MINUTES

OF

THE ACADEMIC COUNCIL (SENATE) MEETING

HELD ON

10TH APRIL, 2019

भारतीय सुचना प्रौद्योगिकी संस्थान सेनापति, मणिपुर

Indian Institute of Information Technology Senapati, Manipur

The Minutes of the 1st Meeting of the Academic Council (Senate) Of IIIT Senapati, Manipur Held On 10th April, 2019

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Ref. No.:- IIITM/1_Senate_Minutes/2019

Date: 11/04/2019

Minutes of the 1st meeting of Academic Council (Senate) held on 10th April, 2019 at 10 AM in the conference Hall of Administrative block, IIIT Senapati, Manipur.

The following were present:

SN	NAME OF THE MEMBERS	DESIGNATION
1	Prof. Amarendra Kumar Das	Director/ Chairman
2	Prof. P K Das	Professor, CSE Department, IIT Guwahati, External Member
3	Prof. H B Nemade	Professor, ECE Department, IIT Guwahati, External Member
4	Prof. A Srinivasan	Professor, Physics Department, IIT Guwahati, External Member
5	Prof. B K Sharma (On Skype)	Professor, Mathematics Department, IIT Guwahati, External Member
6	Dr Bhargab Deka	In-charge, Academic Section, HBS Department, IIIT Senapati Manipur
7	Dr L. Sarbajit Singh	In-charge, Students' Affairs, HBS Department, IIIT Senapati Manipur
8	Dr Nagesh Ch.	HOD ECE Department, IIIT Senapati Manipur
9	Dr N. Kishorjit Singh	HOD CSE Department, IIIT Senapati Manipur
10	Dr Kishor Kumar Das	HOD HBS Department, IIIT Senapati Manipur
11	Dr Subasit Borah	In-charge, Administration, ECE Department, IIIT Senapati Manipur (Invitee)
12	Dr Kabita Th.	In-charge, Library, CSE Department, IIIT Senapati Manipur (Invitee)
13	Dr Gaurav Saxena	In-charge, Research and Development, ECE Department, IIIT Senapati Manipur (Invitee)
14	Dr Navanath Saharia	In-charge, Training and Placement, CSE Department, IIIT Senapati Manipur (Invitee)
15	Dr R. C. Mishra	Coordinator, TEQIP III, ECE Department, IIIT Senapati Manipur (Invitee)
16	Dr Sanjib Choudhury	Nodal Officer, Procurement, TEQIP III, HBS Department, IIIT Senapati Manipur (Invitee)
17	Dr Murli Manohar	Asst. Professor, ECE Department, IIIT Senapati Manipur (Invitee)
18	Dr Prerna Mohit	Asst. Professor, CSE Department, IIIT Senapati Manipur (Invitee)
19	Mr. Himangshu Sarma	Technical Officer, CSE, IIIT Senapati Manipur (Invitee)
20	Mr. U C Das	Ex Interim Registrar, IIIT Senapati Manipur (Invitee)
21	Mr. Dibya Jyoti Goswami	Interim Registrar, IIIT Senapati Manipur (Secretary)

Prof. Amarendra Kumar Das, the Chairman, Senate, extended heartiest welcome to all the external members for sparing their valuable time to attend the meeting. The chairman introduced all the external members to the institute's faculty members. There after chairman handed over the proceedings to Dr Bhargab Deka, In-charge Academic Section.

In the introduction, Dr Bhargab Deka briefed regarding existing infrastructure and facilities of the institute. After that the meeting started as per the agenda items. The items were presented by Dr Bhargab Deka for deliberation.

Item No. 1: Course Structure for the B. Tech Programmes in CSE and ECE

The Senate noted that the four year B. Tech Programmes were started in Computer Science and Engineering (CSE) and in Electronics and Communication Engineering (ECE) in July 2015 with approved strength of 30 students in each branch for the first year. Students were admitted through the All India JEE (Main) examination conducted by the CBSE. (Initially 35 students took admission. However as provisions provided per CSAB rule, 11 students left to join other institutes.) The B.Tech. Course structure for IIIT Senapati, Manipur was adopted from IIIT Guwahati with the approval from the 2nd Governing Body Meeting of IIIT Senapati for the batches starting from 2015 onwards

The Senate noted the following adjustments made in the course structure adopted from IIIT Guwahati:

1.1 The third Semester HSS course HS201 (Introduction to Linguistics) was interchanged with Second Semester course HS102 (Economics) in accordance with the expertise of the existing faculty member of the Institute at that time.

1.2 The ECE department's eighth semester course EC472 (Microwave system Design) was adopted from IIIT Guwahati's revised syllabus in accordance with the expertise of the existing faculty members of the Institute.

1.3 The total credit allocated for 8^{th} semester B. Tech students was 42 for ECE and 42 for CSE and it was found that the same is exceeding in comparison of that offered by IIIT Guwahati in its revised course structure which is 36 for both CSE and ECE. Total 104/98 credits were already covered till 7^{th} semester in the HBS courses as per the existing Syllabus; therefore, SC201 (Physics II) and HS40X (HSS Elective) were dropped from the 8th Semester B. Tech course and the credit for Project (CS410 for CSE and EC401 for ECE) is enhanced to 18 from the existing credit 12 of both the ECE and CSE departments to make more rooms for the project work and GATE preparation as prescribed by MHRD.

Resolution 1: The Senate resolved to approve the course structure for the B. Tech programmes as given in Annexure 1 that were used in the first eight semesters from 2015 to 2019.

Item No. 2: Syllabi for the Courses of the B. Tech Programme in CSE and ECE

The Senate examined the syllabi of the courses of the B. Tech Programmes in CSE and ECE for the course duration from 2015 to 2019.

Resolution 2: The Senate resolved to approve the present revised syllabi of all the courses of the B. Tech Programmes in CSE and ECE for the current session (2015 to 2019) as given in the Annexure 2.

The Senate suggested for reviewing the existing syllabi with reference to the recent syllabi of other Institutes like IITs/IIITs. It is suggested to put up the revised syllabi for approval in the next Academic Council Meeting. The changes will be effective as and when approved by the Senate.

Item No. 3: Ordinances

a) Academic rules for B. Tech programme

b) Hostel Constitution

c) Students' Affairs Council

The Senate examined the above rules and ordinances of the B. Tech Programmes.

Resolution 3: The Senate resolved to approve the ordinances of the B. Tech programme as given in the Annexure 3.

Item No. 4: Academic performance of the students

The Senate noted the academic performance of the students and it has become important to monitor their progress on a regular basis and to counsel them on their academic and other matters. The Senate suggested strengthening the students' placement mechanism with the help of IIT Guwahati, the mentor institute.

Resolution 4: The Senate recommended that the students of IIIT Senapati, Manipur can be facilitated for placement through IIT Guwahati if needed.

Item No. 5: Process for awarding degree for the final year Batch 2015-19

The Senate noted that the first batch of IIIT Senapati, Manipur is graduating in the year 2019. The format of the B. Tech. Grade Card and Degree certificate are presented.

Resolution 5: The Senate resolved to approve the formats related to the award of degree with the minor typo graphical corrections.

Item No. 6: Course structure, Rules and Regulations of PhD programme in all disciplines

The Senate noted that the PhD programme in IIIT Senapati, Manipur was initiated in winter semester 2018. The Ordinances for the PhD programme and adopted course structure were presented.

Resolution 6: The Senate resolved to approve the PhD Ordinance and course structure attached in Annexure 4 and Annexure 5**.**

Item No. 7: Academic Calendar for the year 2019

The Senate approved the proposed academic calendar. The Senate advised that the calendar may be revised later on as and when required.

Resolution 7: The Senate examined and approved the Academic Calendar for year 2019 as given in Annexure 6.

Item No. 8: Credit Transfer through SWAYAM Course

The Senate noted, as per AICTE mandate, Institute is required to offer few courses for students through SWAYAM. Hence, flexibility of opting UG and PhD courses through SWAYAM can be considered as a part of academic curriculum. Department can list the number of courses as per the requirement. For 6/8 credit course, the course duration should not be less than 12 weeks.

Resolution 8: The Senate suggested restricting the SWAYAM courses only to the student's higher semesters and PhD students.

The meeting ended after thanking the Chair.

Bhargab Deka

(Dr Bhargab Deka)
In-Charge, Academic Section

Approved

(Prof. Amarendra Kumar Das)
Chairman, Senate

ANNEXURE-1

Indian Institute of Information Technology Senapati, Manipur

B.Tech Course Structure

1. Computer Science and Engineering (CSE)

i. 1st Semester

Sem.	Course Code	Course Name	L	T	P	C
I	MA101	Mathematics I	3	1	0	8
I	CS101	Computer Programming	3	1	0	8
I	CS110	Computer Programming Lab	0	0	3	3
I	EC101	Digital Design	3	1	0	8
I	EC110	Digital Design Lab	0	0	3	3
I	EC102	Electrical Circuit Analysis	3	1	0	8
I	CS102	IT Workshop I	2	0	3	7
I	HS101	English (Pass / Not Pass)	2	0	0	4

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	18	19	8	4

ii. 2nd Semester

Sem.	Course code	Course Name	L	T	P	C
ii	MA102	Mathematics II	3	1	0	8
ii	CS103	Data Structures	3	1	0	8
ii	CS111	Data Structures Lab	0	0	3	3
ii	CS104	Computer Organization	3	1	0	8
ii	EC103	Basic Electronic Circuits	3	1	0	8
ii	EC111	Basic Electronics Lab	0	0	3	3
ii	HS2xx	HSS Elective I	3	0	0	6
		Total	15	4	6	44
		Contact Hours / Week	25			

HSS Elective I:					
Course code	Course Name	L	T	P	C
HS201	Introduction to Linguistics	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	19	11	8	6

iii. 3rd Semester

Sem	Course Code	Course Name	L	T	P	C
iii	MA203	Mathematics III	3	0	0	6
iii	MA205	Discrete Mathematics	3	0	0	6
iii	CS201	Algorithms	3	0	0	6
iii	CS251	IT Workshop II	2	0	3	7
iii	CS231	Operating Systems	3	0	0	6
iii	CS232	Operating Systems Lab	0	0	4	4
iii	SC201	Physics I	3	0	0	6
iii	HS102	Economics	3	0	0	6
		Total	20	0	7	47
		Contact Hours / Week				27

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	23	0	18	6

iv. 4th Semester

Sem	Course code	Course Name	L	T	P	C
iv	CS210	Formal Languages and Automata	3	0	0	6
iv	CS240	Database Management Systems	3	0	0	6
iv	CS241	DBMS Lab	0	0	4	4
iv	CS252	Computer Networks	3	0	0	6
iv	CS253	Computer Networks Lab	0	0	4	4
iv	CS200	Project-I	0	0	6	6
iv	SC202	Chemistry	3	0	0	6
iv	HS 2xx	HSS Elective II	3	0	0	6
		Total	15	0	14	44
Contact Hours / Week			29			

HSS Elective II:					
Course code	Course Name	L	T	P	C
HS202	Language and Society	3	0	0	6
HS203	Science Fiction	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	32	0	6	6

v. 5th Semester

Sem	Number	Course Name	L	T	P	C
V	CS301	Theory of Computation	3	0	0	6
V	CS320	Compilers	3	1	0	8
V	CS321	Compilers Lab	0	0	3	3
V	CS302	Data Communication	3	0	0	6
V	CS303	Distributed Systems	3	0	0	6
V	CS351	IT Workshop III: Cloud Computing	1	0	3	5
V	SC301	Biology	3	0	0	6
V	HS3xx	HSS Elective III	3	0	0	6
		Total	19	1	6	46
		Contact Hours / Week				26

HSS Elective III:					
Course code	Course Name	L	T	P	C
HS301	Macroeconomic Problems and Policies	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	34	0	6	6

vi. 6th Semester

Sem	Course code	Course Name	L	T	P	C
VI	MA305	Optimization Techniques	3	0	0	6
VI	CS330	Software Engineering	3	0	0	6
VI	CS331	Software Engineering Lab	0	0	3	3
VI	CS340	Computer Graphics	3	0	0	6
VI	CS341	Computer Graphics Lab	0	0	3	3
VI	CS306	Machine Learning	3	0	0	6
VI	CS36X	Elective I	3	0	0	6
VI	CS300	Project II (Optional)	0	0	6	6
VI	HS 3xx	HSS Elective IV	3	0	0	6
		Total	18	0	12/6	48/42
		Contact Hours / Week	30/24			

Elective I:					
Course code	Course Name	L	T	P	C
CS 361	Computer and Network Security	3	0	0	6
CS362	Topics in Algorithms	3	0	0	6

HSS Elective IV:					
Course code	Course Name	L	T	P	C
HS 302	Language, Cognition and Culture	3	0	0	6
HS303	Indian Writing in English	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	30/36	0	6	6

vii. 7th Semester

Sem	Course Code	Course Name	L	T	P	C
VII	CS450	Internet Protocols	3	0	0	6
VII	XXxxx	Open Elective	3	0	0	6
VII	CS4xx	Elective II	3	0	0	6
VII	CS4xx	Elective III	3	0	0	6
VII	CS400	Project III	0	0	12	12
VII	HSxxx	HSS Elective V	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week				27

Open Elective					
Number	Course Name	L	T	P	C
CS401	Number Theory in Cryptography	3	0	0	6

Departmental Electives					
Number	Course Name	L	T	P	C
CS402	Advanced graph algorithms	3	0	0	6
CS430	Parallel Programming	3	0	0	6
CS440	Image and Video Processing	3	0	0	6

HSS Elective V:					
Course code	Course Name	L	T	P	C
HS 401	Consumer Behaviour and Welfare Economics	3	0	0	6
HS402	Understanding Democracy and Governance in India	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	36	0	0	6

viii. 8th Semester

Sem	Course Code	Course Name	L	T	P	C
VIII	CSxxx	Elective IV	3	0	0	6
VIII	CSxxx	Elective V	3	0	0	6
VIII	CSxxx	Elective VI	3	0	0	6
VIII	CS410	Project IV	0	0	18	18
		Total	9	0	18	36

		Contact Hours / Week	27

Electives					
Number	Course Name	L	T	P	C
CS412	Game Theory	3	0	0	6
CS414	Advance Architecture	3	0	0	6
CS415	Ubiquitous Computing	3	0	0	6
CS460	Financial Engineering	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	36	0	0	6

Total Distribution for all the semesters:

Total Credit: 350/356

Course	CSE	ECE	Basic Sciences	Humanities
Credit	228/234	30	52	40
Percentage (%)	65/66	9/8	15	11

Indian Institute of Information Technology Senapati, Manipur

B.Tech Course Structure

2. Electronics and Communication Engineering (ECE)

i. 1st Semester

Sem.	Course Code	Course Name	L	T	P	C
I	MA101	Mathematics I	3	1	0	8
I	CS101	Computer Programming	3	1	0	8
I	CS110	Computer Programming Lab	0	0	3	3
I	EC101	Digital Design	3	1	0	8
I	EC110	Digital Design Lab	0	0	3	3
I	EC102	Electrical Circuit Analysis	3	1	0	8
I	CS102	IT Workshop I	2	0	3	7
I	HS101	English (Pass / Not Pass)	2	0	0	4
		Total	16	4	9	49

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	18	19	8	4

ii. 2nd Semester

Sem	Course code	Course Name	L	T	P	C
ii	MA102	Mathematics II	3	1	0	8
ii	CS103	Data Structures	3	1	0	8
ii	CS111	Data Structures Lab	0	0	3	3
ii	CS104	Computer Organization	3	1	0	8
ii	EC103	Basic Electronic Circuits	3	1	0	8
ii	EC111	Basic Electronics Lab	0	0	3	3
ii	HS2xx	HSS Elective I	3	0	0	6
Total			15	4	6	44
Contact Hours / Week			25			

HSS Elective I:					
Course code	Course Name	L	T	P	C
HS201	Introduction to Linguistics	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	19	11	8	6

iii. 3rd Semester

Sem	Course Code	Course Name	L	T	P	C
III	MA203	Mathematics III	3	0	0	6
III	EC201	Analog Circuits	3	1	0	8
III	EC202	Analog Circuits Lab	0	0	3	3
III	EC241	Signals and Systems	3	0	0	6
III	EC242	Signals and Systems Lab	0	0	3	3

III	CS231	Operating Systems	3	0	0	6
III	CS232	Operating Systems lab	0	0	4	4
III	SC201	Physics I	3	0	0	6
III	HS102	Economics	3	0	0	6
		Total	18	1	10	48
		Contact Hours / Week	29			

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	10	20	12	6

iv. 4th Semester

Sem	Course code	Course Name	L	T	P	C
IV	MA204	Mathematics IV	3	0	0	6
IV	EC251	Principles of Communication	3	1	0	8
IV	EC252	Communications Lab	0	0	3	3
IV	EC243	Digital Signal Processing	3	0	0	6
IV	EC244	Digital Signal Processing Lab	0	0	3	3
IV	EC260	Semiconductor Devices	3	0	0	6
IV	SC202	Chemistry	3	0	0	6
IV	HS2xx	HSS Elective II	3	0	0	6
		Total	18	1	6	44
		Contact Hours / Week				25

HSS Elective II:					
Course code	Course Name	L	T	P	C
HS202	Language and Society	3	0	0	6
HS203	Science Fiction	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	0	26	12	6

v. 5th Semester

Sem	Number	Course Name	L	T	P	C
V	EC351	Digital Communication	3	1	0	8
V	EC352	Digital Communication Lab	0	0	3	3
V	EC301	Analog Integrated Circuits	3	0	0	6
V	EC302	Analog Integrated Circuit Lab	0	0	3	3
V	EC370	Electromagnetics	3	1	0	8
V	EC380	Control Systems	3	1	0	8
V	SC301	Biology	3	0	0	6
V	HS3xx	HSS Elective III	3	0	0	6
		Total	18	3	6	48
		Contact Hours / Week				27

