphertext attacks (CCA2).

Network Security: Introduction to Web application security, Secure socket layers (SSL) / Transport layer security (TLS), HTTPS, Secure Shell (SSH), Access controls, Firewalls, Packet filtering firewall, Stateful inspection firewalls.

Text Books:
1. William Stallings, *Cryptography and Network Security - Principles and Practice*, Seventh Edition, Publisher: Pearson, 2016.
2. Trappe and Washington, *Introduction to Cryptography with Coding Theory*, Second Edition, Publisher: Pearson, 2009.
3. Katz & Lindell, *Introduction to Modern Cryptography: Principles and Protocols*, Second Edition, Publisher: Chapman & Hall/CRC, 2014.

Reference Books:
1. Bruce Schneier, *Applied Cryptography: Protocols, Algorithms, and Source Code in C*, Second Edition, Publisher: Wiley, 1996.
2. Douglas R. Stinson, *Cryptography: Theory and Practice*, Third Edition, Publisher: Chapman and Hall/CRC, 2005.
3. Kaufman et al., *Network Security*, Second Edition, Publisher: Prentice Hall, 2002.

Course Code	Course Name	L-T-P: C
CS364	**Introduction to Cryptography and Network Security Lab**	**0-0-2: 1**

Contents: Laboratory assignments will consist of the following topics to develop creativity and analytical abilities of students. The assignments should be in the form of hands-on experience of cryptosystems, in one (or more) of the programming language(s), and network security protocols.
1. Classical ciphers to understand encryption, decryption, cryptanalysis.
2. Data Encryption Standard.
3. Advanced Encryption Standard.
4. Generation of S-Boxes used in AES.
5. Modes of operations and their analysis.
6. Cryptographic hash algorithm such as SHA-512.
7. Message authentication codes such as HMAC.
8. Number theory related concepts such as Chinese remainder theorem (CRT).
9. Analyze the impact of various parameter sizes on number theoretic problems such as integer

factorization problem, Discrete logarithm problem, Elliptic curve discrete logarithm problem (ECDLP).
10. RSA cryptosystem, Diffie-Hellman key exchange, Elgamal cryptosystem (1024/2048-bits).
11. Implementation of elliptic curve arithmetic.
12. Elliptic curve digital signature algorithm (ECDSA).
13. Secure socket layers (SSL)/Transport layer security (TLS).
14. Secure shell (SSH).
15. Firewalls (e.g. iptables)

Course Code	Course Name	L-T-P: C
IT302	**Software Project Management**	**3-0-0: 3**

Prerequisite: CS303.

Contents:

Introduction: Introduction to project management; Open source tools, merits and limitations.

Software Measurement: software metrics, cyclomatic complexity, class cohesion metrics.

Software Estimation: Cost estimation, effort estimation, schedule estimation, duration estimation.

Software Management: Software planning; configuration management; software tendering and contracting processes; risk management.

Project Execution and Quality: Project execution; quality insurance, deadline management, configuration management.

Standards and Methodologies: RFPs, IETF, ISO, IEEE standards.

Web Based Open Source Project Management Tools: Simulation/emulation, performance measures, applications.

Text Book:
1. *Software Project Management: A Process-Driven Approach* -- A. Ahmed: Auerbach Publications, 2011

Reference Book:
1. *Applied Software Project Management* -- A. Stellman and J. Greene: O'Reilly Media, 2005.

Course Code	Course Name	L-T-P: C
IT362	**Software Project Management Lab**	**0-0-3: 2**

The course provides exposure of Computer Based Project Management (CBPM) tools used in the Industry via group project/activity.

Course Code	Course Name	L-T-P: C
IT304	**Management Information System**	**3-0-0: 3**

Prerequisite: CS303.

Contents:

Introduction: Technology of Information Systems, concepts, definition; role and impact of MIS; role and importance of management; approaches to management; functions of the manager; management as a control system; concepts of data models; database design; client-server architecture.

Process of Management: Planning, organization, staffing, coordination and controlling; management by exception; MIS as a support to management; organization structure and theory; basic model and organization structure; organizational behavior.

Decision Making and Information: Decision making concepts, methods, tools and procedures; behavioral concepts in decision making; organizational decision making; information concepts as a quality product; classification of the information; methods of data and information collection; value of the information; organization and information system concepts, control types; handling system complexity; post implementation problems in systems.

System Analysis and Design: Need for system analysis; system analysis of existing system; new requirement; system development model; structured system analysis and design; computer system design; development of MIS; development of long range plans of the MIS; ascertaining the class of the information; determining the information requirement; development and implementation of the MIS; management of quality; MIS factors of success and failure.

Decision Support Systems: Deterministic systems; artificial intelligence; knowledge based systems; MIS and the role of DSS; enterprise management systems; enterprise resource planning (ERP); ERP features and benefits; implementation factors of ERP; Internet and Web based information system; Electronic Commerce.

Text Book:
1. *Management Information Systems*, K. C Landon, J. P. Laudon, Prentice Hall, 2000.

Reference Book:
1. *Management Information Systems*, G. B. Davis, M. H. Olson, McGraw Hill, 1998.

Course Structure: Fourth Year

Semester-VII

[A] CSE Branch

Course Code	Course Name	L	T	P	C
CS401	Introduction to Distributed and Parallel Computing	3	0	0	3
CS461	Introduction to Distributed and Parallel Computing Lab	0	0	2	1
-	Program Elective (PE5)*	3	0	0	3
-	Program Elective (PE6)*	3	0	2	4
-	Elective from other Branch of Engineering (EO2)#	3	0	0	3
-	Open Elective (OE2)$	3	0	0	3
CS491	Research/ Industrial Internship	0	0	0	3
Total		**15**	**0**	**4**	**20**

**List of Program Electives is provided in Appendix-I.*
#List of Electives from other Branch of Engineering is provided in Appendix-II.
$List of Open Electives is provided in Appendix-III.