					HSS Elective:
Course code	Course Name	L	T	P	C
HS301	Macroeconomic Problems and Policies	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	0	36	6	6

vi. 6th Semester

Sem	Course code	Course Name	L	T	P	C
VI	EC353	Information Theory and Coding	3	0	0	6
VI	EC361	VLSI Design	3	0	0	6
VI	EC362	VLSI Design Lab	0	0	3	3
VI	EC371	Microwave Engineering	3	0	0	6
VI	EC372	Microwave Engineering Lab	0	0	3	3
VI	EC381	Embedded Systems	3	0	0	6
VI	EC382	Embedded Systems Lab	0	0	3	3
VI	EC354	Communication Networks	3	0	0	6
VI	HS3xx	HSS Elective IV	3	0	0	6
VI	EC300	Project (optional)	0	0	3	6
		Total	18	0	15/9	51/45
		Contact Hours / Week				33/27

HSS Elective IV:					
Course code	Course Name	L	T	P	C
HS 302	Language, Cognition and Culture	3	0	0	6
HS303	Indian Writing in English	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	0	39	0	6

vii. 7th Semester

Sem	Number	Course Name	L	T	P	C
VII	EC451	Mobile Communication	3	0	0	6
VII	EC481	Measurement and Instrumentation	3	0	0	6
VII	ECxxx	Elective I	3	0	0	6
VII	EC400	Project I	0	0	12	12
VII	XXxxx	Open Elective	3	0	0	6
VII	HS4xx	HSS Elective V	3	0	0	6
		Total	15	0	12	42
		Contact Hours / Week				27

Open Elective					
Number	Course Name	L	T	P	C
EC455	Wireless Sensor Networks	3	0	0	6
EC441	Image Processing	3	0	0	6

Departmental Electives					
Number	Course Name	L	T	P	C
EC461	VLSI Technology	3	0	0	6
EC454	Communication Systems	3	0	0	6

HSS Elective V:					
Course code	Course Name	L	T	P	C
HS 401	Consumer Behaviour and Welfare Economics	3	0	0	6
HS402	Understanding Democracy and Governance in India	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	0	36	0	6

viii. 8th Semester

Sem	Course code	Course Name	L	T	P	C
VIII	EC401	Project II	0	0	18	18
VIII	EC4xx	Elective II	3	0	0	6
VIII	EC4xx	Elective III	3	0	0	6
VIII	EC4xx	Elective IV	3	0	0	6
		Total	9	0	18	36
		Contact Hours / Week				27

Departmental Electives					
Number	Course Name	L	T	P	C
EC452	Detection and Estimation Theory	3	0	0	6
EC471	Antenna and Wave Propagation	3	0	0	6
EC472	Microwave system Design	3	0	0	6
EC480	Digital Control Systems	3	0	0	6

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	0	36	0	0

Total Distribution for all the semesters:

Total Credit: 356/362

Course	CSE	ECE	Basic Sciences	Humanities
Total Credit	47	223/229	46	40
Percentage (%)	13	63	13	11

ANNEXURE-2

Indian Institute of Information Technology Senapati, Manipur

B.Tech. Course HSS Syllabus

B.Tech I Sem

HS101	**English**	**2-0-0-4**
Pass / Not Pass		

The course should enable the learners to

- Read and understand any type of text on her/his own
- Comprehend obvious and implied meanings of the text
- Speak with relative fluency with the target of achieving accuracy
- Write with clarity and coherence, and creatively when needed, to express assimilated ideas and complex thought patterns
- Communicate effectively in academic presentations and business communication, as a second language or a language for specific purposes

Syllabus/ Content:

The components of the course are: the four language skills – listening, reading, writing and speaking; integration of the four skills through grammar, vocabulary and literature; academic writing; skills of presentation

The following texts (and the select works) will act only as facilitators in the fulfilment of the aims and objectives mentioned above. The focus is on an 'emergent' syllabus that emerges from the ongoing process of the teaching-learning situation in the field of English Language Teaching (ELT), catering to the learners' needs and space for developing original and critical thinking. It will take into perspective the current know-how of the methods of ELT.

Prose:

- "Letter to my Daughter" by Jawaharlal Nehru
- "An Astrologer's Day" by R.K.Narayan
- "Money and the Englishman" by Nirad C. Chaudhuri

Poem:

- "Pied Beauty" by Gerard Manley Hopkins
- "The Villain" by William H. Davies
- "Magic of Love" by Helen Farries
- "Sonnet CXVI" by William Shakespeare
- "The Charge of the Light Brigade" by Alfred, Lord Tennyson

Texts:

1. **Menon, Madhavi**, ed. *Prose for Our Times*. 2004. Kolkata: Orient BlackSwan, 2004.
2. **Sriraman, T.,** and **N. Krishnaswami,** eds. *Verses for a Multiverse: Poems for the New Generation*. Hyderabad: The English and Foreign Languages University; Orient BlackSwan, 2011.
3. **Wood, F.T.** *A Remedial English Grammar for Foreign Students*. New Delhi: Macmillan, 1965.
4. **Arora, V.N.,** and **Lakshmi Chandra**. *Improve Your Writing*. New Delhi: OUP, 1981.
5. **Anderson, Marilyn, Pramod K. Nayar**, and **Madhucchanda Sen**. *Critical Reasoning, Academic Writing and Presentation Skills*. Rev. ed. New Delhi: Longman-Pearson, 2010.

References:

1. **Mukherjee, Meenakshi**. *Let's Go Home and Other Stories*. New ed. Hyderabad: Orient BlackSwan, 2009.
2. **Krishnaswami, N.,** and **T. Sriraman**. *Current English for Colleges*. Chennai: Macmillan, 1990.
3. **Krishnaswami, N.,** and **T. Sriraman**. *Creative English for Communication*. 2nd ed. New Delhi: Macmillan, 2009.
4. **Swan, Michael**. *Practical English Usage*. 3rd ed. Oxford: OUP, 2005.
5. **Swan, Michael**, and **Catherine Walter**. *Oxford English Grammar Course: Advanced*. Oxford: OUP, 2011.
6. *Oxford Collocations Dictionary: For Students of English*. 2nd ed. Oxford: OUP, 2009.

Methodology: The teacher will be a facilitator rather than a 'giver' of knowledge in the communicative language teaching process. This should help the development of independence in learners as active participants and innovators of practices of language use.

B.Tech II Sem

HS201	Introduction to Linguistics	3-0-0-6

Aim:

1. To introduce the major branches of Linguistics
2. To enable students to appreciate the scientific nature of the study of language
3. To provide students with an understanding of the basic features and core concepts within each sub-field of Linguistics
4. To provide an academic base to students with which they can take a multi-pronged approach to the study of language

Syllabus:

Historical Linguistics, Linguistic Typology: Language universals; the major language families; types of languages in the world (isolating, agglutinating, polysynthetic etc.); languages of India

Phonetics, Phonology, Morphology: The production of speech; the organs of speech; a phonetic description of speech sounds (vowels and consonants and their place and manner of articulation); combination of speech sounds; minimal pairs; free and bound morphemes; word building strategies; inflectional and derivational morphology

Syntax, Semantics: The structure of sentences and their constituents; basic sentence patterns; the subject, verb and object/ complement; IC Analysis; word meaning and sentence relations; sense relations (synonymy, homonymy etc)

Sociolinguistics, Applied Linguistics, Neurolinguistics: What is language/ mother-other tongue?; language, society and variation; basic concepts: language/ dialect/ sociolect/ idiolect/ style/ context/ register; methods of teaching language; language and the brain

Texts:

1. **Murray, T. 1995.** *The Structure of English: Introduction to Phonetics, Phonology and Morphology.* Boston: Allyn & Bacon
2. **Mathews, P.H. 2003** *Linguistics: A Very Short Introduction*. Oxford University Press

References:

1. **Fromkin, V., Rodman R. and Hyams, N. 2003.** *An Introduction to Language*. Heinle and Thompson.
2. **Radford, A., Atkinson, M., Britain, D., Clahsen, H. and Spenser, A. 2009** *Linguistics: An Introduction*. Cambridge University Press.
3. **Additional reference material to be provided by Instructor**

B.Tech III Sem

HS102	Economics	3-0-0-6

Syllabus:

Definition of economics, subject matter, scope and nature of economics; Basic concepts: goods, utility, wealth, value, consumption, human wants; Law of diminishing marginal utility; Demand: concept, law and elasticity; Supply: concept, law and elasticity; Theory of the firm - Production functions in the short and long run; Market Structure- Competitive market; Imperfect competition (Monopoly, Monopolistic and Oligopoly)- Pricing in different markets. Factors of production; National income: definition, concepts and measurement; Costs and revenue concepts; Economic system: basic ideas; Money: evolution, definition and its function; Banking: central bank and its function; Commercial bank: functions, balance sheet and essentials of sound banking; Public finance: public Vs private finance, taxes, Budget; Economic growth and development: definitions, measurement, obstacles and basic requirement.

Texts:

1. J. K. Mitra, Economics, World Press Pvt. Ltd., 1998.

References:

1. P .A. Samuelson and W. D. Nordhans, Economics, Mc Graw Hill Inc., 1995
2. S. B.Gupta, Monetary Economics, S. Chand & Co. Ltd., 2002.
3. B. P.Tyagi, Public Finance, Jai Prakash Nath & Co., 1998.
4. M. L. Jhingan, The Economics of Development and Planning, Vrinda Publ., 1997.

B.Tech IV Sem

HSS Elective:

HS202	Language and Society	3-0-0-6

Syllabus:

Language and Society:

Theoretical perspectives:
Language as evolutionary biology (Chomsky, Pinker etc); Linguistic Relativity (Sapir-Whorf Hypothesis/ Bernstein's Deficit Hypothesis (restricted and elaborated code); Behaviorism (Bloomfield , Skinner); Austin's Speech Act Theory; Gricean Maxims Cooperation etc.

Key concepts in Sociolinguistics: Language/ mother-other tongue/ society/ speech community/ variation/ dialect/ accent/ sociolect/ idiolect/ style/ context/ register/ pidgins/ creoles/ codes/ diglossia/ Lingua Franca/ vernacular/ standard language

Social aspects of language:

Languages and Communities: Varieties; Case Studies (New York City, Martha's Vineyard etc); Speech Communities; Identities (dialect, sex, age, social class, ethnic group, nation, geography etc); Bilingualism and Multilingualism

Language variation and change: The linguistic variable; Language change in progress; Regularity; Social motivation of language change, Spoken and Written Language; Code mixing/ switching; Diglossia

Linguistic aspects of society:

Language Contact, Conflict and Degeneration: Language maintenance and shift; Displacement, Migrations, Language death

Language and culture: Kinship/ Taboo/ Euphemisms

Sociolinguistics of Communication: Prestige, Media, Communicative Competence; Conversation/ Discourse Analysis;

Multiple perspectives:

Ethnographies, Solidarity, Politeness, Gender; Language Planning and Education, Power

Texts:

1. **Wardaugh, R. 2006**. *An Introduction to Sociolinguistics* Blackwell Publishing, UK.

References:

1. **Trudgill, P. 1974**. *Sociolinguistics: An Introduction to Language and Society*. Penguin Books, London
2. **Florian, C.** *The Handbook of Sociolinguistics*. Blackwell Reference Online.
3. **Additional reference material to be provided by Instructor**

HS203	Science Fiction	3-0-0-6

This course explores the long-established literary genre of science fiction through certain representative texts. The topics for discussion range from alien invasion, cyborgs, global catastrophe, and space travel to utopian and dystopian future societies. In our examination of these texts, we will consider questions regarding the impact of science and technology on "global culture"; the intimate relationship between technological development and the history of warfare in the 20th century, the use of alien narratives to explore issues about race; the ways gender and sexuality have been transformed by scientific advances; and the complexities of human government and power.

Texts:

1. Raymond William,"Science Fiction", Science Fiction Studies, 15.3 (1988).
2. Select chapters from Tom Shippey (ed), *The Oxford Book of Science Fiction Stories*, Oxford: OUP, 1992.

References:

1. Camille Bacon-Smith, *Science Fiction Culture*, Philadelphia: University of Pennsylvania, 2000.
2. Adam Roberts, *Science Fiction*, London: Routledge, 2000.

B.Tech V Sem

HSS Elective:

HS301	Macroeconomic Problems and Policies	3-0-0-6
Introduction to macroeconomics, objectives of macroeconomic policies, Balance of Payment; Business cycle: Recovery, Prosperity, Recession, and Depression, Inflation: demand pull inflation and cost push inflation, causes of inflation, Inflation as a development promotion strategy; Deflation; Stagflation; Money and prices: Fisher's transactions approach to the quantity theory of money; The general theory of Employment, Interest and Money; Monetary policy: Objective of monetary policy, Instruments of monetary policy: Bank rate, Cash reserve ratio, Open market operations, The statutory liquidity ratio, repo rate, reverse repo rate, Selective credit control, limitation of monetary policy, Credit creation mechanism of commercial bank; Fiscal/Budgetary Policy: objective of fiscal policies, importance of fiscal policy, Instruments of fiscal policies: Taxation, Public Expenditure, Public borrowings, Deficit financing, Budget deficit and public debt; Role of monetary and fiscal policies in tackling business cycle.		
Texts: 1. Paul, R.R.Money Banking and International Trade, Kalyani Publisher, 2008.		
References: 1. Misra S.K. and Puri V.K, Economics of Development and Planning, Himalaya Publishing House (2005). 2. Dornbusch, R. and Fischer, S., Macroeconomics, McGraw-Hill Publishing Company, 5th Edition. 3. Gupta, S.B., Monetary Economics: Institutions, Theory and Policy, S. Chand & Company Pvt. Ltd., 2013.		

B.Tech VI Sem

HSS Elective:

HS 302	Language, Cognition and Culture	3-0-0-6
Syllabus: Language evolution: Form and content; ways of thinking; role of meaning in comprehension Cognitive and semantic issues: Structural and linguistic issues; categorization, metaphor and mental imagery; sense relations; spatial and temporal language Socio-cultural issues: Embodiment, universalism / relativism, schemas; kinship relations Theoretical perspectives: Various approaches and views; Separate Worlds Hypothesis; Gender Theory; Speech Act Theory; Gricean Maxims; Performative Theory etc.		
Texts: 1. A. Akmajian, R. A. Demers, A. K. Farmer, R. M. Harnish. 2001. *Linguistics: An Introduction to Language and Communication*. (PART II: 'Communication and Cognitive Science'). MIT Press, London. 2. Croft, W. and D.A. Cruse. 2004. *Cognitive Linguistics*, Cambridge University Press. 3. Select papers (Langacker, Harris, van Djik etc) to be provided by Instructor.		
References: 1. Friedenberg, J. and Silverman, G. 2006. *Cognitive Science: An Introduction to the Study of Mind*. Sage Publications, Thousand Oaks, California. 2. Albertazzi, L. 2000. *Meaning and Cognition: A Multidisciplinary Approach*. John Benjamins Publishing Company. 3. Gumperz, J. and Levinson, S. C. 1996. *Rethinking Linguistic Relativity*. Cambridge University Press. 4. Sunderland, J. 2006. *Language and Gender: An Advanced Resource Book.* Routledge, New York.		

HS303	Indian Writing in English	3-0-0-6

This course introduces the learner to the large and diverse body of Indian Writing in English. Representative texts are employed to consider cultural issues like hybridity, nationalism, diaspora, post-colonialism, etc. The aim of the course is to make the students aware of literary genres, themes and styles used by various Indian authors in order to express themselves in English. The texts chosen for the course further make the students aware of the many socio-political issues that govern cultural relations in India.

Texts:

1. Select chapters from Salman Rushdie and Elizabeth West (eds), *The Vintage book of Indian writing, 1947-1997*, London: Vintage Books, 1997.

References:

1. M.K. Naik, A History of Indian English Literature, New Delhi: Sahitya Akademi, 2009.

2. Arvind Krishna Mehrotra (ed), *An Illustrated History of Indian Literature in English*, Orient Blackswan, 2003.

3. Meenakshi Mukherjee, "The anxiety of Indianness: Our novels in English,"*Economic and Political Weekly* (1993): 2607-2611.

B.Tech VII Sem

HSS Elective:

HS401	Consumer Behaviour and Welfare Economics	3-0-0-6

Syllabus:

Consumer preferences, Budget constraints, Optimal allocation; Choice under uncertainty: Attitude towards risk, risk averter, risk lover; Analysis of markets structure: Evaluating the gains and losses of taxes and subsidy, Consumer and producer surplus; Investment, time and capital markets; Markets with asymmetric information: The problem of moral hazard, Principal – agent problem; Welfare economics: Introduction to basic issues, Pareto optimality, Compensation principle

Texts:

1. R.S. Pindyck and D.L. Rubinfeld, Microeconomics, Prince-Hall International, Inc. 2012.

References:

1. P .A. Samuelson and W. D. Nordhans, Economics, Mc Graw Hill Inc., 1995.
2. H.L. Ahuja. Advanced economic theory, S. Chand & Co. Ltd., 2006.

HS402	Understanding Democracy and Governance in India	3-0-0-6

Syllabus:

Introduction to Politics; The case for Indian Model of democracy, Structures and Process of Governance- Parliament-Lok Sabha and Rajya Sabha, Party System, Party Politics and Electoral behaviour, Theories of Federalism and Indian Experience, The Supreme Court and Judicial Activism, Local Governance-Panchayati Raj Institution special reference to 73rd and 74th Amendment, Women and SC, ST in Panchayati Raj Institution; Theories of development- Emergence of Classical Political Economy; Political Economy and Theories of Free Trade; the Great Depression and the crisis of neo-classical theories; the Keynesian revolution, Debates over Models of Development in India, Liberalisation of Indian Economy, E-governance.

Texts:

2. Gopal Jayal, Niraja and Pratap Bhanu Metha, eds., (2010), *The Oxford Companion to Politics in India* (Delhi: Oxford University Press)

References:

3. Frankel, Francine (2005). *India's Political Economy (1947-2004): The Gradual Revolution.* (Delhi: Oxford University Press).

4. Chari, Sharad and Stuart Corbridge (2008). (eds.). *The Development Reader*. (Delhi: Routledge

Indian Institute of Information Technology Senapati, Manipur

B.Tech. Course Mathematics Syllabus

B.Tech. I Sem

MA101	Mathematics I	3-1-0-8

Syllabus:

Linear Algebra: Systems of linear equations and their solutions; vector space R_n and its subspaces; spanning set and linear independence; matrices, inverse and determinant; range space and rank, null space and nullity, eigenvalues and eigenvectors; diagonalization of matrices; similarity; inner product, Gram-Schmidt process; vector spaces (over the field of real and complex numbers), linear transformations.

Single Variable Calculus: Convergence of sequences and series of real numbers; continuity of functions; differentiability, Rolle's theorem, mean value theorem, Taylor's theorem; power series; Riemann integration, fundamental theorem of calculus, improper integrals; application to length, area, volume and surface area of revolution.

Texts:

1. G. Strang, *Linear Algebra and Its Applications*, 4th Edition (South Asian Edition), Wellesley-Cambridge Press, 2009(ISBN: 9788175968110).
2. S. R. Ghorpade and B. V. Limaye, *An Introduction to Calculus and Real Analysis*, Springer India, 2006 (ISBN: 9788181284853).

References:

1. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
2. K. Hoffman and R. Kunze, *Linear Algebra*, 2nd Edition, Prentice Hall India, 2009.
3. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, 3rd Edition, Wiley India, 2007.

B.Tech. II Sem

MA102	Mathematics II	3-1-0-8

Syllabus:

Multivariable Calculus: Vector functions of one variable – continuity, differentiation and integration; functions of several variables - continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; tangent planes and normals, maxima and minima, Lagrange multiplier method; repeated and multiple integrals with applications to volume, surface area, moments of inertia, change of variables; vector fields, line and surface integrals; Green's, Gauss' and Stokes' theorems and their applications.

Ordinary Differential Equation: First order differential equations - exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem, applications; higher-order linear differential equations - solutions of homogeneous and non-homogeneous equations, method of variation of parameters, series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds. Laplace and inverse Laplace transforms; properties, convolutions; solution of ODE by Laplace transform. Systems of first-order equations, two-dimensional linear autonomous system, phase plane, critical points, stability.

Texts:

1. G. B. Thomas, Jr. and R. L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Pearson Education India, 1996.
2. S. L. Ross, *Differential Equations*, 3rd Edition, Wiley India, 1984.

References:

1. H. Anton, I. C. Bivens and S. Davis, *Calculus*, 10th Edition, Wiley, 2011.
2. T. M. Apostol, *Calculus*, Volume 2, 2nd Edition, Wiley India, 2003.
3. W. E. Boyce and R. C. Di Prima, *Elementary Differential Equations and Boundary Value Problems*, 9thEdition, Wiley India, 2009.
4. E. A. Coddington, *An Introduction to Ordinary Differential Equations*, Prentice Hall India, 1995.

B.Tech. III Sem

MA203	Mathematics III	3-0-0-6

Syllabus:

Introduction to probability: mathematical background - sets, set operations, sigma and Borel fields; classical, relative-frequency and axiomatic definitions of probability; conditional probability, independence, total probability, Bayes rule; repeated trials; Random variables: cumulative distribution function, continuous, discrete and mixed random variables, probability mass function, probability density functions; functions of a random variable; expectation - mean, variance and moments; characteristic and moment-generating functions; Chebyshev, Markov and Chernoff bounds; special random variables-Bernoulli, binomial, Poisson, uniform, Gaussian and Rayleigh; joint distribution and density functions; Bayes rule for continuous and mixed random variables; joint moments, conditional expectation; covariance and correlation- independent, uncorrelated and orthogonal random variables; function of two random variables; sum of two independent random variables; random vector- mean vector and covariance matrix, multivariate Gaussian distribution; Vector-space representation of Random variables, laws of large numbers, central limit theorem; Random process: discrete and continuous time processes; probabilistic structure of a random process; mean, autocorrelation and autocovariance functions; stationarity- strict-sense stationary and wide-sense stationary (WSS) processes: autocorrelation and cross-correlation functions; time averages and ergodicity; spectral representation of a real WSS process-power spectral density, cross-power spectral density, Wiener Khinchin theorem, linear time-invariant systems with WSS process as an input- time and frequency domain analyses; spectral factorization theorem;
Examples of random processes: white noise, Gaussian, Poisson and Markov processes, Basics of Queuing Theory, Characteristics of queuing systems.

Texts:

1. *Papoulis and S.U. Pillai, Probability Random Variables and Stochastic Processes, 4/e, McGraw-Hill, 2002.*
2. *A. Leon Garcia, Probability and Random Processes for Electrical Engineering, 2/e, Addison-Wesley, 1993.*

References:

1. *H. Stark and J.W. Woods, Probability and Random Processes with Applications to Signal Processing, 3/e, Prentice Hall, 2002.*
2. *John J. Shynk, Probability, Random Variables, and Random Processes: Theory and Signal Processing Applications, 1/e, Wiley publications, 2012.*

MA205	Discrete Mathematics	3-0-0-6

Syllabus:

Set theory: sets, relations, functions, countability
Logic - formulae, interpretations, methods of proof, soundness and completeness in propositional and predicate logic
Number theory: division algorithm, Euclid's algorithm, fundamental theorem of arithmetic, Chinese remainder theorem, special numbers like Catalan, Fibonacci, harmonic and Stirling
Combinatorics: permutations, combinations, partitions, recurrences, generating functions
Graph Theory:- paths, connectivity, subgraphs, isomorphism, trees, complete graphs, bipartite graphs, matchings, colourability, planarity, digraphs
Algebraic Structures: semigroups, groups, subgroups, homomorphisms, rings, integral domains, fields, lattices and Boolean algebras

Texts:

1. C. L. Liu, *Elements of Discrete Mathematics*, 2nd Ed., Tata McGraw-Hill, 2000.
2. K. H. Rosen, *Discrete Mathematics and its Applications*, 7th Ed., Tata McGraw-Hill, 2009.

References:

1. J. P. Tremblay and R. P. Manohar, *Discrete Mathematical structures with Applications to Computer Science*, Tata McGraw-Hill, 2001.
2. R. C. Penner, *Discrete Mathematics: Proof Techniques and Mathematical Structures*, World Scientific, 1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, *Concrete Mathematics*, 2nd Ed., Addison-Wesley, 1994.
4. J. L. Hein, *Discrete Structures, Logic, and Computability*, 3rd Ed., Jones and Bartlett, 2010.

B.Tech. IV Sem

MA204	Mathematics IV	3-0-0-6

Syllabus:

Complex Analysis**:** Complex numbers and elementary properties. Complex functions - limits, continuity and differentiation. Cauchy-Riemann equations. Analytic and harmonic functions. Elementary functions. Anti-derivatives and path (contour) integrals. Cauchy-Goursat Theorem. Cauchy's integral formula, Morera's Theorem. Liouville's Theorem, Fundamental Theorem of Algebra and Maximum Modulus Principle. Taylor series. Power series. Singularities and Laurent series. Cauchy's Residue Theorem and applications. Mobius transformations.

Partial Differential Equations**:** First order partial differential equations; solutions of linear and nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary and initial value problems (Dirichlet and Neumann *type) involving wave equation, heat conduction equation, Laplace's equations and solutions by method of separation of variables (Cartesian coordinates); initial boundary value problems in non-rectangular coordinates.*

Solving PDEs by Transforms Methods: Solution of PDE by Fourier Transform method and Laplace Transform method.

Texts:

1. *J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2003. (or 8th Edition- 2008).*
2. *K. Sankar Rao, Introduction to Partial Differential Equations, 3rd Edition, 2011.*

References:

1. *J. H. Mathews and R. W. Howell, Complex Analysis for Mathematics and Engineering, 3rd Edition, Narosa, 1998.*
2. *I. N. Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1957.*

B.Tech VI Sem

MA305	Optimization Techniques	3-0-0-6

Syllabus:

Linear programming problem: formulation and geometric ideas, simplex algorithm, duality, transportation and assignment problem, Integer programming problems; Nonlinear optimization: method of Lagrange multipliers, Karush-Kuhn-Tucker theory, numerical methods for nonlinear optimization; Convex optimization and quadratic programming; Applications of linear, integer and quadratic programming to various areas of science and engineering.

Texts:

1. S. Chandra, Jayadeva, A. Mehra, Numerical Optimization with Applications, 1st Edition, Narosa Publishing House, 2009.

References:

1. *John J. Jarvis, Mokhtar S. Bazaraa, Hanif D. Sherali, Linear Programming and Network Flows, 4th Edition, John Wiley & Sons, 2010.*
2. *Hamdy A. Taha. Operation Research: An Introduction, 9th Edition, Prentice Hall, 2011.*
3. *D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 3rd Edition, Springer, 2008.*

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B.Tech. Course Physics Syllabus

B.Tech III Sem

SC201	Physics I	3-0-0-6

Classical Mechanics: Motion in plane polar coordinates; Dynamics of system of particles and conservation principles; Rotation about fixed axis; Rigid body dynamics; Non-inertial frames and pseudo forces. [14 Lectures]

Modern Physics: Special Theory of Relativity - Michelson-Morley experiment, Einstein postulates, Lorentz transformations, length contraction and time dilation, twin paradox, relativistic momentum and energy; Quantum Mechanics - De Broglie's hypothesis, uncertainty principle, Schrodinger equations, probability and normalizaiton, expectation values, Eigenvalues and eigenfunctions, particle in a box, potential barrier, harmonic oscillator. [16 Lectures]

Optics: Review of wavefront and Huygen's principle; Interference by the division of wavefront – Yount's double slit, Fresnel biprism, Lloyd's mirror arrangement; interference by division of amplitude – plane parallel film illuminated by plane wave, non-reflecting films, plane film illuminated by a point source, colour of thin films, Newton's Rings, Michelson interferometer; Single slit and two slits Fraunhoffer diffraction; diffraction grating. [12 Lectures]

Texts:

1. D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics, Tata McGraw-Hill, 2000.
2. Kenneth S. Krane, Mondern Physics, John Wiley &Sons, Inc, 3rd Edition, 2012
3. F. A. Jenkins and H. E. White, Fundamentals of Optics, McGraw-Hill, 1981.

References:

1. J.M. Knudsen and P.G. Hjorth, Elements of Newtonian Mechanics, Springer, 1995
2. A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill, New Delhi, 1995.
3. Ajoy Ghatak, Optics, Tata McGraw-Hill, New Delhi, 1992

B.Tech VIII Sem

SC401	Physics II	3-0-0-6

Syllabus:

Nuclear Physics: General Properties of Nucleus – radius, size, mass, spin, moments, binding energy, nuclear angular momentum and parity; Nuclear Forces; Nuclear Models; Nuclear decays and Radioactivity – Fundamental laws of radioactivity, α, β and γ Decays; Nuclear reactions and their conservation laws; Nuclear reactors; Nuclear fission and fusion; Accelerators.

Astrophysics: Astronomical scale and dimensions, Night sky, Stars and Constellations, Sidereal time, The Sun and Solar system, Orbital dynamics, Kepler's Laws, Astronomical coordinate systems, Space velocity and motion of stars; Photometric study – Stellar luminosity, Magnitude scale system, The Color Index, Stellar temperatures; Stellar spectra and classification – Saha equation, HR Diagram; The milky way.

Nanophysics: Introduction: Nanoscale regime, Emergence of nanoscience, Nanoparticles, Nanowires, Nanotubes, Nanoscience to nanotechnology, Challenges of nanotechnology; Nanostructure synthesis: Natural occurrence, Chemical route, Chemical bath deposition, Sol-gel techniques, Chemical vapour deposition (CVD), Physical vapour deposition, Magnetron sputtering, Pulsed laser deposition(PLD); Characterization of Nanostructures: X-ray diffraction (XRD), Electron microscopy (SEM and TEM), Spectroscopic techniques, X-ray photoelectron spectroscopy.

Texts:

1. K. S. Krane, Introductory Nuclear Physics, John Wiley, 1987.
2. I. Kaplan, Nuclear Physics, Addison-Wesley, 2002.
3. Pankaj Jain, Introduction to Astronomy and Astrophysics, Boca Raton: CRC Press, 2015.
4. Charles P. Poole and Frank J. Owens, Introduction to Nanotechnology, Wiley-Interscience, 2003.
5. G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press, 2004.

References:

1. S.N. Ghoshal, Nuclear Physics, S.Chand, 2010.
2. Bradley W. Carroll and Dale A. Ostlie, An introduction to modern Astrophysics, Addison Wesley, 2007.
3. K. D. Sattler, Handbook of Nanophysics, CRC Press, 2011.
4. G. Schmid, Nanotechnology: Principles and Fundamentals, Wiley-VCH Verlag, 2008

Indian Institute of Information Technology Senapati, Manipur

B.Tech. Course Chemistry Syllabus

B.Tech. IV Sem

SC202	Chemistry	3-0-0-6

Chemical Thermodynamics: The zeroth and first law, Work, heat, energy and enthalpies; The relation between C_v and C_p; Second law: entropy, free energy (the Helmholtz and Gibbs) and chemical potential; Third law; Chemical equilibrium; Equilibrium electrochemistry; Chemical kinetics: The rate of reaction, elementary reaction and chain reaction; Surface: The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physisorption and chemisorption;

Periodic properties of elements; Shapes of inorganic compounds; Ionic solids and their structure, Coordination compounds: ligand, isomerism, colour, magnetism; Bioinorganic chemistry; Chemistry of materials and organometallic chemistry;

Stereo and regio-chemistry of organic compounds, conformers; Pericyclic reactions; Bioorganic chemistry: Amino acids, peptides, proteins, enzymes, carbohydrates, nucleic acids and lipids; Macromolecules (polymers); Green chemical processes. Basic spectroscopic techniques (Uv-Vis, IR, ^{1}H NMR).

Texts:

1. P. W. Atkins, J. De Paula *Physical Chemistry*, 9th Ed., OXFORD UNIVERSITY PRESS, 2011.
2. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike Hagerman; *Shriver & Atkins' Inorganic Chemistry*, 5th Ed. 2012, OXFORD UNIVERSITY PRESS-NEW DELHI.
3. Jonathan Clayden, Nick Geeves, Stuart Warren, *Organic Chemistry*, 2nd Edition, 2012, OXFORD UNIVERSITY PRESS.

References:

1. I. A. Levine, *Physical Chemistry*, 6th Ed., Tata-McGraw-Hill, 2011.
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, O. K. Medhi, *Inorganic Chemistry: Principle of structure and reactivity*, 4th Ed., Pearson Education, 2006..
3. F. A. Cotton, and G. Wilkinson, *Advanced Inorganic Chemistry*, 3rd Ed., Wiley Eastern Ltd., New Delhi, 1972, reprint in 1988.
4. L. G. Wade (Jr.), Maya S. Gingh, *Organic Chemistry*, 6th Edition, Pearson Education, 2008.
5. Paula Y. Bruce, *Organic Chemistry*, 3rd Ed. (13th Impression), Pearson Ed. Inc. New Delhi, 2013.
6. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee. *Organic Chemistry*, 7th Edition, Pearson Education, 2011.

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B.Tech. Course Biology Syllabus

B.Tech. V Sem

SC301	Biology	3-0-0-6

1. Chemical Foundation of Cells : Carbon compounds in cells (carbohydrates, proteins, lipids and nucleic acids) , their types, structure and function .
2. Cell Structure and Function: Components of typical animal and plant cells, concept of cell organelles and their functions.
3. Cell division : mechanism of mitosis and meiosis and their significances.
4. Animal tissues : preliminary idea of different types of animal tissues and their functions.
5. Flow of information : Principles of inheritance, Chromosome and DNA, DNA as genetic material;structure of DNA; DNA replication; transcription; translation; genes to proteins ; gene expression and regulation; recombinant DNA technology. Control of genes, recombinant DNA and genetic engineering.
6. Human physiology: Nutrition and digestion, respiration, circulation, movement, neural coordination and sensory receptors; chemical coordination and preliminary idea of immunity and immune system.
7. Mode of nutrition in plants: Photosynthesis and its mechanism

Texts:

1. P.S. Verma and V.K. Agarwal, Cell Biology, Genetics, Molecular biology, Evolution and Ecology, 2015 Edition, S.Chand and company Ltd., Ramnagar, New Delhi-55

References:

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman &Co, 2002.
2. D. L. Nelson and M. M. Cox, Lehninger, Principles of Biochemistry, Macmillan Worth, 2000.
3. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell,Garland Science, 2008. 1st edition.
4. J.B.Reece, L.A.Urry, M.L.Cain, S.A.Wasserman, P.V.Minorsky, R.B.Jackson, Biology, Benjamin Cummings, 2010. 9th edition.

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B.Tech. Course CSE Syllabus

B.Tech I Sem

CS101	Computer Programming	3-1-0-8
Syllabus: Procedural programming through Language 'C': Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures, Simple I/O, Functions and parameter passing, Strings and string processing, Pointers and References, Structures, Recursion. Algorithm development: Techniques of problem solving, Stepwise Refinement, Simple numerical examples, algorithms for searching and sorting, merging order lists. Examples taken from real-world applications involving data manipulation.		
Texts: 1. **Bryon Gottfried**, Programming with C, McGraw Hill, Third edition (ISBN: 9780070145900).		
References: 1. **Horowitz, Sahni**, and **Anderson-Freed**, Fundamentals of Data Structures in C, Universities Press, Second edition (ISBN: 9788173716058). 2. **Kernighan** and **Ritchie**, The C Programming Language, PHI, Second edition, (ISBN:9788120305960).		