[B] IT Branch

Course Code	Course Name	L	T	P	C
IT401	System Administration and Maintenance	2	0	0	2
IT461	System Administration and Maintenance Lab	0	0	3	2
-	Program Elective (PE5)*	3	0	0	3
-	Program Elective (PE6)*	3	0	2	4
-	Elective from other Branch of Engineering (EO2)#	3	0	0	3
-	Open Elective (OE2)$	3	0	0	3
IT491	Research/Industrial Internship	0	0	0	3
Total		**14**	**0**	**5**	**20**

**List of Program Electives is provided in Appendix-I.*
#List of Electives from other branch of Engineering is provided in Appendix-II.
$ List of Open Electives is provided in Appendix-III.

Semester-VIII:

Common to CSE and IT Branch

Course Code	Course Name	L	T	P	C
CS490/ IT490	B. Tech. Project	0	0	36	18
Total		**0**	**0**	**36**	**18**

Semester-VII: Courses and Contents

Course Code	Course Name	L-T-P: C
CS401	**Introduction to Distributed and Parallel Computing**	3-0-0: 3

Description: This course covers the foundations of distributed systems including models of computing, different types of communication (Layered Protocols, Remote Procedure Calls, Remote Objects, messages, streams), process models (threads, client/server, code migration and software agents), naming of entities, logical clocks and synchronization. The course will include programming assignments, project and project presentation. Specific language mastery is not important, though using one of C, C++, or Java will be essential.

Prerequisites: IT101, CS201, CS204 and CS301.

Contents:

Overview of C, UNIX and UNIX system calls.

Introduction: Definition of a distributed system, goals, hardware concepts, software concepts, the client-server model.

Communication: Layered Protocols, Remote Procedure Call, Remote Object Invocation, Message-Oriented and Stream-Oriented Communication.

Processes: Threads, Servers, Code Migration and Software Agents.

Naming: Naming Entities, Locating Mobile Entities, Removing Unreferenced Entities.

Synchronization: Clock Synchronization, Logical Clocks and Election Algorithms.

Parallel Computing: Parallel Computer memory architectures, Programming Models, Shared memory model, Flynn's Programming model, Pipeline computations. Automatic vs Manual Parallelization, Data dependencies, Load balancing.

Cloud Computing: Cloud Computing Models, Web Application Framework, Cloud Web Services, Service Oriented Architectures towards Cloud Computing.

Text/Reference Books:

1. *Distributed Systems: Principles and Paradigms*, Andrew Tanenbaum and Maarten van Steen, Prentice Hall.
2. *Distributed Systems: Concepts and Design*, George Coulouris, Jean Dollimore, and Tim Kindberg.

Course Code	Course Name	L-T-P: C
CS461	**Introduction to Distributed and Parallel Computing Lab**	0-0-2: 1

Tasks included in this Lab course are:

1. Basic client-server.
2. Multi-client single server.
3. Multi-client multi server.
4. Java RMI.
5. Distributed Chat application.
6. Distributed Banking application.
7. Distributed File system application.

Course Code	Course Name	L-T-P: C
IT401	**System Administration and Maintenance**	2-0-0: 2

Objectives: The course introduces students to the roles and responsibilities of the system administrator in large organizations (e.g., data centers), and focuses on hands-on experience of IT infrastructure administration.

Learning Outcomes:

1. To list the roles and responsibilities of a system administrator in organizations.
2. To manage the resources (system, network, database, users, etc.) and security of an IT infrastructure.
3. To use the UNIX/Linux utilities and scripting languages effectively.
4. To design and manage policies governing IT infrastructure.

Prerequisite: CS301.

Contents:

Introduction: Roles and responsibility of the system administrator, Friction between UNIX and Linux, Linux distributions and examples, System- specific administration tools, Man pages and other authoritative documentations.

Scripting and the Shell: Shell basics - Command editing, Pipes and redirection, Variables and quoting, Common filter commands, bash scripting, Regular expressions, Python scripting, Scripting best practices.

Bootstrapping the system: Booting PCs, GRUB: The GR and Unified Boot loader, Booting to single-user mode, Working with startup scripts, init and its run levels, systemd, Rebooting and shutting down.

Access Control and Users: Traditional UNIX access control, Modern access control - Role-based access control, SELinux: security-enhanced Linux, PAM: Pluggable Authentication Modules, Kerberos - third-

party cryptographic authentication, Access control lists, Real-world access control – su and sudo, Pseudo-users other than root, The /etc/passwd file, The /etc/shadow file, The /etc/group file, Adding and removing users, Managing users with system-specific tools.

Controlling Processes: Components of a process, The life cycle of a process, Signals, kill, Process states, nice and renice: influence scheduling priority, ps - monitor processes, Dynamic monitoring with top, prstat, and topas, The /proc filesystem, strace: trace system calls, Runaway processes.

Periodic Processes: cron - schedule commands, The format of crontab files, Crontab management, Linux and Vixie-cron extensions, Common uses for cron.

The Filesystem: Pathnames, Filesystem mounting and unmounting, File types, File attributes - The permission bits, The setuid and setgid bits, The sticky bit.

Syslog and log files: Syslog: the system event logger, Syslog architecture, Configuring syslogd, Syslog debugging, Alternatives to syslog, Linux kernel and boot-time logging, logrotate - manage log files, Condensing log files to useful information, Logging policies.

Backups and restore: Introduction and requirements for backups, Backup devices and media, Incremental backups, dump and restore, archiving programs – tar and dd, Commercial backup products.

Networking and Routing: TCP/IP and its relationship to the Internet, Networking road map, Packet addressing, IP addresses, Routing, ARP, DHCP, Basic network configuration, Linux networking.

Text Book:

1. Evi Nemeth et al., *UNIX and Linux System Administration Handbook*, Fifth Edition, Publisher: Addison-Wesley Professional, 2017.