CS 110	Computer Programming Lab	0-0-3
Programming assignments on: Basic Assignment Statement, Conditional and Iterative Control Structures, Some Numerical Examples, Functions and parameter passing, Array and String, Pointer, Structure, Recursion, Dynamic Memory Allocation, File Handling, Linked List, Sorting, Command Line Arguments		

CS102	IT Workshop I	2-0-3-7
Aim: This is intended to act as an introductory course which aims to provide theory and hands on experience on general Linux system. This would enable the students to use Linux systems for their day to day activities. Also, the students will be able to create basic database backed web applications through simple tools like HTML, PHP, MySQL. The integrated development environment to be used is phpMyAdmin.		
Syllabus: Overview of Linux system and basic commands; Basic Linux Administration---logging, authentication, network setup, mail system, backup and archiving etc; Linux File system, vi editor, Open-office, Environment variables, Filters, Basic Shell Programming using Bash. Simple Database Driven Web Site: HTML, php, and MySQL (using phpMyAdmin)		
Texts: 1. **S. Das**, *Unix System V.4 Concepts and Applications*, 4th Edition, Tata McGraw-Hill, 2006. 2. **Timothy Boronczyk**, **Elizabeth Naramore**, **Jason Gerner**, **Yann Le Scouarnec**, **Jeremy Stolz** and **Michael K. Glass**, *Beginning PHP6, Apache, MySQL Web Development*, Wiley India Pvt. Ltd., 2009.		
References: 1. **Brian W. Kernighan** and **Rob Pike**, *The UNIX programming environment*, 1st Edition, PHI Learning, 1984, (Reprint 2011). 2. **Bruce Lawson** and **Remy Sharp**, *Introducing HTML5*, 2nd Edition, Pearson, 2012.		

B.Tech II Sem

CS103	Data Structures	3-1-0-8
Syllabus: Performance of algorithms: space and time complexity, asymptotics; Fundamental Data structures: linked lists, arrays, matrices, stacks, queues, binary trees, tree traversals; Algorithms for sorting and searching: linear search, binary search, insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing; Search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.		
Text: 1. Seymour Lipschutz, Data Structures with C, SCHAUM SERIES, Tata McGraw-Hill, 1st edition, 2010		
References: 1. M A Weiss, Data Structures and Problem Solving Using Java, Addison-Wesley, 1997. 2. A M Tannenbaum, Y Langsam and M J Augenstein, Data Structures Using C++, Prentice Hall India, 1996. 3. A H Aho, J E Hopcroft and J Ullman, Data Structures and Algorithms, Addison-Wesley, 1987. 4. Robert Sedgewick, Algorithms in C++ Parts 1-4, Pearson Education, Third Edition, 1998. 5. Robert Sedgewick, Algorithms in C++ Part 5, Pearson Education, Third Edition, 2002.		

CS111	Data Structure Lab	0-0-3-3
Programming assignments on: Using C Programming Language, Implementation of linked lists, stacks, queues, binary trees, tree traversals: Implementation of algorithms for sorting: Insertion-sort, selection sort, bubble-sort, quicksort, mergesort, heapsort, shellsort; Implementation of algorithms for searching: linear search, binary search. Assignments on Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps; Graphs: representations, depth first search, breadth first search; Hashing: separate chaining, linear probing, quadratic probing; Assignments on search Trees: binary search trees, red-black trees, AVL trees, splay trees, B-trees; Strings: suffix arrays, tries; Randomized data structures: skip lists.		

CS104	Computer Organization	3-1-0-8
Syllabus: Basic Computer Architecture; ARM Instruction Set and Assembly Language Programming; Computer Arithmetic: integer addition (carry look-ahead), multiply (booth's algorithm), division (restoring and non-restoring), floating point arithmetic; Processor Design – single cycle, multi-cycle; pipelined design; memory architecture (static and Dynamic RAM; row and column addressing; interleaving, banks), cache memory (direct, set-associative, multi-level); storage basics: disks, tapes, printers, displays, flash memory; Buses (daisy chaining; synchronous and asynchronous; point-to-point; PCI, PCIe); Intel Sandy Bridge Archtecture; Intel X86 instruction set introduction.		
Text: David A. Patterson and John L. Hennesy, Computer Organization and Design: The Hardware Software Interface, ARM Edition, 4th edition, Elesevier India, 2010.		

B.Tech III Sem

CS201	Algorithms	3-0-0-6
Syllabus : Models of Computation: space and time complexity measures, lower and upper bounds; Design techniques: the greedy method, divide-and-conquer, dynamic programming, backtracking, branch and bound; Lower bound for sorting; Selection; Graph Algorithms: connectivity, topological sort, shortest paths, minimum spanning trees, network flow; The disjoint set union problem; String matching; NP-completeness; Introduction to approximate algorithms and Randomized algorithms.		
Texts : 1. T H Cormen, C E Leiserson, R L Rivest and C Stein, Introduction to Algorithms, MIT Press, 2001.		
References : 1. Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley, 2005 2. A Aho, J E Hopcroft and J D Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974. 3. S Sahni, Data Structures, Algorithms and Applications in C++, McGraw-Hill, 2001. 4. M T Goodrich and R Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons, 2001.		

CS 251	IT Workshop II	2-0-3-7
Syllabus: Programming in Java; **Java Basic:** Why Java, Basic Syntax and Semantics, Variables, Types, Expressions, Assignment statements, Conditional and Iterative Control Structures; **Object Oriented Programming with Java:**objects and classes, methods and messages, abstraction and encapsulation, inheritance, Interfaces, abstract classes, polymorphism, access specifiers, static members, constructors, finalize method **Java concept:** Exception handling, Threads, packages, Array and String, Handling I/O, Files, Networking **Database Programming with Java:** JDBC architecture, Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements, Working with Result Set **JSP:** java server pages (JSP); SQL basics; Use of Mysql and a web server using JSP for assignments.		
Texts: 1. **Harvey Deitel, Paul Deitel**: Java How to Program, 9/e, Prentice Hall India		
References: 1. **The online Java tutorial** http://docs.oracle.com/javase/tutorial/ 2. **Y. Daniel Liang**: Introduction to Java Programming, 9/e, Pearson Publishing 3. **Herb Schildt**: Java The Complete Reference 8/e Tata Mcgraw Hill Education		

CS 231	Operating Systems	3-0-0-6
Syllabus: Process Management: process, thread, scheduling; Concurrency: mutual exclusion, synchronization, semaphores, deadlocks; Memory Management: allocation, protection, hardware support, paging, segmentation; Virtual Memory: demand paging, allocation, replacement, swapping, segmentation, TLBs; File Management: naming, file operations and their implementation; File Systems: allocation, free space management, directory management, mounting; I/O Management: device drivers, disk scheduling, Basics of Security		
Text: 1. Silberschatz, A. and Galvin, P. B. Operating System Concepts. 8/e. Wiley, 2008.		

References:

1. Stalling, W. Operating Systems: Internals and Design Principles. 6/e. Pearson, 2008.
2. Tanenbaum, A. S. Modern Operating System. 3/e. Pearson, 2007.
3. Dhamdhere, D. M. Operating SystemsA Concept Based Approach, McGrawHill, 2008

CS 232	**Operating Systems Lab**	**0-0-4-4**

Programming assignments on:

1. Linux Programming with System Calls
2. Critical Section Problems
3. Scheduling
4. Memory Management
5. File Systems

Alternative, to build parts of an OS kernel. Use of a teaching package such as Nachos, Pintos.

B.Tech IV Sem

CS 210	**Formal Languages and Automata Theory**	**3-0-0-6**

Prerequisites: MA 204 or equivalent: Elementary discrete mathematics including the notion of set, function, relation, product, equivalence relation etc.

Syllabus:

Alphabets, language, grammars; Finite Automata, regular language, regular expression; Context free grammars, Push Down Automata; Context Sensitive grammars, Linear Bounded Automata; Turing Machines, design of Turing Machine, Universal Turing Machine, Halting Problem; Operations on formal language and their properties; Chomsky hierarchy.

Texts:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and computation, 3rd Edition, Pearson / Addison Wesley, 2011.

References:

1. H. R. Lewis and C. H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, PHI Learning, 2009.
2. M. Sipser, Theory of Computation, 3rd Edition, Cengage Learning India Private Limited, 2014.

CS240	**Database Management Systems**	**3-0-0-6**

Syllabus:

Databases: Introduction, Introduction to the Relational Model, Introduction to SQL, Intermediate SQL, Advanced SQL, Formal Relational Query Languages.

Database Design: ER Model, Functional Dependencies, Schema Design, Normal Forms.

Data Storage and Querying: Storage and File Structure, Indexing and Hashing, Query Processing, Query Optimization.

Transaction Management: Transactions, Concurrency Control, Recovery System.

System Architecture: Database System Architecture, Parallel Databases, Distributed Databases.

Advanced Topics: Data Warehousing and Mining, Information Retrieval, XML.

Texts:

1. Database System Concepts - Silberschatz, Korth & Sudarshan (6th Edition) 2011.

References:

1. An Introduction to Database Systems - CJ Date (8th Edition) 2003.
2. Database Systems: The Complete Book - Gracia-Molina, Ullman, Widom. (2nd Edition) 2008.

CS241	Database Management Systems Lab	0-0-3-3
Familiarization with databases packages like Microsoft Access and MySql. The database language SQL, constraints and triggers in SQL, system aspects of SQL. Creation of views and stored procedures using PL/SQL. Client-server and 3 tier web enabled database programming. Design and implementation of a Database application using a multi-user DBMS.		

CS 252	Computer Networks	3-0-0-6
Network Basics: Evolution of computer networks; Network Models, Network Media, LAN, MAN and WAN, needs and goals of networking topology, network architecture, need for protocols, OSI Reference Model, layer services, primitives and service access points **Data link layer:** Framing, HDLC, PPP, sliding window protocols, medium access control, Token Ring, Wireless LAN; Virtual circuit switching: Frame relay, ATM; **Network Layer:** Internet addressing, IP, ARP, ICMP, CIDR, routing algorithms (RIP, OSPF, BGP); **Transport Layer:** UDP, TCP, flow control, congestion control; Introduction to quality of service; **Application Layer:** DNS, Web, email, authentication, encryption.		
Texts: *Andrew S. Tanenbaum, "Computer Networks", 4th ed., Prentice Hall, 2003.*		
References: Forouzan, *Data Communications and Networking,* 4th Ed., Tata Mcgraw Hill, 2006.		

CS 253	Computer Networks Lab	0-0-4-4
Linux network configuration, measurement and analysis tools, Wireshark, Socket programming using C++ - TCP and UDP, peer-to-peer applications; reliable communications using unreliable datagrams; client-server using RPC;concurrent servers using threads or processes. Assignment on simulation of LAN, Wi-Fi etc using NS3 simulator		
References: http://tldp.org/ http://www.nsnam.org/documentation/		

B.Tech V Sem

CS 301	Theory of Computation	3-0-0-6
Prerequisites: MA 204 or equivalent: Elementary discrete mathematics including the notion of set, function, relation, product, equivalence relation etc.; CS 210 or equivalent: Formal languages and Automata theory. *Syllabus:* The Church – Turing Thesis: Turing Machines, Variants of Turing Machines, The Definition of Algorithm. Decidability: Decidable Languages, Undecidability. Reducibility: Undecidable Problems from Language Theory, A Simple Undecidable Problem, Mapping Reducibility. Advanced Topics from Computability: The Recursion Theorem, Decidability of Logical Theories, Turing Reducibility, A Definition of Information. Time Complexity : Measuring Complexity, The Class P, The Class NP, NP – completeness, Additional NP-complete Problems. Space Complexity: Savitch's Theorem, The Class PSPACE, PSPACE-completeness, Class L and NL, NL-completeness, NL equals coNL. Intractability: Hierarchy Theorems, Relativization, Circuit Complexity. Advanced Topics of Complexity Theory: Approximation Algorithms, Probabilistic Algorithms, Alternation, Interactive Proof Systems, Parallel Computation, Cryptography.		
Texts: 1. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning India Private Limited, 2014.		

References:

1 J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and computation, 3rd Edition, Pearson / Addison Wesley, 2011.
2. H. R. Lewis and C. H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, PHI Learning, 2009.

CS 320	**Compilers**	**3-1-0-8**

Syllabus:

Compilers and translators, different phases of a compiler; Lexical analysis: specification of tokens, recognition of tokens, input buffering, automatic tools; Syntax analysis: context free grammars, top down and bottom up parsing techniques, construction of efficient parsers, syntax-directed translation, automatic tools; Semantic analysis: declaration processing, type checking, symbol tables, error recovery; Intermediate code generation: run-time environments, translation of language constructs; Code generation: flow-graphs, register allocation, code-generation algorithms; Introduction to code optimization techniques.

*Texts***:**

1. A. V. Aho, L.S. Monica R. Sethi and J. D. Ullman, Compilers: Principles, Techniques, and Tools, 2nd Ed., Prentice Hall, 2009.

*References***:**

1. V. Raghavan, Principles of Compiler Design, McGrawHill, 2010.
2. C.N. Fischer and R.J. Le Blanc, Crafting a Compiler with C, Pearson Education, 2009.
3. J. Levine, T. Mason and D. Brown, Lex & Yacc, 2nd Edition, O'Reilly Media, Inc, 1992.

CS 321	**Compilers Lab**	**0-0-3-3**

Programming assignments to build a compiler for a subset of a C-like programming language, using tools such as Lex / Flex / JLex and Yacc / Bison / CUP etc.

*Texts***:**

1. D. Brown, J. Levine and T. Mason, *Lex and Yacc,* 2nd Ed., O'Reilly Publications.

CS 302	**Data Communication**	**3-0-0-6**

Basics of Digital communications: Signals, noise, Nyquist rate, Shannon capacity; Analog

Transmission: Modulation techniques, Fundamentals of modems, FDM; Digital transmission: PCM,

Transmission media: Guided (twisted pair, coaxial, fiber optic) and Unguided media; Balanced and

Local area networks: Ethernet, Fast Ethernet, Introduction to Gigabit Ethernet and WLANs, Hubs,

Wireless Technologies: 3G LTE, RFID

*Texts***:**

1.W. Stallings, *Data and Computer Communications,* 8th Ed., Pearson India, 2007.

*References***:**

1. A. S. Tanenbaum, *Computer Networks,* 4th Ed., Pearson India, 2003.
2. B. Forouzan, *Data Communications and Networking,* 4th Ed., Tata Mcgraw Hill, 2006.
3. J. Quinn, *Digital Data Communications,* 1st Ed., Prentice Hall Career and Technology, 1995.
4. P. C. Gupta, *Data Communications and Computer Networks,* 2nd Ed., Prentice Hall of India, 2009.
5. F. Halsall, Data Communications, Computer Networks and Open Systems, 4th Ed., Addison Wesley, 1996.

CS303	Distributed Systems	3-0-0-6
Syllabus: Introduction, design issues; Naming, resolution; Process and threads in distributed system, code migration; Clock synchronization; Global state, election; Distributed mutual exclusion, token- and non-token based algorithms; Distributed deadlock prevention, avoidance, detection, resolution; Distributed shared memory, memory coherence; Distributed file system, sharing semantics, caching, replication, fault-tolerance, atomicity; Distributed scheduling, load distribution, balancing, sharing; Consistency and replication, data- and client-centric models; Failure and recovery, synchronous and asynchronous checkpointing, message logging; Fault tolerance, commit protocols, failure resilient processes, group membership; Security, secure channels, access control matrix.		
Texts: 1. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, Addison-Wesley/Pearson Education, 2011.		
References: 1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Prentice-Hall/Pearson Education, 2006. 2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011. 3. Joel M. Crichlow, Distributed Systems: Computing over Networks, 2nd Edition, Prentice-Hall/Pearson Education, 2014.		

CS 351	IT Workshop III (Cloud Computing)	1-0-3-5
Introduction to Cloud Computing, Cloud Concepts & Technologies, Cloud Services & Platforms, Hadoop & MapReduce - Concepts, Cloud Application Design, Python for Cloud, Cloud Application Development in Python, Big Data Analytics, Multimedia Cloud, Cloud Security, Cloud Application Benchmarking & Tuning		
Texts: 1) Cloud Computing: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, 2013, Universities Press		
References: 1) Cloud Computing Bible by Barrie Sosinsky, 2011, Willey India Pvt Ltd		

B.Tech VI Sem

CS 330	Software Engineering	3-0-0-6
Software Engineering Principles: Overview of the software engineering discipline, Software lifecycle models, Agile development, The Unified Process (UP)Organising development projects Requirements Engineering: Documenting requirements, user stories, use cases and scenarios Introduction to UML: Review of object-oriented principles, UML use case, class, sequence, activity, state, component and deployment diagrams. UML models The Analysis and Design Process: User story realisation, Object-oriented modelling, Incremental refinement, Design Principles: Software architecture, Separation of concerns, Design patterns, Object-Oriented design practices, Refactoring, Testing: Unit Testing, Test-Driven Development, Functional Testing.		
Texts: 1) R. S Pressman, Software Engineering: A Practioner's Approach, 5th Ed, McGraw-Hill, 2001.		
References: 1) I. Sommerville, Software Engineering, 8th Ed, Addison-Wesley, 2007. 2) Jim Arlow, Ila Neustadt. UML and the Unified Process Addison Wesley. 2nd Edition, 2005. 3) Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide (2nd Edition), Addison Wesley, 2005.		

CS 331	Software Engineering Lab	0-0-0-3

Software Engineering Principles: Overview of the software engineering discipline, Software lifecycle models, Agile development, The Unified Process (UP)Organising development projects Requirements Engineering: Documenting requirements, user stories, use cases and scenarios Introduction to UML: Review of object-oriented principles, UML use case, class, sequence, activity, state, component and deployment diagrams. UML models The Analysis and Design Process: User story realisation, Object-oriented modelling, Incremental refinement, Design Principles: Software architecture, Separation of concerns, Design patterns, Object-Oriented design practices, Refactoring, Testing: Unit Testing, Test-Driven Development, Functional Testing.

Texts:

1) Jim Arlow, Ila Neustadt. UML and the Unified Process Addison Wesley. 2nd Edition, 2005.

2) R. S Pressman, Software Engineering: A Practioner's Approach, 5th Ed, McGraw-Hill, 2001.

References:

1) I. Sommerville, Software Engineering, 8th Ed, Addison-Wesley, 2007.

2) Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide (2nd Edition), Addison Wesley, 2005.

CS340	Computer Graphics	3-0-0-6

Syllabus:
Introduction: Graphics input and output devices; Raster scan and random scan devices.
Output primitives: Points, lines; Line/circle/ellipse-drawing algorithms.
Filled area primitives: Scan line polygon fill algorithm; Boundary-fill and flood-fill algorithms.
2D geometrical transformation: Translation, rotation, scaling, reflection, shear; Matrix representations.
2D viewing: Viewing pipeline; Viewing coordinate reference frame; Window-viewport coordinate transformation; Line/polygon clipping algorithms.
3D object representation: Polygon surfaces and quadric surfaces: Spline representation; Hermite, Bezier and B-Spline curve representations; Bezier and B-Spline surfaces; Polygon rendering methods.
3D geometrical transformation & viewing.
Visible surface determination: Visible line and surface determination methods; Depth cueing.
Graphics Architecture: GPU; Graphics pipeline; DirectX, OpenGL.

Text:

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, Computer Graphics with OpenGL, 4th Edition, Pearson Education, 2014.

References:

1. Peter Shirley, Michael Ashikhmin and Steve Marschner, Fundamentals of Computer Graphics, 3rd Edition, CRC Press, 2009.
2. Sumanta Guha, Computer Graphics through OpenGL®: From Theory to Experiments, 2nd Edition, CRC Press, 2014.
3. John L. Hennesy and David A. Patterson, Computer Architecture: A Quantitative Approach, 5th Edition, Chapter 4 (Data-Level Parallelism in Vector, SIMD, and GPU Architectures), Elsevier India, 2012.

CS341	Computer Graphics Lab	0-0-3-3

- Programming assignments to learn and practice topics in Computer Graphics using C/C++ and OpenGL.

References:

1. Dave Shreiner, Graham Sellers, John M. Kessenich and Bill M. Licea-Kane, OpenGL® Programming Guide. The Official Guide to Learning OpenGL® Version 4.3, 8th Edition, Addison-Wesley Professional, 2013.
2. Graham Sellers, Richard S Wright Jr. and Nicholas Haemel, OpenGL® SuperBible: Comprehensive Tutorial and Reference, 6th Edition, Addison-Wesley Professional, 2014.

CS 306	Machine Learning	3-0-0-6
Supervised learning algorithms: linear and logistic Regression, gradient descent, support vector machines, kernels, artificial neural networks, decision trees, ML and MAP Estimates, K-nearest neighbor, Naive Bayes, Bayesian networks; Unsupervised learning algorithms: K-means clustering, Gaussian mixture models, learning with partially observable data (EM); Dimensionality reduction and principal component analysis; Model selection and feature selection; Introduction to Markov decision processes; Application to information Retrieval, natural language processing, and image processing etc.		
Texts: 1. T. M. Mitchell, Machine Learning, McGraw-Hill, 2013. 2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2013.		
References: 1. S. Theodoridis and K. Koutroumbas. Pattern Recognition. Academic Press, 2009. 2. S. Haykin. Neural Networks: A Comprehensive Foundation. Prentice-Hall of India, New Delhi, 2007.		

List of Subjects for Elective I

CS 361	Computer and Network Security	3-0-0-6
Objectives of cryptography, Basic cryptographic primitives, Cryptanalysis, Symmetric and Asymmetric key cryptography, stream cipher (Based on LFSR) and block cipher (AES), Public key encryption (RSA, Rabin and ElGamal), Digital signature, Entity authentication, Key Exchange (Diffie Hellman), Key distribution, Lightweight cryptography and its application Attacks and countermeasures: Buffer overflow attacks, Internet worms, viruses, spyware, Spam, phishing, botnets, denial of service, Web security, OWASP top ten, Wireless security. Security and Privacy: Physical Media security, LAN security, TCP/IP and DNS security, routing protocol security, Firewalls and intrusion detection systems, Signature and Anomaly Detection, Traffic Analysis, Operational Network Security, Intrusion prevention system		
Text Books: 1) Behrouz A. Forouzan, Introduction to Cryptography and Network Security, McGraw-Hill 1st edition, 2008. 2) W. Stallings, Cryptography and Network Security: Principles and Practice, 5th Ed, Prentice Hall, 2011.		
References: 1) Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography CRC Press, October 1996, Fourth Printing (July 1999). 2) Kaufman, Perlman, and Speciner, Network Security (2nd edition), Prentice Hall (2002).		

CS362	Topics in Algorithms	3-0-0-6
Syllabus: **Advanced Data Structures**: Hashing, Heap, Red Black trees, B-trees, Interval Trees, Binomial Heap, Fibonacci Heap, van Emde Boas Trees; **Parallel Algorithms**: Introduction to Parallel Algorithm, Parallel Computational Models, Performance Measures of Parallel Algorithms, Parallel Sorting Network, Parallel Searching Algorithms, Root Findings of Linear and Non-Linear Equations, Graph Searching Algorithm, Combinatorial Algorithm for Permutation, Combinations and Derangements **Graph Algorithms**: Introduction to graphs: definition and basic concepts, efficient representations of graphs; Graph Searching: BFS and DFS; Applications of graph searching: finding connected components, bi-connected components, testing for bipartite graphs, finding cycles in graphs; Different MST algorithms; Shortest path algorithms; Hamiltonian graphs: sufficient conditions for Hamiltonian Graphs; Eulerian graphs: characterization of Eulerian graphs, construction of Eulerian tour; Network Flows and Matching; Planarity Testing Algorithms.		
Texts: 1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Cifford Stein. Introduction to Algorithms, 3rd Edition, MIT Press, 2010. 2. Pankaj Sharma. Parallel Algorithms, 2nd Edition, S.K. Kataria & Sons, 2012.		

References:

1. Douglas B. West. Introduction to Graph Theory, 2nd Edition, Prentice Hall, 2001.
2. Alferd.V. Aho, John E. Hopcroft, Jeffrey D. Ullman. Data Structures and Algorithms, Pearson Education, 2009.

B.Tech VII Sem

CS450	**Internet Protocols**	**3-0-0-6**

Syllabus:
Internetworking Protocols: IP, ICMP, IGMP, ARP, RARP, DHCP:Routing Protocols: RIP-2, RIPng for IPV6, OSPF, EIGRP, EGP, BGP:IP Multicast: Mobile IP, IPV6:Quality of Service: Queuing techniques (WFQ, RED, etc.):Multi-Protocol Label Switching (MPLS) and GMPLS:Virtual Private Network (VPN) Protocols: L2TP, PPTP:IP security; VOIP, IPTV, IP service management:Integrated services, differentiated services, RSVP:Transport over IP: TCP, UDP, SCTP, RTP, SNMP.

Texts:
1. Lydia Parziale et. al. TCP/IP Tutorial and Technical Overview, 2006. (Available online at www.ibm.com/redbooks).

References:
1. Adrian Farrel, The Internet and Its Protocols: A Comparative Approach(The Morgan Kaufmann Series in Networking), 2004.

Open Elective

CS401	**Number Theory in Cryptography**	**3-0-0-6**

Syllabus:
Elementary Number Theory: Euclid's Algorithm, Congruence, Chinese Remainder Theorem, Primitive Roots, Finite fields, Quadratic residue and reciprocity, Arithmetic Functions. **Primality Testing and Factorization:** Primality Testing, Pseudo-primes, Fermat's pseudo-primes, Pollard's rho method for factorization, Continued fractions, Continued fraction method for factorization. **Public Key Cryptosystems:** Public Key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based crypto-systems, RSA crypto-system, Signature Schemes, Digital signature standard, RSA Signature schemes, Knapsack problem, Attack on RSA, Forging of Digital Signature. **Elliptic Curve Cryptography:** Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Discrete Log problem for Elliptic curves, Factorization using Elliptic Curves and other applications.

Texts:
1. Neal Koblitz *, A course in Number Theory and Cryptography, 2nd Edition, Springer, 1994.*
2. D. R. Stinson, *Cryptography: Theory and Practice*, 3rd Edition, Chapchan & Hall/ *CRC Press, 2006*.

Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, *Introduction to Algorithms* , Second Edition, *PHI,* 2001.
2. William Stallings, *Cryptography and Network Security,* Sixth Edition, Pearson Publication, 2014.
3. Lawrence C. Washington, *Elllliptic Curves: Number Theory and Cryptography*, 2nd Edition, CHAPMAN & HALL/CRC, 2003.
4. Tom M. Apostol, *Introduction to Analytic Number Theory*, 1st Edition, Springer, 1976.

Department Electives

CS402	**Advanced graph algorithms**	**3-0-0-6**

Syllabus:
Basic graph algorithms (BFS, DFS, Shortest path, Max Flow), Matching, Perfect graph and its sub-classes (chordal and interval graphs), Planar graphs, NP-complete graph problems (clique, independent set, dominating set), Approximation algorithms for NP-hard graph problems, Basic randomized algorithms and probabilistic methods (alternation technique, Second moment methods), Basic concept of parameterized complexity

Texts:

1. Neal Koblitz *, A course in Number Theory and Cryptography, 2nd Edition, Springer, 1994.*

2. D. R. Stinson, *Cryptography: Theory and Practice*, 3rd Edition, Chapchan & Hall/ *CRC Press, 2006*.

Reference Books:

1. D. B. West, Introduction to Graph Theory, 2nd Edition, Prentice Hall, 2001
2. R. Diestel, Graph Theory, 4th Edition, Springer, 2010
3. M.C. Golumbic, Algorithmic graph theory and perfect graphs, 2nd Edition, Elsevier, 2004
4. D. P. Williamson and D. B. Shmoys, The design of approximation algorithms, Cambridge University Press, 2010
5. M. Mitzenmacher and E. Ufpal, Probability and Computing_Randomized algorithms and probabilistic analysis, Cambridge University Press, 2005
6. M. Cygan, F. V. Fomin, L. Kowalik, D. Lokshtanov, D. Marx, M. Pilipczuk, M. Pilipczuk and S. Saurabh, Parameterized Algorithms, Springer, 2015

CS430	**Parallel Programming**	**3-0-0-6**

Syllabus:

Introduction to course; Introduction to parallel computing; Single Processor Machines; Principles of parallel algorithm design; Parallel Models; Parallel Machines and programming models; Basic techniques in parallel computing; Analytical models of parallel programming; Programming shared address space platforms; PThreads; Dense Linear Algebra; OpenMP; Graphics Processing Units (GPU); Compute Unified Device Architecture (CUDA); Distributed Memory Machines; Introduction to Message Passing; MPI Basics; Implementation of MPI primitives; Parallel graph computations; Benchmarking; Overview of parallel programming models; Partitioned Global Address Space (PGAS); Hybrid programming models; MPI + X; Cloud computing and virtualization; Map-reduce

Texts:

1. Introduction to Parallel Computing by Ananth Grama et. al.
2. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn

Reference *Books:*

1. An Introduction to Parallel Algorithms by Joseph Jaja.
2. Various publications and reading materials that will be posted along with lecture slides.

CS440	**Image and Video Processing**	**3-0-0-6**

Syllabus:

Image Representations: Image acquisition, Sampling, Quantization **Visual Perception and Color Spaces:** Physiological characteristics of the eye and image formation

Human color vision: Color models: CIE, RGB, CMYK, HSI, HSV, L*a*b*

Spatial Domain Image Enhancement and Filtering: Point processing (contrast enhancement, histogram equalization), Spatial domain 2-D LSI filtering, Median filtering

Frequency Domain Image Filtering and Enhancement: 2-D Discrete Fourier Transform, Frequency domain LSI filtering, Enhancement in the frequency domain **,** DCT

Image Compression: JPEG **Multi-resolution and Wavelet Transform Video representation and compression:** MPEG2, H.264/AVC

Texts:

1. Digital Image Processing, 3rd edition by Gonzalez, Woods, Pearson Education India

Reference Books:

1. Handbook of Image and Video Processing, 2nd edition, Editor A L Bovik, Academic Press;
2. Fundamentals of Digital Image Processing, 1st edition by Anil K. Jain, Prentice Hall India Learning Private Limited; (2015)
3. Digital video Processing, 2nd Edition, by M. Tekalp, Prentice Hall International

B.Tech VIII Sem

Department Electives

CS412	Game Theory	3-0-0-6

Syllabus:
Games and equilibria, two player Zero-Sum Games, Nash equilibria and existence properties, complexity of finding Nash equilibria, information, strategic, dynamic and repeated games, bargaining, auction and mechanism design with applications, market equilibria, inefficiency of equilibria, routing games, load balancing games.

Texts:
1. E. N. Barron, Game Theory: An Introduction, Wiley, 2nd edition, 2013.

References:
1. N. Nisan, T. Roughgarden, V. Vazirani and E. Tardos, Algorithmic Game Theory, Cambridge University Press, 1st edition, 2007.

CS414	Advance Architecture	3-0-0-6

Syllabus:
Introduction: review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. **Pipelining:** Basic concepts of pipelining, data hazards, control hazards, and structural hazards, Techniques for overcoming or reducing the effects of various hazards. **Hierarchical Memory Technology:** Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses, mapping and management techniques, memory replacement policies. **Instruction-level parallelism:** Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP, Superscalar and VLIW processor architectures. **Multiprocessor Architecture:** Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture.

Texts:
1. Computer Architecture: A Quantitative Approach - J. L. Hennessy and D. A. Patterson, Morgan Kaufmann, (fourth edition) 2006.

References:
1. Parallel Computer Architecture: A Hardware/Software Approach - David Culler, J.P. Singh and Anoop Gupta, Morgan Kaufmann, (first edition) 1998.

CS415	Ubiquitous Computing	3-0-0-6

Syllabus:
Introduction to ubiquitous systems: properties and challenges – pervasive solutions, architectural design of UbiCom systems: smart DEI model – Applications and requirements: tabs, pads, liveboards, smart classroom, smart home, smart transport system, other projects in the domain of IoT – Smart device access: tagging physical objects – RFID tags – MEMS – controllers – Context awareness: types, representation, adaptation, modeling and architecture, mobility, spatial and temporal awareness – Location in ubiquitous systems: location representation, location tracking, location systems, location management principles and techniques – Introduction to mobile middleware: adaptation – agents – service discovery – Introduction to sensor and ad hoc networks: properties – applications – design challenges – autoconfiguration – communication scheduling – mobility requirements – deployment and self organization – data routing – fault tolerance and reliability – energy efficiency – Ubiquitous communication: NFC, ADLS broadband, Bluetooth, ZigBee, WLAN, WiMax, 6LoWPAN, RPL, PLC, PAN, Body Area Network – network access control – group communication – service oriented network – Privacy in Ubiquitous Computing: understanding privacy – motivation – challenges – privacy enhancing technologies basics

Text Books:
1. **Ubiquitous Computing: smart devices, environments and interactions** by Stefan Poslad, Willey Publication
2. **Fundamentals of Mobile and Pervasive Computing** by Frank Adelstein, Sandeep K.S. Gupta, Golden G. Richard III, Loren Schwiebert, McGraw Hill Education Pvt Ltd

References:
1. **Ubiquitous Computing Fundamentals** by John Krumm, CRC Press

CS460	Financial Engineering	3-0-0-6

Syllabus:

Introduction of financial system, financial markets, and financial instruments: stocks, bonds, derivatives, mutual funds; Interest rates, present and future values of cash flow streams; Bonds and bonds pricing, yield, duration and convexity; Mean-variance portfolio optimization, two and one fund theorems, capital asset pricing model, security market line; no-arbitrage principle; Hedging, pricing, forward and futures contracts and their pricing, hedging strategies using futures; Call and put options, hedging strategies involving options, Pay-off curves of options combinations, single and multi period binomial lattice models, risk neutral probabilities, pricing American options, Cox-Ross-Rubinstein(CRR) formula, Black-Scholes option pricing formula.

Text Books:

1. D. G. Luenberger (1998), Investment Science, Oxford University Press, New York.
2. J. C. Hull (2000), Options, Futures and other Derivatives, Fourth edition, Prentice Hall Inc., Upper Saddle River.

References:

1. M. Capinski and T. Zastawniak (2003), Mathematics for Finance: An Introduction to Financial Engineering and Springer-Verlar, London.
2. S. Chandra, S. Dharmaraja, A. Mehra, R. Khemchandani , Financial Mathematics: An Introduction, Alpha Science International Ltd.

Indian Institute of Information Technology Senapati Manipur

B.Tech. Course ECE Syllabus

B.Tech I Sem

EC101	Digital Design	3-1-0-8

Syllabus:

Binary Arithmetic: Representation of integers, fractions and signed numbers in different codes; Addition and subtraction operations on binary-coded numbers; Algorithms for performing multiplication and division.

Combinational Circuits: Boolean expressions and their minimization using algebraic identities; Karnaugh map representation and minimization of Boolean functions using K-map; Two-level realizations using gates -- AND-OR, OR-AND, NAND-NAND and NOR-NOR structures.

Combinational Circuits using MSI Modules: Multifunction gates, Multi-bit adder, Multiplexers, Demultiplexers, Decoders, Programmable ALU; Multiplexer-based realization of K-maps; Combinational circuit design using multiplexers and gates.

Sequential Circuits: Latches and Flip-flops; Ripple counters using T flip-flops; Synchronous counters; Shift Registers; Ring and MLS counters; Sequence generator using J-K / D flip-flops.