Reference Books:

1. Æleen Frisch, *Essential System Administration*, Third Edition, Publisher: O'Reilly Media, 2009.
2. Limoncelli et al., *The Practice of System and Network Administration*, Second Edition, Publisher: Addison-Wesley Professional, 2007.

Course Code	Course Name	L-T-P: C
IT461	**System Administration and Maintenance Lab**	**0-0-3: 2**

Laboratory Contents:

1. OS Installations, VM Installation, Configurations, Printing, etc.
2. To learn and effectively use shell scripts e.g., Bash, Perl, Python, to monitor and manage IT infrastructure.
3. To understand the bootstrapping and shutdown, and the related scripts involved during the processes.
4. To configure & debug the startup scripts.
5. Access control and user management.
6. To effectively manage (e.g., monitor, start, stop, schedule, etc.) the processes.
7. Mount/ unmounts/ configure/ access-control/ etc. the filesystem.
8. Network configuration and management.
9. To generate/ configure/ debug Syslog and log files.
10. To generate/ configure/ debug backups and restore.

Apart from the laboratory exercises, students are expected to learn and effectively use, at least, one of the following (or any other state-of-the-art) DevOps tools: Docker, Kubernetes, Jenkins, Chef, Puppet, Ansible, etc.

Course Code	Course Name	L-T-P: C
CS491/ IT491	**Research / Industrial Internship***	**0-0-0: 3**

**The Research/Industrial Internship is a Pass/Fail course. It is conducted during summer vacation between 6th and 7th semester. The evaluation of the internship is carried out in 1st week of 7th semester and its grade will appear in the 7th semester grade sheet.*

Scope of the Internship: It provides the students with an opportunity to update their skill-set by deploying themselves in a real-time environment. It is offered in two modes:

1. Summer Research Internship (SRI) and
2. Summer Industrial Internship (SII)

Under SRI mode, a student is allowed to join any academic institution around the globe by collaborating with faculty and associated research lab. It provides an opportunity to expose himself/herself with the initial glimpse of research environment in more profession way.

Under SII mode, a students is introduced to the corporate world. It teaches him/her professional ethics and polishes his/her soft skills like communication and interpersonal skills. This internship will be helpful for an effortless adaptation to work environment when he/she joins a full-time job. Also, a considerable number of internships come with a pre-placement offer (PPO) which gives an opportunity to prove his/her abilities and convert internship into a full-time job. In addition, SII allows to create professional network which could come in handy when a student will be applying for jobs in future.

Semester-VIII

Course Code	Course Name	L-T-P: C
CS490/ IT490	B. Tech. Project	0-0-36: 18

The B. Tech. Project (BTP) is an academic course. A student may pursue BTP

1. **On-campus**: Under the supervision of the Institute's faculty members.
2. **Off-campus:** At an Organization/Institute of repute under an Off-campus supervisor. In addition, student will be assigned On-campus mentor from the Institute. The Off-campus supervisor gives feedback to the On-campus mentor about the progress of the project and the On-campus mentor provides the interface to the student with the Institute.

Acceptable B. Tech. Projects:

1. Software Development.
2. System Design and Simulation.
3. Hardware Development/Implementation.
4. Embedded System (Software & Hardware combined) Development/Implementation.
5. Theoretical Modeling.
6. Technical Study.
7. Modules of a big research and development project jointly guided by teams of faculty with a focus on synthesis of their class-room learning to solve real world problems.

The project work could be on

1. A novel/new idea.
2. An extension of some previous research work.
3. An abstract problem.
4. Some proof of concept problem.

Objective: The project work (On-campus or Off-campus)/Internship (Off-campus) is expected to provide an opportunity to final year undergraduate students to design/develop/implement systems involving information technology, computer science, embedded systems and its applications, requiring an individual effort on the part of the student.

Scope: Different kinds of projects and the associated deliverables that could be accepted as a final year student's project are conceived broadly as follows:

1. Software Development.
2. System Design & Simulation.
3. Hardware Development/Implementation.

Deliverables: In general, the expected deliverables will include one or more of the followings

1. Product developed.
2. Code developed.
3. Research work in the form of Conference/Journal paper.
4. Software developed along with instructions and source code.
5. Comparative study (products/ methods/ designs).
6. Simulation study results.
7. Project report at the end of the work.

In case certain projects may not get clearly classified amongst the categories mentioned above, the concerned supervisor may identify the specific deliverables for those projects.

Group project: A group project is defined as a project where several students work in a group on one problem; or sub-task of a larger problem or a problem set. In such case it is mandatory to clearly define the deliverables of individual student of the group.

Duration: The Off-campus project is for a minimum duration of 16 weeks after the completion of seventh semester. It is expected that the project would end by the last week of April in the respective academic year.

Expectations from the student: Followings are expected from students:

For On-campus students:

1. Student must find an On-campus supervisor from IIIT Vadodara.
2. The student is expected to complete the project work assigned by the On-campus supervisor and is expected to meet all the milestones identified.
3. The student is expected to follow the work-plan decided by his/her On-campus supervisor. This includes reporting, leave and working hours during the project tenure.
4. The student should report immediately to the On-campus supervisor in the event of exceptional circumstances like illness.
5. The student is supposed to submit a 'Project Report' in the prescribed format to the BTP Coordinator at IIIT Vadodara on or before due date.
6. Student will be responsible for the plagiarism and copy-right issues.

For Off-campus students:

1. Student will be allotted an On-campus mentor from IIIT Vadodara. Students are advised to meet prospective faculty member to act as mentor.
2. The student is expected to complete the project work assigned by the Off-campus supervisor and is expected to meet all the milestones identified.
3. The student is expected to follow the work-plan decided by his/her Off-campus supervisor and due

concern with On-campus mentor. This includes reporting, leave and working hours during the project tenure.
4. The student should report immediately to the Off-campus supervisor and On-campus mentor in the event of exceptional circumstances like illness.
5. The student is expected to follow the rules and regulations of the organization as briefed by the Off-campus supervisor.
6. The student is supposed to submit a "Project Report" in the prescribed format to the BTP Coordinator at IIIT Vadodara on or before the due date.
7. Student will be responsible for the plagiarism and copy-right issues.