Memories, Microprocessors and Microcomputer Organization: RAM, ROM, PAL, PLA, Introduction to microprocessor and microcomputer organization; Central processing unit (CPU), memory and input/output devices.

Texts:

1. M. Morris Mano, Digital Logic and Computer Design, 11th Edition, Pearson Education, 2009.
2. R. S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085

References:

3. Ronald J Tocci, Neal S Wisdmer and Gregory L. Moss, Digital Systems: Principle and Applications, 10th Edition, Pearson Education, 2011.
4. Albert Paul Malvino, Donald P Leach and Gautam Saha, Digital Principles and Applications 7th Edition, Tata McGraw - Hill Education, 2011.

EC110	Digital Design Lab	0-0-3-3

Familiarization with digital IC family 74LS00 and 74HS00. Familiarization with laboratory equipments – voltage generator, function generator, oscilloscope. Study of digital IC characteristics – input voltage, input current, output voltage, output current, fan out, noise margin and propagation delay.

Combinational logic circuits: Implementation of Boolean functions using logic gates; Arithmetic operations using logic gates; Implementation of Multiplexers, Demultiplexers, Encoders, Decoders; Implementation of Boolean functions using Multiplexers/Decoders

Study of sequential logic circuits: Implementation of flip flops, Implementation of counters, Implementation of sequence generators

Microprocessor: Programming in 8085 microprocessor

EC102	Electrical Circuit Analysis	3-1-0-8

Syllabus:

Basic components and electric circuits: charge, current, voltage and power, voltage and current sources, Ohm's law; Voltage and current laws: nodes, paths, loops and branches, Kirchoff's current law, Kirchoff's voltage law, independent sources, voltage and current division;
Basic nodal and mesh analysis: nodal analysis, supernode, mesh analysis, supermesh;
Network theorems: linearity and superposition, source transformations, Thevenin and Norton equivalent circuits, maximum power transfer;
RL and RC circuits: source-free RL circuit, source-free RC circuit, unit-step function, driven RL circuits, natural and forced response, driven RC circuits;
RLC circuit: source-free parallel circuit, overdamped parallel RLC circuit, critical damping, underdamped parallel RLC circuit, source-free series RLC circuit, complete response of the RLC circuit;
Sinusoidal steady-state analysis: forced response to sinusoidal functions, complex forcing function, phasor, phasor relationship for R, L and C, impedance, admittance, phasor diagrams, instantaneous power, average power, apparent power and power factor, complex power;
Polyphase circuits: polyphase systems, single-phase three-wire systems, three-phase Y-Y connection, delta connection, power measurement in three-phase systems;
Magnetically coupled circuits: mutual inductance, energy considerations, linear transformer, ideal transformer; Frequency response: parallel and series resonance, Bode plots, Filters;
Two-port networks: one-port networks, admittance parameters, impedance parameters, hybrid parameters, transmission parameters.

Texts:

1. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata-McGraw-Hill Publishing Company Limited, 7th / 8th Edition, 2010/ 2012.

References:

1. Bruce Carlson, Circuits: Engineering Concepts and Analysis of Linear Electric Circuits, 2nd Reprint, Thomson Asia Pvt. Ltd., 2006.
2. R. A. De Carlo and P. M. Lin, Linear Circuit Analysis, 2nd Edition, Oxford University Press, 2001.

B.Tech II Sem

EC103	Basic Electronic Circuits	3-1-0-8

Objective - After pursuing this course the students shall be able to: 1. develop simple electronic circuits, 2. analyze the behavior of basic electronic circuits, 3. use operational amplifiers as basic building blocks of analog electronic circuits

Course Topics - Examples of Electronic Systems: Music System, Radio, Television, D-C power supply: Diode characteristics, half-wave and full wave rectifiers, shunt capacitor filter, voltage regulator, regulated D-C power supply.

Amplifier: Amplifier parameters, controlled source models, classification, the operational amplifier (OP-AMP) as a linear active device, the VCVS model of an op-amp, different amplifier configurations using op-amp, frequency response of op-amp and op-amp based amplifiers.

Filter: Concepts of low-pass, high-pass and band-pass filters, ideal (brick-wall) filter response, frequency response of simple RC filters, active RC filters using Op-amp.

Oscillator: Effects of negative and positive feedback of an amplifier, condition of harmonic oscillation, RC and LC oscillator circuits.

Comparator: Op-amp as a comparator, digital inverters (TTL/CMOS) as comparators, comparator with hysteresis, Schmitt trigger using Op-amp, 555 timer as a two dimensional comparator.

Waveform generators: Concept of bistable, monostable and astable circuits, timer and relaxation oscillator based on comparator and RC timing circuit, square wave generator using 555 timer, crystal clock generator.

Analog-Digital conversion: Digital to Analog Converter (DAC) using binary resistor scheme, R-2R ladder DAC, DAC using switched current resources, Analog to Digital converter (ADC) using capacitor charge/discharge: single-slope and dual-slope ADCs, ADC using counter and DAC, ADC using successive approximation.
Outcome - As a result of this course students become acquainted with basics of electronic circuits at least at the system integration level.

Texts:
1. Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits, International Version 6th Edition, 2013, Oxford University Press India

EC111	**Basic Electronics Lab**	**0-0-3-3**
Experiments using diodes: diode characteristics, design and analysis of half-wave and full-wave rectifier circuits without and with filter, clipping circuits, clamper circuits, experiments using operational amplifier: inverting amplifier, non-inverting amplifier, voltage follower, integrator, differentiator, comparators, Multivibrators, Wien's Bridge Oscillator, first-order filters, D/A and A/D converters.		

B.Tech III Sem

EC201	**Analog Circuits**	**3-1-0-8**
Syllabus: Review of working of BJT, JFET and MOSFET and their small signal equivalent circuits both for low and high frequencies; Different types of biasing for BJT and MOSFET, Bias Compensation, Thermal Stabilization; Single stage amplifiers CE-CB-CC and CS-CG-CD; Multistage amplifiers: RC Coupled, Transformer Coupled, Direct Coupled amplifier and their frequency responses; Differential amplifiers: DC and small signal analysis, CMRR, current mirrors, active load and cascade configurations, frequency response; case study: 741 op-amp – DC and small signal analysis, frequency response, frequency compensation, GBW, phase margin, slew rate, offsets; Feedback amplifiers: basic feedback topologies and their properties, analysis of practical feedback amplifiers, stability; Power Amplifiers: class A, B, AB, C, D, E stages, output stages, short circuit protection, power transistors and thermal design considerations, Tuned Amplifier; Filter: filter approximations: Butterworth, Chebyshev and elliptic, first order and second order passive/active filter realizations.		
Text: 1. Adel S. Sedra, Kenneth C. Smith &Arun N. Chandorkar, Microelectronic Circuits, International Version 6th Edition, Oxford University Press India, 2013.		
References: 1. P. Gray, P. Hurst, S. Lewis and R. Meyer, Analysis &Design of Analog Integrated Circuits, 5/e, Wiley, 2009. 2. Millman,Halkias, Parikh – Integrated Electronics, 2/e,Penguin Books Ltd, 2009. 3. Sergio Franco - Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, McGraw Hill Book Company, 2001.		

EC202	**Analog Circuits Lab**	**0-0-3-3**
Experiments using BJTs: BJT characteristics in different configurations, hybrid parameters, single-stage and multistage BJT amplifiers, effect of negative feedback; experiments using FETs: FET characteristics, FET amplifiers; current mirror, differential amplifier, filters, voltage regulators.		

EC241	**Signals and Systems**	**3-0-0-6**
Signals: Signal Basics, Elementary signals, classification of signals; signal operations: scaling, shifting and inversion; signal properties: symmetry, periodicity and absolute integrability; Sampling and Reconstruction, Sampling and Nyquist theorem, aliasing, signal reconstruction: ideal interpolator, zero-order hold, first-order hold; Sinc function, Practical reconstruction. Systems: classification of systems; Time-Domain Analysis of Continuous-Time Systems; system properties: linearity, time/shift-invariance, causality, stability; continuous-time linear time invariant (LTI) and discrete-time linear shift invariant (LSI) systems: impulse response and step response; response to an arbitrary input: convolution; circular convolution; system representation using differential equations; Eigen functions of LTI/ LSI systems, frequency response and its relation to the impulse response. Signal representation: signal space and orthogonal basis; continuous-time Fourier series and its properties; continuous-time Fourier transform and its properties; Parseval's relation, time-bandwidth product; discrete time fourier series; discrete-time Fourier transform and its properties; relations among various Fourier representations. Linear Convolution using DFT. Fast Fourier Transform (FFT); Laplace transform and properties, Inverse Laplace Transform by Partial Fraction and Z-transform: definition, region of convergence, properties; transform-domain analysis of LTI/LSI systems, system function: poles and zeros; stability, inverse Z-Transform by Partial Fraction.		
Text: 1. M. J. Roberts, "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill, 2007.		

References::

1. A.V. Oppenheim, A.S. Willsky and H.S. Nawab, "Signals and Systems", 2nd Edition Prentice Hall of India, 2006.
2. B. P. Lathi, "Signal Processing and Linear Systems", 1st Edition , Oxford University Press, 1998.
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th Edition, Prentice Hall, 1998.
4. Simon Haykin, Barry van Veen, "Signals and Systems", 2nd Edition, John Wiley and Sons, 1998.

EC242	Signals and Systems Lab	0-0-3-3

Matlab code generation and execution for the following modules: Generation of the basic continuous and discrete time signals, Basic Mathematical Operations on Signals, Convolution-All types, Continuous and Discrete time fourier series, Continuous and Discrete time fourier Transform, Sampling, Laplace transform and applications, Z transform and applications, Application of Matlab in Image Processing.

B.Tech IV Sem

EC251	Principles of Communication	3-1-0-8

Basic blocks in a communication system: transmitter, channel and receiver; baseband and pass band signals and their representations; concept of modulation and demodulation. Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB), double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation; angle modulation -- phase modulation (PM) & frequency modulation (FM); narrow and wideband FM. AM transmitter – Broadcast transmitters – SSB transmitter – Radio telegraphy transmitter – FM transmitter – Tuned radio frequency and super heterodyne receivers – AM broadcast receiver – SSB receivers – Diversity reception – FM receivers. Pulse Modulation: sampling process; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM); line coding; differential pulse code modulation; delta modulation; adaptive delta modulation. Noise in CW and pulse modulation systems: Receiver model; signal to noise ratio (SNR); noise figure; noise temperature; noise in DSB-SC, SSB, AM & FM receivers; pre-emphasis and de-emphasis, noise consideration in PAM and PCM systems. Basic digital modulation schemes: Phase shift keying (PSK), amplitude shift keying (ASK), frequency shift keying (FSK) and Quadrature amplitude modulation (QAM); coherent demodulation and detection; probability of error in PSK, ASK, FSK & QAM schemes. Multiplexing schemes: frequency division multiplexing; time division multiplexing.

Text:

1. J. G. Proakis and M. Salehi, Communication system engineering, 2nd Edition, Pearson Education Asia, 2002.
2. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 5th Edition, John Wiley & Sons, 2001.

References :

1. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2001.
2. K. Sam Shanmugam, Digital and Analog Communication Systems, 1st Edition, John Wiley and Sons, 1979.
3. A. B. Carlson, Communication Systems, 3rd Edition, McGraw Hill, 1986.
4. B. P. Lathi, Modern Analog and Digital Communication systems, 3rd Edition, Oxford University Press, 1998.
5. H. Taub and D. L. Schilling, Principles of Communication Systems, 2nd Edition, McGraw Hill, 1986.

EC252	Communications Lab	0-0-3-3

Amplitude Modulation -- Implementing the switching function using with the help of diode based ring modulator: AM generation, Demodulation of AM signal using envelope detector, To generate a conventional AM signal using multiplier chip AD633, To design and implement an envelope detector for appropriate demodulation of AM signal. Frequency Modulation -- FM generation using IC555, Demodulation using slope detector. Pulse Amplitude Modulation -- Generation of PAM signal, Reconstruction of PAM signal, Pulse Width Modulation -- Generation of PWM and PPM signals, Demodulation of PWM signals.

Matlab Experiments: Generation of AM signal, Demodulation of AM signal, Understanding Signal correlation, Autocorrelation, Cross correlation of signals, Power spectral density of signals, Modulation and demodulation of FM signals, Modulation and Demodulation of DSB-SC, Modulation and Demodulation of SSB-SC, Modulation and demodulation of PAM, PPM, PWM waveforms, QAM modulation, Communication receiver and BER performance, RZ, NRZ, Manchester codes.

EC243	Digital Signal Processing	3-0-0-6

Syllabus :

Review of discrete time signals, systems and transforms: Discrete time signals, systems and their classification, analysis of discrete time LTI systems: impulse response, difference equation, frequency response, transfer function, DTFT, DTFS and Z-transform.

Frequency selective filters: Ideal filter characteristics, lowpass, highpass, bandpass and bandstop filters, Paley-Wiener criterion, digital resonators, notch filters, comb filters, all-pass filters, inverse systems, minimum phase, maximum phase and mixed phase systems.

Structures for discrete-time systems: Signal flow graph representation, basic structures for FIR and IIR systems (direct, parallel, cascade and polyphase forms), transposition theorem, ladder and lattice structures.

Design of FIR and IIR filters: Design of FIR filters using windows, frequency sampling, Remez algorithm and least mean square error methods; Design of IIR filters using impulse invariance, bilinear transformation and frequency transformations.

Discrete Fourier Transform (DFT): Computational problem, DFT relations, DFT properties, fast Fourier transform (FFT) algorithms (radix-2, decimation-in-time, decimation-in-frequency), Goertzel algorithm, linear convolution using DFT. Multi-dimensional DFT (M-D DFT) and its computation.

Finite wordlength effects in digital filters: Fixed and floating point representation of numbers, quantization noise in signal representations, finite word-length effects in coefficient representation, roundoff noise, SQNR computation and limit cycle.

Introduction to multirate signal processing: Decimation, interpolation, polyphase decomposition; digital filter banks: Nyquist filters, two channel quadrature mirror filter bank and perfect reconstruction filter banks, subband coding. Applications of multi-rate filters in signal processing and communication. Adaptive digital filters and their applications. Introduction to wavelet transform and its applications. Case studies of applications of DSP: Applications in audio, medical and communication.

Text:

1. A. V. Oppenheim and R. W. Shafer, Discrete-Time Signal Processing, 2nd Edition, Prentice Hall India, 2004.
2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson Education, 2007.
3. E. C. Ifeachor and B. W. Jervis, Digital Signal Processing: A Practical Approach, 2nd Edition, Pearson, 2006.

References :

1. V.K. Ingle and J.G. Proakis, Digital Signal Processing using MATLAB, Cengage, 2008.
2. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th Edition, McGraw Hill, 2006.
3. T. Bose, Digital Signal and Image Processing, John Wiley and Sons, Inc., Singapore, 2004.
4. L. R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall India, 2005.
5. A. Antoniou, Digital Filters: Analysis, Design and Applications, 2nd Edition, Tata McGraw-Hill, New Delhi, 2009.
6. T. J. Cavicchi, Digital Signal Processing, John Wiley and Sons, Inc., Singapore, 2002.

EC244	Digital Signal Processing Lab	0-0-3-3

List of Experiments:

1. Generation of signals – (i) ramp signals at different sampling frequencies, (ii) sinusoid signals, (iii) multi-toned sinusoid signals, (iv) pseudo random noise sequence.
2. Echo generation using three different delay.
3. Generation of AM and FM signals.
4. Application of mean filtering on a noisy sinusoid.
5. Application of autocorrelation function to generate sinusoid from a noisy signal.
6. Design of filters, IIR filter and FIR filter.

EC260	Semiconductor Devices	3-0-0-6

Syllabus:

Brief discussion of quantum theory of solids: energy bands, electrical conduction in solids, formation of Fermi-Dirac probability function using the concepts of statistical mechanics and k-space diagram.

Semiconductors in equilibrium: charge carrier profile in intrinsic and extrinsic semiconductor, behavior of Fermi energy level with varying temperature and doping concentration.

Carrier transport in semiconductors: drift current and diffusion current, Hall Effect. Semiconductors in non-equilibrium condition: carrier generation and recombination, continuity equation, ambipolar transport.

P-N junction: under zero applied bias and reverse bias, comparative study of abrupt junction and linearly graded junction, qualitative and quantitative discussion of p-n junction current, small signal model of p-n junction, junction breakdown and Tunnel diode.

Behavior of metal semiconductor junction: Schottky barrier diode, metal-semiconductor ohmic contact.

Bipolar transistor: basic principles of operation, carrier distribution under different modes of operation, non-ideal effects, frequency limitations. Fundamentals of MOSFET, capacitance-voltage characteristics, current voltage relationship, frequency limitations.

Text:

1. Donald A. Neamen, Semiconductor Physics and Devices, Tata McGraw Hill, 3rd Edition, 2007

References :

1. Ben G. Streetman, Solid State Electronic Devices, PHI, 5/e, 2001.
2. J. Singh, Semiconductor Devices - Basic Principles; John Wiley & Sons Inc., 2001.
3. Simon M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley, 3/e, 2006/7.

B.Tech V Sem

EC351 Digital Communication 3-1-0-8

Syllabus:

Review of the basics of Digital Communication System: message symbols, signaling waveforms, constellation diagram, distance metric; Performance metrics – Error rates, Data rates, Transmit power, Receiver sensitivity, Range of communication. Communication channels – Additive-White-Gaussian Noise (AWGN) channel, Band-limited channel (Inter-Symbol-Interference: ISI channel), Fading Multipath channel.

Transmission of message symbols by carrier modulation (bandpass signaling): Carrier Amplitude modulation – ASK, MASK; Carrier Phase modulation – BPSK, QPSK, Offset QPSK, MPSK; Quadrature-amplitude modulation (QAM) – MQAM; Constellation diagram for MPSK and MQAM signaling, minimum distance in a signal constellation, Gray-coded symbols, BER in terms of minimum distance; Comparison of various modulation schemes.

Frequency Modulation: BFSK, MFSK; Phase-coherent demodulation, Non-coherent demodulation; Probability of error; Continuous-phase FSK (CPFSK), Minimum-shift keying, Probability of error; Continuous-phase modulation (CPM).

Differential modulation schemes – DBPSK (DPSK), DQPSK, π/4-QPSK; Probability of error; Non-coherent receiver.

Synchronization: Carrier frequency and phase synchronization (coherent receiver); Symbol time synchronization (clock recovery).

Digital Communication through band-limited AWGN channel: Inter-symbol interference (ISI), Eye-diagram; signal design for band-limited channel for zero ISI – Nyquist criterion, raised-cosine and square-root raised cosine signals for transmit and receive pulse shaping; Partial-response signaling.

Selected topics in Digital Communication:

(a) Communication through fading multi-path channel
(b) Multi-carrier modulation and OFDM
(c) Spread-spectrum communication

Texts:

1. J. G Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education, 2005.
2. S. Haykin, "Communication Systems", Wiley- Student Edition, 5/e, 2010.

References:

1. B. Sklar, "Digital Communication: Fundamentals and Applications", Pearson India, 2/e, 2009.
2. I. Clover, "Digital Communication", Pearson India, 2/e, 2007.
3. J. B. Anderson, "Digital Transmission Engineering", IEEE Press, Wiley-Interscience, 2/e, 2005.
4. S. Haykin, "Digital Communication Systems", Wiley Student Edition, 2014.

EC352 Digital Communication Lab 0-0-3-3

Pulse shaping, Carrier modulations: ASK, PSK, FSK, QAM, MSK, Inter symbol interference, Measurement of Receiver Sensitivity, Nyquist criterion, Receiver performance with noise, Matched filter receiver, correlation receiver, BER performance of digital modulation techniques, Differential modulation schemes – DBPSK (DPSK), DQPSK, π/4-QPSK; M-ary signals, M-ary pulse-amplitude modulation, M-ary orthogonal signals. Performance evaluation under fading. Implementation of AWGN channel, Band-Limited Channel.

EC301 Analog Integrated Circuit 3-0-0-6

Syllabus:

Frequency response of different configurations of BJT, MOS amplifiers, Bipolar differential amplifier, and MOS differential amplifier. Feedback, different feedback configurations and frequency response of different feedback amplifiers and their stability analysis. Two stage MOS operational amplifier, MOS telescopic cascode amplifier, Folded cascode amplifier and their frequency response. Different output stages and their characterization. Voltage and current references. Low current, supply insensitive and temperature insensitive biasing. Non-linear analog circuits: precision rectification, analog multipliers, phase locked loop. Different types of filters, filter transfer functions, implementation and realization of active filters.

Texts:

1. P. Gray, P. Hurst, S. Lewis and R. Meyer, Analysis & Design of Analog Integrated Circuits, 5/e, Wiley, 2009.

References:

1. Adel S Sedra, Kenneth C Smith, Microelectronics Circuits, Theory and Applications, Oxford International Students Edition.
2. BehzadRazavi, Design of Analog CMOS Integrated Circuits, McGraw hill Education.

EC302	**Analog Integrated Circuit Lab**	**0-0-3-3**

Implementation and characterization of different feedback amplifiers, current mirror load differential amplifier. Behavioural study of different current biasing scheme. Implementation and characterization of oscillators. Study of VCO, PLL. Design and implementation of active LPF, HPF, BPF filters.

EC370	**Electromagnetics**	**3-1-0-8**

Syllabus:

Electrostatic field: Coulomb's and Gauss's law and its applications, Electric dipole; Electrostatic Boundary-Value Problems: Poisson's and Laplace equations, Uniqueness theorem, Resistance and capacitance, Method of image; Electric fields in material space: Conductor in field, Polarization in dielectrics, Continuity equation, Kirchoff's Voltage and Current laws, Boundary conditions at different interface; Magnetostatic Fields: Biot-Savart's and Ampere's Circuital law and its application; Magnetic vector potentials; Magnetic dipoles; Magnetization and behavior of magnetic materials; Electromagnetic waves: Maxwell's equations: Faraday's law of electromagnetic induction, Maxwell's discovery, Maxwell's equations and boundary conditions, Time-harmonic fields. Wave equation and plane waves: Helmholtz wave equation, Solution to wave equations and plane waves, Wave polarization, Poynting vector and power flow in em fields; Plane wave reflection from a media interface: Plane wave in different media, Plane wave reflection from a media interface, Plane wave reflection from a complex media interface.

Numerical Methods: FDM, MoM, FEM

Basics of Antenna: Radiation fundamentals, parameters, some basic radiators

Texts:

1. M. N. O. Sadiku, Principles of Electromagnetics, 4th Edition, Oxford University Press, 2007.
2. D. K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Pearson, 2001.

References:

1. M.N.O. Sadiku, *Numerical Techniques in Electromagnetic, 2nd Edition,* CRC Press, 2000.
2. R. F. Harrington, Time-Harmonic Electromagnetic Fields, 2nd Edition Wiley-IEEE, 2001.
3. N. Ida, Engineering Electromagnetics, 1st Edition, Springer, 2000.
4. W.H.Hayt & J.A.Buck, Engineering Electromagnetics, 7thEdition Tata-McGraw-Hill, 2006.
5. C. A. Balanis, Advanced Engineering Electromagnetics, 2nd Edition, John Wiley, 2012.
6. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition, John Wiley, 2005.

EC380	**Control Systems**	**3-1-0-8**

A control system consisting of interconnected components is designed to achieve a desired response of a system. At the end of this course, the student shall be able to analyse stability of a system and design controller for linear time invariant systems.

Syllabus:

Mathematical models of physical systems: differential equations of physical systems, state-space models, transfer functions, block diagram algebra, signal flow graphs. Time-domain techniques: response of second-order systems, characteristic-equation and roots, Routh-Hurwitz criteria, Root-Locus. Frequency-domain techniques: frequency responses, Bode-plots, gain-margin and phase-margin, Nyquist plots. Compensator design: proportional, PI and PID controllers, lead-lag compensator. Modern control system techniques: state-space representations of transfer functions, controllability, observability, pole placement by state feedback, observer and observer based state feedback control, Linear Quadratic Regulator (LQR).

Texts:

1. R. C. Dorf and R. H. Bishop, Modern Control Systems, Prentice Hall, 2010.

References:

1. K. Ogata, Modern Control Engineering, Prentice Hall India, 2010.
2. B. C. Kuo, Automatic Control Systems, Wiley, 2002.
3. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age Publishers, 2010.
4. G. C. Goodwin, S. F. Graebe, and M. E. Salgado, Control System Design, Prentice Hall, 2000.

B.Tech VI Sem

EC353	**Information Theory and Coding**	**3-0-0-6**

Syllabus:

Information Theory**:** Entropy, mutual information, source coding, channel capacity, Shannon's noisy coding theorem, differential entropy, Gaussian channel, rate distortion function.

Coding Theory**:** Linear block codes: generator and parity check matrices, standard Array and syndrome Decoding. Convolutional codes: Convolutional encoder representation, decoding of convolutional codes: maximum likelihood detection, the Viterbi Algorithm.

Texts:

1. T. M. Cover and J. A. Thomas, Elements of Information Theory, 1/e, John Wiley, 1991.
2. S. Lin and D.J. Costello, Error Control Coding, 2/e, Prentice-Hall, 2004.

References:

1. R. B. Ash, Information Theory, 1/e, Dover Publisher, 1990.
2. Todd K. Moon, Error Control Coding: Mathematical Methods and Algorithms, 1/e, Wiley, 2005.

EC361	**VLSI Design**	**3-0-0-6**

Syllabus:

Overview of VLSI design methodology, overview of VLSI design flow, fabrication process flow, layout design rules, full custom mask layout design, MOSFET scaling and small geometry effects. Brief ideas of MOS modeling. MOS inverters as VLSI design building blocks. Inverter static characteristics and dynamic characteristics; switching and interconnect issues. Combinational and sequential MOS logic circuits. Dynamic logic circuits using MOS. Construction and characterization of semiconductor memories.

Text:

1. Jan M. Rabaey, Anantha ChandraKasan, Borivoje Nikolic, Digital Integrated Circuits, A Design Perspective, Prentice Hall, second edition, 2003.

Reference:

1. David Hodges, Analysis and Design of Digital Integrated Circuits, In Deep Submicron Technology (special indian edition)

EC362	**VLSI Design Lab**	**0-0-3-3**

Familiarization with analog and digital CAD tools. Implementation of MOS inverter circuits using CAD tools and verification of different characteristics of an inverter. Implementation MOS current mirrors and current sources. Implementation of NAND and NOR gates using CMOS logic and observation of their static and dynamic behaviors. Design of flip-flop circuits and study of its transient behavior. Mask layout of an inverter, application of design verification rules, RC extraction, pre and post layout comparison of characteristics.

EC371	**Microwave Engineering**	**3-0-0-6**

Syllabus:

Transmission lines and waveguides, modes, Smith chart; Narrowband and broadband impedance matching: L-section impedance matching, stub matching, Quarter wave transformer, Theory of small reflections, Multi section matching transformer, Tapered lines; Microwave networks: N-port microwave networks, Impedance, admittance, transmission and scattering matrix representations, Reciprocal and lossless networks, Network matrices transformations, Equivalent circuit extraction.

Microwave passive circuits: RLC, micro strip and waveguide cavity resonators; Periodic structure and microwave filter, Hybrid junctions, directional couplers and power dividers; Ferrite devices and circulators; Microwave tubes: Limitations of conventi onal tubes, Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes, Microwave solid-state devices: Characteristics of microwave bipolar transistors and FET, Transferred electron devices, avalanche diode oscillators.

Microwave integrated circuits: Planar transmission lines, characteristics of microwave integrated circuits; design of single stage amplifier and oscillator using transistor; PIN diode based control circuits, Microwave antennas.

Texts:

1. D. M. Pozar, Microwave Engineering, 4th edition, John Wiley & Sons Inc, 2012.
2. A. Das and S. K. Das, Microwave Engineering, 18th Reprint, Tata McGraw-Hill, 2007.

References:

1. R. E. Collin, Foundations for Microwave Engineering, 2nd Edition, Wiley-IEEE Press, 2000.
2. R. C. Booton, Computational methods for Electromagnetics and Microwaves, 1st Edition, Wiley, 1992.
3. G. Gonzalez, Microwave Transistor Amplifiers: Analysis and Design, 2nd Edition, Prentice Hall of India, 2007.
4. S. M. Liao, Microwave devices and Circuits, 3rd Edition, Prentice Hall of India, 2004.
5. P. A. Rizzi, Microwave Engineering Passive Circuits, 1st Edition, Pearson, 1998.
6. K. C. Gupta, Microwaves, New Age Publishers, 1st Edition 1983, Reprint 2005.
7. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition John Wiley, 2005.

EC372	**Microwave Engineering Lab**	**0-0-3-3**

Frequency and wavelength measurements; determination of standing wave ratio and reflection coefficient; study of characteristics of Klystron tube and Gunn diodes; study of s-parameters; measurement of unknown impedance; simulation and measurement of antenna parameters.

EC381	**Embedded Systems**	**3-0-0-6**

Syllabus:

Introduction: Introduction to embedded systems with examples, Concept of real-time system, Challenges in embedded system design.

Embedded System Architecture: Basic Embedded processor/Microcontroller architecture, CISC (8051), RISC (ARM) Architecture, and Harvard Architecture (PIC).

Designing Embedded computing platform: The CPU Bus, memory devices, I/O devices, component interfacing, Design with microprocessor.

Embedded system design with FPGs: Introduction to FPGA and Verilog HDL, Hardware Design with Verilog HDL.

Processes and Operating Systems: Multiple Tasks and Multiple Processes; Preemptive Real-Time Operating Systems, Priority-Based Scheduling, Interprocess Communication Mechanisms, Evaluating Operating System Performance, Power Management and Optimization for Processes.

Networks: Distributed embedded architectures; Networks for embedded systems. Case studies: Washing machine, Inkjet printer, telephone exchange, etc

Texts:

1. W. Wolf, "Computers as components: Principles of embedded computing system design", 2/e, Elsevier, 2008.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003.

References:

1. D. Symes, and C. Wright, "ARM system developer's guide: Designing and optimizing system software",Elsevier,2008.
2. Muhammad Ali Mazidi, Janice G.Mazidi, Rolin D.McKinlay, "Jack Ganssle, The 8051 Microcontroller and Embedded Systems ".
3. Jack Ganssle, "The art of designing embedded systems", 2/e, Elsevier, 2008.
4. M. D. Ciletti , "Advanced Digital Design with the Verilog HDL", Prentice Hall, 2010.

EC382	**Embedded system Lab**	**0-0-3-3**

Familiarization with ARM microcontroller development environment, assembler, compiler, simulator, debugger and JTAG; Interfacing: LED Blinking, seven segment display, ADC and DAC interfacing, LCD interfacing, Applications: LCD desk clock, pressure and temperature monitoring, different controller implementation in ARM (P, PI, PID etc.), speed control of DC motor, speed and direction control of stepper motor; project

EC354	**Communication Networks**	**3-0-0-6**

Syllabus:

Introduction: Basics of Data Communications for networking; Packet switching, Store-&-Forward operation; Layered network architecture, Overview of TCP/IP operation. Data Link Layer: Framing; error control, error detection, parity checks, Internet Checksum and Cyclic Redundancy Codes for error detection; Flow control and ARQ strategies; HDLC protocol. Media Access Control (MAC): MAC for wired and wireless Local Area Networks (LAN), Pure and Slotted ALOHA, CSMA, CSMA/CD, IEEE 802.3; ETHERNET, Fast ETHERNET, Gigabit ETHERNET; IEEE 802.11 WiFi MAC protocol, CSMA/CA; IEEE 802.16 WiMAX. Network Layer: Routing algorithms, Link State and Distance Vector routing; Internet routing, RIP, OSPF, BGP; IPv4 protocol, packet format, addressing, subnetting, CIDR, ARP, RARP, fragmentation and reassembly, ICMP; DHCP, NAT and Mobile IP; IPv6 summary. Fundamentals of Queueing Theory: Simple queueing models, M/M/- Queues, M/G/1/ Queues, queues with blocking, priority queues, vacation systems, discrete time queues. Transport Layer: UDP, segment structure and operation; TCP, segment structure and operation. Reliable stream service, congestion control and connection management. Selected Application Layer Protocols: Web and HTTP, electronic mail (SMTP), file transfer protocol (FTP), Domain Name Service (DNS). Network Security: Basics of cryptographic systems, symmetric and public key cryptography, certificates, authentication and use of trusted intermediaries; Security for Wi-Fi systems.

Texts:

1. A. Leon-Garcia and I. Widjaja: Communication Networks; 2/e, McGraw Hill, 2004.
2. J.F. Kurose and K. W. Ross: Computer Networking, A Top-Down Approach, 4/e, Pearson/Addison Wesley, 2008.

References:

1. D. Bertsekas and R. Gallagar, Data Networks, 2/e, PHI, 1992.
2. A. S. Tanenbaum, Computer Networks, 3/e, PHI, 1997.
3. W. Stallings, Data and Computer Communication, 7/e, Prentice-Hall, 2004.

EC300	**Project (Optional)**	**0-0-6-6**
A project work, with primary emphasize on research output. A mentor will be allotted to each student.		

B.Tech VII Sem

EC451	**Mobile Communication**	**3-0-0-6**

Syllabus:

Evolution of mobile radio communication; Different generations of wireless communication and their technical specifications; Overview of current wireless systems and standards, Cellular concept: frequency reuse, channel assignment, handoff, interference, improving system capacity and cell coverage, radio trunking; Mobile radio propagation: free space propagation, reflection, diffraction, scattering, link budget design; Fading: multipath propagation, Doppler shift, impulse response model,multipath parameters, statistical models for multipath propagation; Mitigation of fading effects: equalization, diversity, channel coding; Transmitter and receiver techniques: modulation up to GMSK, line coding, pulse shaping, OFDM; Multiple access: FDMA, TDMA, SSMA, SDMA. MIMO channels. Diversity in wireless communications - Non-coherent and coherent reception; error probability for uncoded transmission; realization of diversity: time diversity; frequency diversity: DSSS and OFDM; receiver diversity: SC, EGC and MRC; transmit diversity.

Texts:

1. T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education, 2004.
2. S. Haykin and M. Moher, Modern Wireless Communications, 1st Edition, Pearson Education, 2005.

References:

1. A. J. Goldsmith, Wireless Communications, Cambridge University Press, 2005
2. G. L. Stuber, Principles of Mobile Communications, Kluwer, 1996.
3. D. Tse and P. Viswanath, Fundamentals of Wireless Communications, Cambridge University Press, 2005.

EC481	**Measurement and Instrumentation**	**3-0-0-6**

Syllabus:

Introduction to instrumentation, Static and dynamic characteristics of measurement Systems, Error and uncertainty analysis, standards and calibration, Bridges and potentiometers, measurement of R,L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes, ohmmeter, loading effect, Transducers classification, Measurement of displacement, velocity, acceleration, strain, force, temperature, pressure, flow, level, conductivity, viscosity and humidity, Signal conditioning; Instrumentation amplifier, isolation amplifier, and other special purpose amplifiers, Time, phase and frequency measurements, Cathode ray oscilloscope, Q meter, DMM, frequency counter, spectrum analyzers, logic probe and logic analyzer; programmable logic controller; Virtual instrumentation, Serial and parallel communication. Shielding and grounding.

Texts:

1. E. O. Deobelin, Measurement Systems: Application and Design, 5th Edition, Tata McGraw-Hill, 2003.
2. A. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 2nd Edition, Phi Learning, 2008.