Expectations from the Organization (Off-campus BTP): Followings are expected from the Organization where the student is pursuing the project:

1. Provide an opportunity to the student to carry out a project that satisfies the objective, scope and guidelines of the final year student projects given above.
2. An Off-campus supervisor is to be assigned who would look after the project work of the student and interact closely with the student's On-campus mentor at IIIT Vadodara.
3. The Off-campus supervisor is expected to supervise the performance of the student in achieving the required milestones and is advised to send the feedback on a regular basis (as decided mutually) to the On-campus mentor.
4. Student is required to defend/present his project work in the respective academic year. This requires the physical presence of the student on the campus and this presentation will formally close the process of BTP. The organization is expected to relieve the student by that time.
5. The Organization's Non-disclosure Agreement (NDA), if any, must not prohibit the student to show the data, technique and/or results to the evaluation committee during the presentation of the project.
6. Off-campus supervisor is required to provide evaluation details as listed in next section, to On-campus mentor on or before in the respective academic year.

BTP Report: The mid-semester BTP report should not exceed the prescribed length of 10 pages in the single column format with a font size 12 points and Times New Roman. The page limit of 10 pages will be strictly imposed. Students are required to submit their mid semester report on or before 1st March of the respective academic year.

All care should be taken to write a final report that summarizes the work carried out by the student as part of his/her BTP. The report should not exceed the prescribed length of 40 pages in the single column format with a font size 12 points and Times New Roman. The page limit of 40 pages will be strictly imposed.

The BTP report submitted by the students will be passed through a *plagiarism check* using the Turnitin or similar anti-plagiarism software. Reports which bear similarity of more than 5% with a single source and a cumulative similarity of 20% will be identified and communicated to the evaluation committee and On-campus BTP supervisor/mentor. Note that subsequent revision of the BTP report is not possible under any circumstances.

Appendix-I

List of Program Electives for CSE / IT Branch

Program Verticals (PV)	Code
Artificial Intelligence and Data Analytics	PV1
Cyber Physical Systems	PV2
Security	PV3
Computational Science	PV4

PV	Course Name
PE1-PE3 & PE5-PE6 (3-0-0:3 / 3-0-2:4)	
PV2	Human Computer Interaction
PV2	Enterprise Resource Planning
PV2	Software Project Management (CSE)
PV1, PV2	Advance DBMS
PV1, PV4	Speech Science
PV2	Embedded System
PV2	Wireless Sensor Networks
PV3	Web Application Security
PV2	Advance Computer Networks
PV1	Natural Language Processing
PV1	Data Analytics
PV2	Computer Graphics and Animation
PV1	Information Retrieval
PV1, PV2	Computer Vision
PV2	Compiler Design
PV4	Logic for Computer Science
PV4	Principles of Programming Language
PV2	Software Verification
PV2	Internet of Things
PV2, PV3	Cloud Computing Security
PV2, PV3	Cyber Security
PV3	Security Protocols
PV1, PV4	Data Compression
PV1, PV4	Bio-Informatics
PV1, PV4	Pattern Recognition
PV1	Modeling and Simulation
PV4	Advanced Computer Architecture
PV4	Approximation Algorithms
PV4	Scientific Computing
PV1	Graph Signal Processing
PV1, PV4	Mathematics and Big Data
PV4	Vector Space Projection
PV4	Numerical Optimization
PV2, PV4	Introduction to Distributed and Parallel Computing (IT)
PV1, PV2	Machine Learning
PV1, PV2	Deep Learning
PV1, PV2	Reinforcement Learning
PV3	Introduction to Cryptography
PV3	Block Chain
PV3	Number Theory and Cryptography
PV3	Post Quantum Cryptography
PE4 (0-1-2:2)	
PV4	Parallel Programming Lab
PV4	VHDL Lab
PV1, PV2	Robotics Lab
PV4	HPC Lab

Appendix-II

List of Electives form other Branch of Engineering (EO1 and EO2)

Code	Course Name
	Digital Image Processing
	Deep Learning
	Information Theory Coding
	Cognitive Science
	Soft Computing
	Advanced Image processing
	Graph Theory
	Low power circuit Design
	Real-time System
	Nano-Science
	VLSI Design
	E-Commerce

Appendix-III

List of Open Electives (OE1 and OE2)

Code	Course Name
	Operation Research
	Network Flow Algorithms
	Professional Ethics
	Quantum Mechanics
	Quantum Models in Science and Engineering
	Introduction to Quantum Computation
	Game Theory
	Computational Physics

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MTech Thesis Evaluation Process

According to the approved curriculum and guidelines, the students of MTech (CSE) program have to undergo one-year Thesis mode or one-year Project mode in their second-year. Following is the proposed evaluation process for the MTech Thesis:

1. Semester – III (15 credits)
    a. Final grade shall be awarded based on 40% from In-sem evaluation and 60% from End-sem evaluation.
    b. The In-sem evaluation is comprised of 20% by the Thesis supervisor and co-supervisor (if any) based on work done by the student, and remaining 20% by the Internal committee including the supervisor/co-supervisor based on a short report (up to 4 pages) submitted by a student.
    c. The End-sem evaluation is comprised of 20% by the Thesis supervisor and co-supervisor (if any) based on work done by the student; 20% by the Internal committee based on the report (up to 8 pages); and 20% by the Internal committee including the supervisor/co-supervisor based on presentation by the student.

2. Semester – IV (15 credits)
    a. Final grade shall be awarded based on 40% from In-sem evaluation and 60% from End-sem evaluation.
    b. The In-sem evaluation is comprised of 20% by the Thesis supervisor and co-supervisor (if any) for work done by the student, and remaining 20% by the Internal committee including the supervisor/co-supervisor based on a short report (up to 12 pages) submitted by a student.
    c. The End-sem evaluation is comprised of 20% by the Thesis supervisor and co-supervisor (if any) based on work done by the student; 20% by the Internal committee including supervisor/co-supervisor for the final thesis report and presentation; and remaining 20% by an External expert for the final thesis report and presentation by the student.

Remarks:

- The supervisor is responsible to maintain all the necessary records about his/her student(s) during a semester and submitting the final grade(s) to the Academic Office.
- Formats of internal and final reports are to be communicated to the students.
- After successfully completing both Sem-III and Sem-IV, a student has to submit a hard-bounded copy of duly signed final thesis report to his/her Supervisor, to the Academic office, and to Institute Library. A student also needs to submit a soft copy (CD) of the final thesis report to Library.

THESIS REPORT

Entitled

⟨Title here⟩

MASTER OF TECHNOLOGY
in
Computer Science & Engineering

SUBMITTED BY
⟨Name of Student⟩
(Roll No. ⟨Student Id⟩)

GUIDED BY
⟨Name⟩ (Supervisor)
⟨Name⟩ (Co-supervisor)

INDIAN INSTITUTE OF INFORMATION TEHCNOLOGY
VADODARA

Indian Institute of Information Technology

Vadodara, Gujarat, India.

CERTIFICATE

This is to certify that ⟨Name of Student⟩, Roll no. ⟨ID⟩ of M.Tech. Computer Science Engineering has satisfactorily completed a Thesis on "⟨Title of Thesis⟩" during the year ⟨Academic year⟩.

Signature of Supervisor

⟨Name⟩

Signature of Co-supervisor

⟨Name⟩

Signature of PIC/Dean (Academics)

⟨Name⟩

Signature of HoD

⟨Name⟩

SEAL

Abstract

⟨Abstract here⟩

More Information:

Typesetting Information:

- Font size in text: 12 point (latex command-normalsize) - normal
- Font size in titles: 14 point (latex command-large) - bold typeface
- Font size in subtitles: 12 point (latex command-normalsize) - bold typeface

Acknowledgments

⟨Acknowledgements here⟩

Contents

List of Figures

List of Tables

Chapter 1

Problem Definition

⟨Problem Definition here⟩

Chapter 2

Introduction

2.1 Background and Recent Research

2.1.1 ⟨any sub section here⟩

2.1.2 Literature Survey

some text[1], some more text

2.2 Motivation

Chapter 3

Work Done

3.1 ⟨ Section title⟩

3.1.1 ⟨ Sub-section title⟩

some text[2], some more text

3.1.2 ⟨ Sub-section title⟩

Refer figure 3.1.

Figure 3.1: ⟨Caption here⟩

3.2 ⟨ Section title⟩

Chapter 4

Future Work

⟨Future work here⟩

Chapter 5

Conclusion

⟨Conclusion here⟩

Appendices

Appendix A

Some Appendix

The contents...

Appendix B

Some Appendix

The contents...

References

[1] ⟨Name of the reference here⟩, ⟨url here⟩

[2] ⟨Name of the reference here⟩, ⟨url here⟩

Publications

[1] ⟨Name of the reference here⟩, ⟨url here⟩

[2] ⟨Name of the reference here⟩, ⟨url here⟩

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Date: April 24, 2019.

Additional Guidelines for PhD Comprehensive Examination

The guidelines for PhD comprehensive examination is approved on 01/10/2018 (Appendix-1). It contains two components, i.e., written examination followed by seminar presentation.

Additional guidelines are recommended for PhD students from engineering discipline:

1. The courses along with content will be recommended by the comprehensive examination committee from following: i) all core courses from curriculum of M.Tech. program, ii) all elective courses from curriculum of M.Tech. program, iii) specialized courses included in the list of courses for comprehensive examination approved by the Director, and iv) the courses read/registered by the candidate as a regular student. A list of courses are attached in Appendix-2.
2. Typically a written exam is composed of essential courses from mathematics and statistics as well as the fundamental courses related to the research area of a student.
    a. The weightage of each component of a written exam should be uniform. In case of deviation ~~from the prescribed,~~ approval of the Director is ~~a must~~. to be taken.
    b. Question paper should have scope for options/choice in terms of questions.
    c. There should be a common question paper for students appearing for the same subject for comprehensive examination.

It is further recommended that,

3. The seminar presentation can be scheduled within the semester after the successful completion of the written examination.

[HoD - IT] [HoD – ~~HSS~~ Sciences & Humanities] [HoD - CSE] [PIC-Research Studies]

✓ Approved/ ~~Not approved~~/ Remarks

24/4/2019

Director

To be put up to senate for approval

24/4/2019

Annexure-1

Indian Institute of Information Technology Vadodara

Bldg No. 9, IIITV, Government Engineering College, Sector 28,
Gandhinagar, Gujarat, India - Contact No. +91-79-29750281

1st October 2018

Guidelines for PhD Comprehensive Examination

1. The Comprehensive Examination will be held two times in a year, in the month of March and October (once in each semester – Autumn and Winter) in every academic year, two times in a calendar year. The Comprehensive Examination comprises of two parts – written test and the seminar. The written test should be held on the first Monday of March and first Monday of October every year (or the next working day, if the Monday is a holiday). The seminar and the report submission process should be completed within 20 days of the written test. This will be incorporated in the academic calendar.
2. PhD students who fail to appear in the Comprehensive Examination due to certain compelling circumstance can be permitted to appear in a special exam on recommendation of the Senate.
3. The minimum qualifying grade for Comprehensive Examination is CC (6 grade point on a 10 point scale). The minimum passing percentage in each of the components of the Comprehensive Examination (written test and seminar) is 50%.
4. Candidates securing CD grade or grade below that in Comprehensive Examination will not be eligible to register for research credits and the TA/RA will be stopped until he/she clears the Comprehensive Examination in the following semester.
5. Students receiving scholarship or assistantship from sources outside institute funding (for e.g. UGC, projects etc.) will continue to receive assistantship.
6. Ph.D. students have to complete their Comprehensive Examination before the start of the 5th semester registration process failing which the studentship will be terminated.

Bhargat 1/10/2018

1/10/2018

01.10.18

01.10.2018

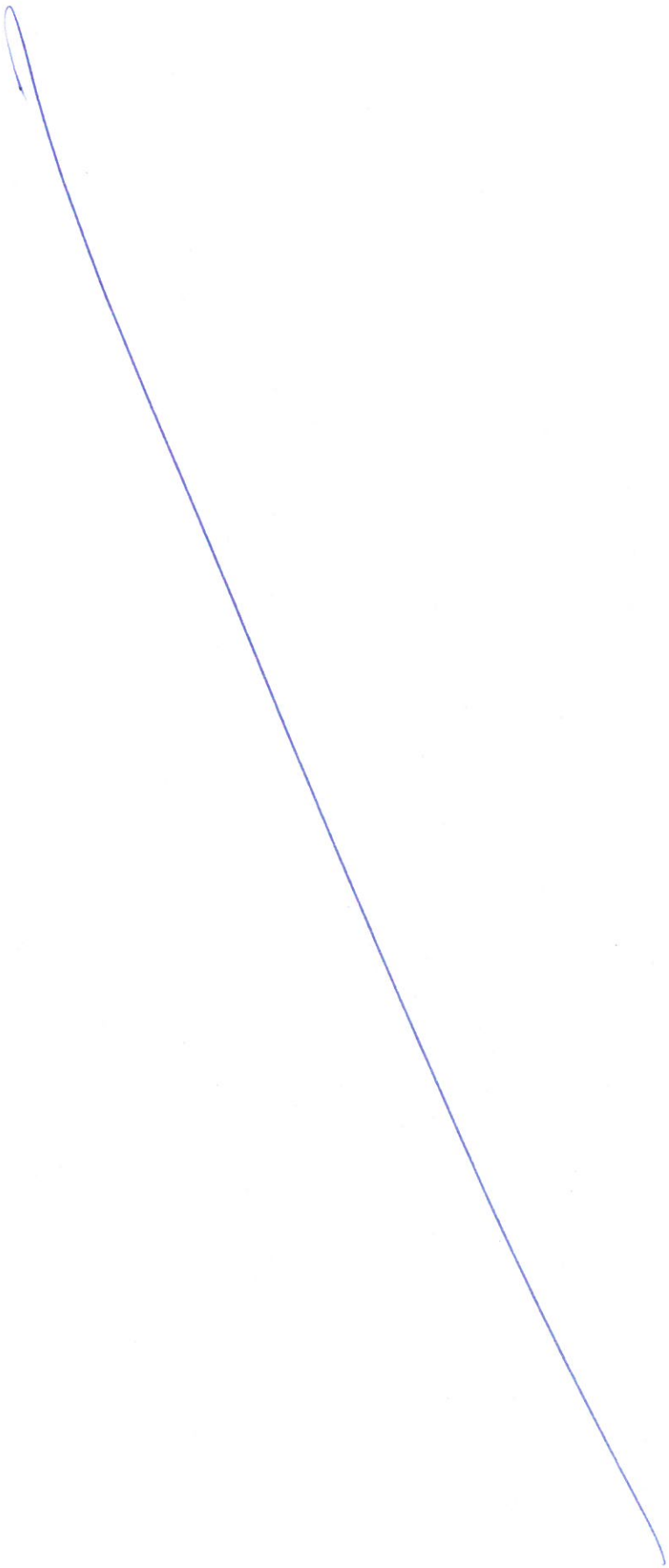
Approved

01/10/2018

Appendix-2

List of courses for written examination part in PhD comprehensive examination for engineering:

1. Operating Systems
2. Advanced Computer Architecture
3. Design and Analysis of Algorithms
4. Essential Mathematics
5. Linear Algebra
6. Numerical Linear Algebra
7. Optimization Techniques
8. Probability and Statistics
9. Probability, Random variables, and Random Processes
10. Statistical Communication Theory
11. Digital Image Processing
12. Systems and Signal Theory
13. Discrete Mathematics
14. Digital Signal Processing
15. Graph Signal Processing
16. Machine learning
17. Deep learning
18. Modeling and Simulation
19. Topics in Information Retrieval
20. Information Security
21. Number Theory
22. Lattices and Codes
23. Cryptography
24. Information Theory
25. Commutative Algebra
26. Graph Theory
27. Computer Vision
28. Distributed Algorithms
29. Cloud Security



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Indian Institute of Information Technology Vadodara

Block No. 9, Government Engineering College, Sector 28,
Gandhinagar, Gujarat, India - Contact No. 079- 2397 7511

ENDOWMENT FUND POLICY

1. **Endowment:** Endowment is the stable and sustainable source of Scholarship. Endowment are important resource devoted by various individuals and groups to the Institute's future. They contribute the flow of funds essential to promote educational research, stimulate innovation, and to strengthen academic programs at University. Endowments at IIIT Vadodara are funds established by a Donor whereby only the interest is used for the specified purpose of the fund. The Principal amount of the gift remains intact & is invested for the long-term growth. **50%** of the interest from fund is used for supporting scholarships and other activities and the remaining **50%** is requested for taking care of inflation and are use under special circumstances.

2. **Purpose:** IIIT Vadodara established by Ministry of Human Resource Department, Government of India under PPP model in the year 2013. In order to provide financial assistance to the students, building specialized infrastructure and other value added service, IIIT Vadodara seeks the support of institutions, individuals, alumni in developing an **Endowed Merit cum Means Scholarship Fund** that can provide financial assistance to students in form of Scholarships. These scholarships instill motivation and enthusiasm amongst the students to excel in their academic endevour and also provide financial assistance to meritorious and needy students.

3. **Endowed Merit cum Means Scholarship Fund:**

In order to recognize academically outstanding needy students, the endowed merit cum means scholarship fund is an initiative of IIIT Vadodara for providing financial assistance to IIIT Vadodara students who have limited means. This fund is setup to aid deserving students attain their educational objective through student scholarships to meet their professional objective. IIIT Vadodara seeks unrestricted contribution from its alumni, well-wisher & faculty/former faculty, institutions/ organizations & foundations to support the progress of its students. These scholarships are paid to the student recipients once in a academic year. Calculation based on 10 months expenses or make it quarterly payment subject to fulfill criteria.

4. **Types of Donations**. A Donor can also choose to contribute in the any of following initiative of IIIT Vadodara:-

(a) **Unrestricted Use**. The funds will be used by the institute as per institute requirement as decided by the management.
(b) **Infrastructure Development**. Funds to be used for various infrastructure establishment and improvements at the IIIT Vadodara Campus.
(c) **Research Support.** For encouraging research at institute. Following are some of suggested heads:-

(i) A research project for specific problem related to research
(ii) Establishment of center of excellence in specific subject.
(iii) Establishment of specialized laboratory.

(d) **Faculty and Staff Development**. For activities related to development of faculty and staff. Expenditure will not be asked for which other heads exists, like salaries etc.

(e) **Overseas travel**. For overseas travel of faculty, staff and students for the following purposes:-

(i) Faculty and Staff for training at University/ Organization of repute or attachment to laboratory.
(ii) Students for internship attachment for joint research.

(f) Fund for Financially Needy Students

(g) Students affairs

5. **Types of Donors:**

(a) **Individual Donors:** Individual Donors refers to any individual person who is willing to donate. Individual Donor can donate towards **Endowed Merit cum Means Scholarship Fund** or any specific cause. Tax benefit 80G certificate is provided to all donors allowing of tax exemption to 50% of donated amount.

(b) **Batch Donors:** A group of people like: alumni from a particular batch can become donors. Any group can choose to give an unrestricted donation for the **Endowed Merit cum Means Scholarship Fund**.

(i) For every particular group, an authorized member is nominated as the representative.
(ii) An MoU will be signed between IIIT Vadodara and a particular group.
(iii) The utilization of interest amount for various defined activities shall be finalized by Contributor's representative.
(iv) The Director is authorized to take decisions on behalf of IIIT Vadodara.
(v) A separate head in the books of accounts of IIIT Vadodara will be created for each fund.
(vi) The account shall be jointly operated as decided by the Board of Governors.
(vii) Tax Benefit – 80G certificate is provided to all donors allowing 50% tax exemption.

(c) **Institutional Donors:** Institutional Donors refer to organizations willing to donate fund to IIIT Vadodara towards Endowed Merit cum Means Scholarship Fund or any specific cause.

6. **Criteria/Rules for Endowed Merit cum Means Scholarship Scheme:** The criteria/ rules can be framed from time to time to meet the requirements. They should generally be continued on a semester-wise basis for a maximum of eight semesters (normal duration of the program) provided that the student satisfies the conditions, such as:

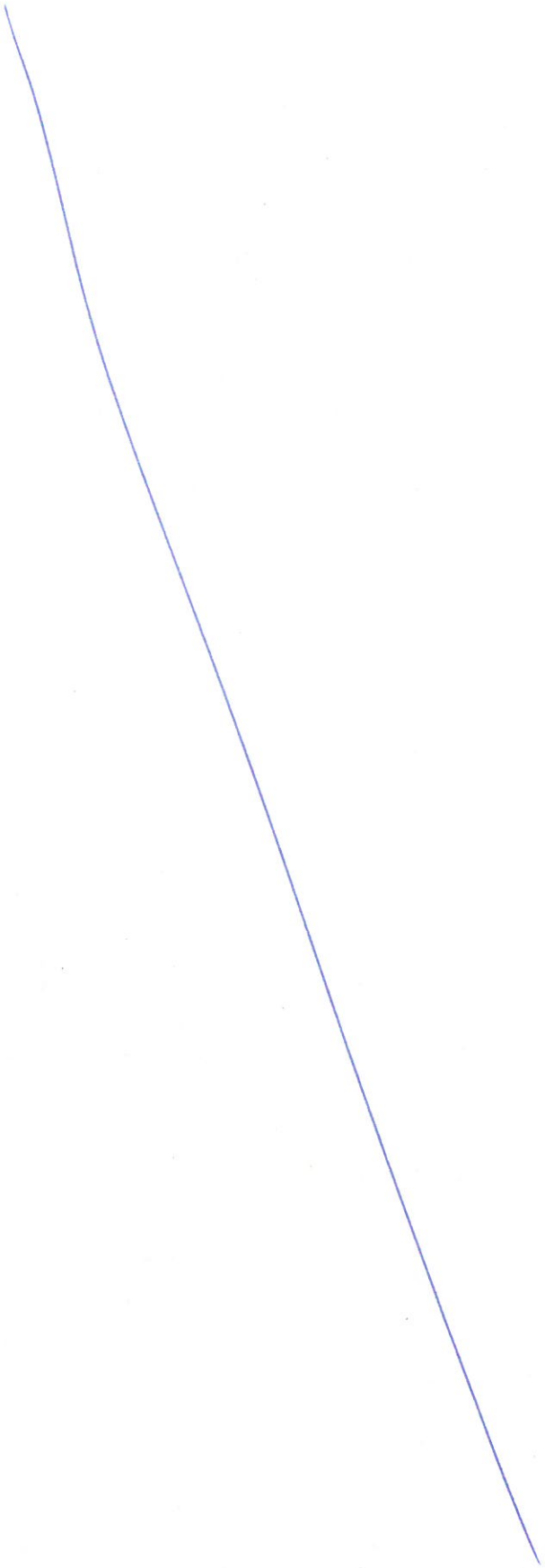
(a) Means Test.
(b) Minimum academic performance.
(c) Pass in all Courses.

(d) Duration of Study.
(e) Probation or Disciplinary Action.
(f) Special conditions, if any.

7. Procedure for awarding scholarship:
As soon as the donation and details for instituting a scholarship are received in the Institute, the proposal is sent to the following committee for approval of the scholarship:-

(a)	Director	-	Chairman
(b)	Registrar	-	Member
(c)	PIC Academic	-	Member
(d)	Female Faculty/ Female Officer	-	Member

8. These Scholarship can be given to students subject to availability of funds. Thus, cannot be claimed as an entitlements.



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सत्यमेव जयते

F No: 12-4/2019-U1
Government of India
Ministry of Human Resource Development
Department of Higher Education
*****

Shastri Bhawan, New Delhi
Dated: 17th January, 2019

OFFICE MEMORANDUM

Subject: Reservation for Economically Weaker Sections (EWSs) for admission in Central Educational Institutions.

In accordance with the provisions of the Constitution (One Hundred and Third Amendment) Act 2019, and the reference of Ministry of Social Justice and Empowerment vide OM No. 20013/01/2018-BC-II dated 17th January 2019, enabling provision of reservation for the Economically Weaker Sections (EWSs) who are not covered under the existing scheme of reservations for the Scheduled Castes, the Scheduled Tribes and the Socially and Educationally Backward Classes, it has been decided to provide reservation in admission to educational institutions subject to a maximum of ten per cent of the total seats in each category. This would not apply to the minority educational institutions referred to in clause (1) of Article 30 of the Constitution of India.

2. The provision of reservations to the Economically Weaker Sections shall be in accordance with the directions contained in the OM No. 20013/01/2018-BC-II dated 17th January 2019 of the Ministry of Social Justice & Empowerment and shall be subject to the following:

a) The reservations shall be provided to EWSs for admission in Central Educational Institutions, (as defined in clause (d) of section (2) of The Central Educational Institutions (Reservation in Admission) Act, 2006) from the academic year 2019-20 onwards.
b) The above reservation would not be applicable to the 8 institutions of excellence, research institutions, institutions of national & strategic importance as specified in the Schedule to The Central Educational Institutions (Reservation in Admission) Act, 2006, as amended from time to time, and appended to this OM, and to the minority educational institutions referred to in clause (1) of article 30 of the Constitution.
c) Every Central Educational Institution shall, with the prior approval of the appropriate authority (as defined in clause (c) of section 2 of The Central Educational Institutions (Reservation in Admission) Act, 2006), increase the number of seats over and above its annual permitted strength in each branch of

17/1/19

study or faculty so that the number of seats available, excluding those reserved for the persons belonging to the EWSs, is not less than the number of such seats available, in each category, for the academic session immediately preceding the date of the coming into force of this O.M.

d) Where, on a representation by any Central Educational Institution, the appropriate authority is satisfied that for reasons of financial, physical or academic limitations or in order to maintain the standards of education, the annual permitted strength in any branch of study or faculty of such institution cannot be increased for the academic session following the commencement of this Act, it may permit such institution to increase the annual permitted strength over a maximum period of two years beginning with the academic session following the commencement of this Act; and then, the extent of reservation for the Economically Weaker Sections shall be limited for that academic session in such manner that the number of seats made available to the Economically Weaker Sections for each academic session shall not reduce the number and the percentage of reservations provided for SC/ST/OBC categories.

e) The scheme for implementing the reservation for the EWS shall be displayed on the website of the institution as soon as possible, but no later than 31st March 2019.

3. The Chairman UGC, Chairman AICTE and Chairperson NCTE and the Bureau Heads of the Department of Higher Education in the Ministry of Human Resource Development responsible for management of the Institutions of National Importance are requested to ensure immediate compliance of this OM.

4. This issues with the approval of the Minister for Human Resource Development.

Encl: As above

12/1/19

(Smita Srivastava)
Director

1. **Chairman UGC**
2. **Chairman AICTE**
3. **Chairperson NCTE**
4. **All Bureau Heads of Department of Higher Education**

Copy to:

Chief Secretaries of all State Governments/UTs: with a request to give effect to the provisions of the Constitution (One Hundred and Third Amendment) Act, 2019 for all higher educational institutions funded/aided, directly or indirectly, by the State Government in such manner that the provision for reservation for EWS would become operational from the academic year 2019-20.

Appendix

SCHEDULE

(The Central Educational Institutions (Reservation in Admission) Act, 2006)

S.No.	Names of the Institutions of Excellence, etc.
1.	Homi Bhabha National Institute, Mumbai and its constituent units, namely:-
	(i) Bhabha Atomic Research Centre, Trombay;
	(ii) Indira Gandhi Centre for Atomic Research, Kalpakkam;
	(iii) Raja Ramanna Centre for Advanced Technology, Indore;
	(iv) Institute for Plasma Research, Gandhinagar;
	(v) Variable Energy Cyclotron Centre, Kolkata;
	(vi) Saha Institute of Nuclear Physics, Kolkata;
	(vii) Institute of Physics, Bhubaneshwar;
	(viii) Institute of Mathematical Sciences, Chennai;
	(ix) Harish-Chandra Research Institute, Allahabad;
	(x) Tata Memorial Centre, Mumbai.
2.	Tata Institute of Fundamental Research, Mumbai.
3.	North-Eastern Indira Gandhi Regional Institute of Health and Medical Science, Shillong.
4.	National Brain Research Centre, Manesar, Gurgaon.
5.	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.
6.	Physical Research Laboratory, Ahmedabad.
7.	Space Physics Laboratory, Thiruvananthapuram.
8.	Indian Institute of Remote Sensing, Dehradun.