Reference:

1. B. G. Liptak, Instrument Engineers Handbook: Process Measurement and Analysis, 4th Edition, CRC, 2003.
2. A. K. Sawhney, A course of Electrical and Electronic Measurement and Instrumentation, 9th Edition, Dhanpat Rai Publication, 2014.

Open Elective

EC455	Wireless Sensor Networks	3-0-0-6

Syllabus:

Characteristics of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contentionbased protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol. Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB. Embedded Operating Systems: Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems, Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM. Applications Of WSN: Few WSN Applications.

Texts:

1. KazemSohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Ltd., 2005.

References:

1. Feng Zhao & Leonidas J. Guibas, Wireless Sensor Networks- An Information Processing Approach, Elsevier, 2007.

Department Electives

EC461	VLSI Technology	3-0-0-6

Syllabus:

Introduction on VLSI Design, Crystal Structure of Si, Defects in Crystal, Crystal growth, Epitaxy; Vapour phase Epitaxy, Doping during Epitaxy, Molecular beam Epitaxy, Oxidation; Kinetics of Oxidation, Oxidation rate constants, Dopant Redistribution, Oxide Charges, Diffusion; Theory of Diffusion, Infinite Source, Actual Doping Profiles, Diffusion Systems, Ion - Implantation Process, Annealing, Masking, Lithography, Wet Chemical Etching, Dry Etching, Plasma Etching Systems, Etching of Si,Sio2,SiN and other materials, Plasma Deposition Process, Metallization, MOSFET Fabrication for IC; Metal gate vs. Self-aligned Poly-gate, Tailoring of Device Parameters, CMOS Technology

Texts:

1. S.K. Ghandhi, VLSI Fabrication Principles – Silicon and Gallium Arsenide, 2nd edition, John Wiley and Sons, 2009.

References:

1. J.D. Plummer, M.D. Deal, P.G. Griffin, Silicon VLSI Technology, 2nd edition, Pearson Education, 2008.
2. S.M. Sze, VLSI Technology, 2nd edition, McGraw Hill, 1988.

EC454	Communication Systems	3-0-0-6

ptical Communication:

Basic Introduction**:** Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays

Components: Optical Transmitter, Optical amplifier, Photoreceiver, Transmission media - free-space, twisted pair and coaxial cable, Optical Fiber

Transmission System: Baseband and modulated transmission, bandwidth filtering, demodulation and signal recovery, multimode and single-mode; attenuation and dispersion; Optical MUX and DEMUX - Operating principle of multiplexers and de-multiplexors, optical telecoms

Communication networks: LAN, MAN, WAN; multiplexing (TDM, WDM, SDM); packet- and circuit-switched networks; network protocols, SONET/SDH, All optical networks; Access networks

Noise and Detection: Noise in optical transmitters, amplifiers and detectors, Crosstalk in WDM system: Component, Stimulated Raman Scattering, Four-Wave mixing, etc., Bit error rate, Power Penalty

Recent Developments: Solitons; Optical Time Division Multiplexing; All optical components; Photonic Band Gap Device

Satellite Communication:

Basic Principles: General features, frequency allocation for satellite services, properties of satellite communication systems. Satellite Orbits: Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping. Satellite Links: Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain. Earth Station: Introduction, earth station subsystem, different types of earth stations. The Role and Application of Satellite Communication.

Texts:

1. John M. Senior , Optical Fiber Communication, 3rd Edition, Pearson Education, 2009

Gerd Keiser, Optical Fiber Communication, 3rd Edition, Mc Graw Hill, 2000

Timothy Pratt, Charles W. Bostian, Satellite Communications, 2nd Edition, John Wiley & Sons, 2003.

References:

J.Gower, Optical Communication System, 2nd Edition, Prentice Hall of India, 1993.

Rajiv Ramaswami, , Kumar N Sivarajan, Galen H. Sasaki, Optical Networks, 3rd Edition, Morgan Kufmann, 2010.

Govind P. Agrawal, Fiber-optic communication systems, 3rd edition, John Wiley & sons, 2002.

R.P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2004

Dennis Roddy, Satellite Communications, 3rd Edition, Mc. Graw-Hill International Ed. 2001

EC441	Image Processing	3-0-0-6

Syllabus:

Digital image fundamentals: Visual perception, image sensing and acquisition, sampling and quantization, basic relationship between pixels and their neighborhood properties.

Image enhancement in spatial domain: Gray-level transformations, histogram equalization, spatial filters- averaging, order statistics filter, smoothing and sharpening filter.

Edge detection: first and second derivative filters, Sobel, Canny, Laplacian and Laplacian-of Gaussian masks.

Image filtering in frequency domain: One and two-dimensional DFT, properties of 2-D DFT, periodicity properties, convolution and correlation theorems, Fast Fourier Transforms, Smoothing and sharpening filtering in frequency domain, ideal and Butterworth filters, homomorphic filtering.

Color image processing: Color models RGB, CMYK, HSI, pseudo-color image processing, full-color image processing, color transformation, color segmentation, noise in color images.

Morphological Image Processing: Basic operations- dilation, erosion, opening, closing, Hit-Miss transformations, Basic morphological algorithms- boundary extraction, region filling, connected components, convex hull, thinning, thickening, skeletons, pruning, extensions to gray-scale morphology.

Image segmentation: Edge linking and boundary detection, Hough transforms, graph-theoretic techniques, global and adaptive thresholding, Region based segmentation, Segmentation by morphological watersheds, motion based segmentation.

Texts:

1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods.

References:

1. Fundamentals of Digital Image Processing by Anil K. Jain.

B.Tech VIII Sem

Department Electives

EC452	Detection and Estimation Theory	3-0-0-6

Syllabus:

Review of probability; Hypothesis testing: Neyman-Pearson, Receiver operating characteristics (ROC), Minimax, and Bayesian detection criteria; Randomized decision; Composite hypothesis testing: Bayesian approach, Generalized likelihood-ratio test; Detection of deterministic and random signals with unknown parameters.

Parameter estimators: properties- consistency, bias, and variance; Bayesian parameter estimation: Minimum mean square error estimation, Maximum a posteriori estimation; Nonrandom parameter estimation: Minimum variance unbiased estimation, Fisher information, Cramer-Rao lower bound, sufficient and complete statistics, Rao-Blackwell theorem; Maximum-likelihood estimation; Least squares; Signal estimation: Linear minimum mean square estimation, Weiner and Kalman filters.

Texts:

3. S. M. Kay, Fundamentals of Statistical Signal Processing: Detection Theory, 1st edition, Prentice Hall PTR, 1998.
4. S. M. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory, 1st edition, Prentice Hall PTR, 1993.

References:

3. H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd edition, Springer, 1994.
4. H. L. Van Trees, Detection, Estimation and Modulation Theory, Part I, 1st edition, John Wiley, 1968.
5. D. L. Melsa and J. L. Cohn, Detection and Estimation Theory, 1st edition, McGraw Hill, 1978.

EC471	Antenna and Wave Propagation	3-0-0-6

Syllabus:

Wire antennas: Dipole, Monopole, Loop; Aperture antennas: Slot, Open-ended waveguide, Horn, Reflector antennas, Antenna arrays: Linear array and Pattern Multiplication, two element array, uniform array, array with non-uniform excitation; Yagi – Uda array, Log-periodic dipole array, Long wire, V, Rhombic Antennas, Turnstile antenna, Helical, Biconical, Spiral, Microstrip antennas, Antenna Measurements: Radiation pattern, Gain, Directivity, Polarization, input impedance and reflection coefficient, Radio Wave Propagation: Ground wave, Ionospheric propagation.

Texts:

1. A.R. Harish, M. Sachidananda, Antennas and Wave Propagation, 1st Edition, Oxford, 2007.

References:

1. C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition John Wiley, 2005.
2. J. D. Kraus, R. J. Marhefka, A. S Khan, Antennas and Wave Propagation, 4th Edition, Tata McGraw-Hill, 2011

EC480	Digital Control Systems	3-0-0-6

Syllabus :

Introduction to digital control: Introduction, discrete time system representation, mathematical modeling of sampling process, data reconstruction.

Modeling discrete-time systems by pulse transfer function: Revisiting Z-transform, mapping of s-plane to z-plane, pulse transfer function, pulse transfer function of closed loop system, sampled signal flow graph.

Time response of discrete systems: Transient and steady state responses, time response parameters of a prototype second order system.

Stability analysis of discrete time systems: Jury stability test, stability analysis using bi-linear transformation.

Design of sampled data control systems: Root locus method, controller design using root locus, root locus based controller design using MATLAB, Nyquist stability criteria, Bode plot, lead compensator design using Bode plot, lag compensator design using Bode plot, lag-lead compensator design in frequency domain.

Deadbeat response design: Design of digital control systems with deadbeat response, practical issues with deadbeat response design, sampled data control systems with deadbeat response;

Discrete state space model: Introduction to state variable model, various canonical forms, characteristic equation, state transition matrix, solution to discrete state equation, controllability, observability and stability.

State feedback design: Pole placement by state feedback, set point tracking controller, full order observer, reduced order observer, output feedback design.

Introduction to optimal control: Basics of optimal control, performance indices, linear quadratic regulator (LQR) design.

Text:

1. B. C. Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, 2007

References :
1. K. Ogata, Discrete Time Control Systems, 2nd Edition, Prentice Hall, 1995. 2. M. Gopal, Digital Control and State Variable Methods, 2nd Edition, Tata Mcgraw Hill, 2003. 3. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems, 3rd Edition, Addison Wesley, 1998, Pearson Education, Asia, 2000. 4. K. J. Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, 3rd Edition, Prentice Hall, 1997.

EC472	**Microwave system Design**	**3-0-0-6**
Syllabus : Transmission Line: Fundamental of transmission line, Different types of planar transmission lines; Discontinuities and components; Passive circuit design: Filter design, Power divider, 90˚ and 180˚ hybrid couplers and multi-section couplers; Noise and Non-linear distortions: Noise Figure, Non-linear distortion, Dynamic Range; Active circuit design: Amplifier, Mixer, Oscillator and Switches; Microwave Antennas, Microwave measurement techniques.		
Text: D. M. Pozar, "Microwave Engineering," 4th Edition, Wiley, 2013. G. Gonzalez, "Microwave Transistor Amplifiers: Analysis and Design," 2nd Edition, Prentice Hall, 1996. R. J. Marhefka, A. S. Khan and J. D. Kraus, "Antennas and Wave Propagation", Tata McGraw - Hill Education 2010		
References : D. M. Pozar, "Microwave and RF Design of Wireless Systems," John Wiley & Sons, 2001. Balanis, C.A., "Antenna Theory and Design", 3rd Edition, John Wiley & Sons, 2005		

ANNEXURE-3

ORDINANCES AND REGULATIONS FOR B.TECH

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
SENAPATI, MANIPUR

ORDINANCES AND REGULATIONS FOR B.TECH

PREFACE

- The Indian Institute of Information Technology Senapati, Manipur (IIIT Senapati, Manipur) is an Indian Institute of Information Technology that will be permanently located in the Senapati district of Manipur. However, classes have commenced from July 2015 at a temporary campus in Mantripukhri, Imphal. It is among the 20 IIIT's proposed under Non-profit Public-Private Partnership (PPP) Model by Ministry of Human Resource Development (India). IIITM is an academic and research Institute fully funded by Government of India, Government of Manipur and Industry partners. IIIT Senapati, Manipur is starting its undergraduate degree courses in two disciplines, Computer Science and Engineering (CSE) and Electronics and Communication Engineering (ECE).

- The Undergraduate courses at IIIT Senapati, Manipur are known for their academic depth and professional learning flexibility, imbibed with options to earn minor or extra credits. Extra Academic activity is a non-credit component of the curriculum that not only helps the students in character and personality building but also in understanding the needs of the society and contributing in an effective way to meet these social challenges.

- IIIT Senapati, Manipur follows a credit based semester system. There are two Semesters in an academic year (Autumn: July - November; and Spring: January - April) during which all courses specified for various degree programs are offered.

- IIIT Senapati, Manipur is a very student friendly place and all efforts are made to ensure that the students are provided the best opportunities that are needed to create outstanding pool of human resources to meet the global challenges in all spheres.

- The students are required to follow certain procedures and meet specified academic requirements each semester. This booklet gives comprehensive information on the existing Rules and Regulations for B.Tech Program.

- We urge the students to make best use of the world class infrastructure and facilities available at IIIT Senapati, Manipur and wish all of them all the very best for a successful career.

ORDINANCES

a) The provisions of these regulations shall be applicable to all B.Tech programmes offered by the Institute.
b) All the regulations noted below shall be applicable to any new B.Tech programme(s) that may be introduced in future.
c) A student becomes eligible for the award of the B.Tech degree after fulfilling all the academic

and non-academic requirements prescribed by the Senate of the Institute.

d) Notwithstanding all that has been stated in the regulations the Senate has the right to modify/relax any of the regulations from time to time.

REGULATIONS

1. Academic Calendar

1.1. The academic session is divided into two semesters each of approximately 17 weeks duration: an Autumn Semester (July-November) and a Spring Semester (January-April).

1.2. 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 the session and published on Institute Web Site.

2. Admission

2.1. The number of seats in each branch of the undergraduate programme for which admission is to be made in the IIIT Senapati, Manipur will be decided by the Senate of IIIT Senapati, Manipur. Seats are reserved for candidates belonging to scheduled castes and scheduled tribes, Economically Weaker Section, physically handicapped candidates and children of defense personnel who died fighting for the country as per the decision of Joint Admission Board of IIITs from time to time.

2.2. The Admission to the B.Tech. Programme in any year will be based as per orders from the Government of India. Currently there 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 central counselling authority (for example by JOSSA and CSAB for the year 2018-19).

2.3. If, at any time after admission, it is found that a candidate has not fulfilled all the requirements stipulated in the offer of admission, the Dean of Academic Affairs may revoke the admission of the candidate and report the matter to the Senate.

2.4. 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 undisciplined conduct.

3. Residence

3.1. The institute is wholly residential and all students shall be required to reside in, and be members of the hostel to which they are assigned at the time of registration. Only in exceptional circumstances a student may be permitted to change from one hostel to another.

3.2. Under special circumstances, the Director/Dean of Academic Affairs may permit a student to

reside with his/her Parent/Guardian in the Institute Campus or within a reasonable distance from the Institute. Such a student shall, however, be attached to a hostel and will be required to pay seat rent according to rules, and Hostel establishment charges fixed by the Warden. However, this permission may be withdrawn at the discretion of the Institute, at any time considered appropriate by it, without assigning any reason.

3.3. No married accommodation shall be provided to any student of the undergraduate courses.

3.4. All students must abide by the rules and regulations of the hostel as may be framed from time to time by the Hostel Management Committee and approved by the Senate.

4. Attendance

4.1. Students are required to attend all the classes (Lectures, Tutorials, Laboratories, Practical, Studio, Workshops etc) for which they have been registered. Students are required to attend all the classes of Extra Academic Activities (NCC, NSS, NSO including camps and other pre-publicized programmers) for which they have been registered.

4.2. A student will be debarred from appearing in an examination if his/her attendance falls below 75 percent. A student will not be awarded certificate in Extra Academic Activities if his/her attendance falls below 75 percent.

4.3. The teacher concerned may condone absence from classes for a very short period due to unavoidable reasons provided he/she is satisfied with the explanation.

5. Leave of Absence

5.1. If the period of leave is for a short duration (less than two weeks), prior application for leave shall have to be submitted to the Head of the Department concerned stating fully the reasons for the leave requested for along with supporting document(s). Such leave will be granted by the Head of the Department.

5.2. Absence for a period not exceeding two weeks in a semester due to sickness or any other unavoidable reasons for which prior application could not be made may be condoned by the Head of the Department provided he/she is satisfied with the explanation.

5.3. If the period of absence is likely to exceed two weeks, a prior application for grant of leave will have to be submitted through the Head of the Department to the Dean of Academic Affairs with supporting documents in each case; the decision to grant leave shall be taken by the Dean of Academic Affairs on the recommendation of the Head of the Department.

5.4. The Dean of Academic Affairs may, on receipt of an application also decide whether the student be asked to withdraw from the course for that particular semester because of long absence.

5.5. The leave of absence as per paras 5.1 to 5.3 will not be condoned for attendance.

5.6. 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 availing the leave.

5.7. In exceptional circumstances, the Dean of Academic Affairs in consultation with the Chairman, Senate may relax any of the above requirements.

6. Change of Branch

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

6.2. However, in special cases the Institute may permit a student admitted through JEE Main to change from one branch of studies to another after the first two semesters. Such changes will be permitted, in accordance with the provisions laid down hereinafter, from a B. Tech. programme in any branch to a B. Tech. programme in any other branch.

6.3. Only those students will be eligible for consideration of a change of branch/programme after the second semester, who have completed all the common credits required in the first two semesters of their studies with a CPI of 8.00 or more, in their first attempt, without having had to pass any course requirement in the summer term examination.

6.4. Applications for a change of branch/programme must be made by intending eligible students in the prescribed form. The Academic Affairs Office will call for applications in the beginning of the odd semester of each academic year and the completed forms must be submitted by the last date specified in the notification.

6.5. It will not be permissible to alter the choice after the application has been submitted.

6.6. 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 Main rank of the applicants will be considered.

6.7. The applicants may be allowed a change in branch/programme, strictly in order of inter se 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.

6.8. All changes of branch/programme 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.

6.9. All changes of branch/programme will be final and binding on the applicants. No student will be permitted, under any circumstances, to refuse the change of branch/programme offered.

7. Registration

7.1. Every student is required to register for the approved courses through the Faculty Advisor at the commencement of each semester on the day fixed for such registration and notified in the Academic Calendar.

7.2. Students who do not register on the day announced for the purpose may be permitted late registration up to the notified day in the Academic Calendar on payment of an additional fee.

7.3. Only those students will be permitted to register who have:

7.3.1 Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters,

7.3.2 Paid all required advance payments of Institute and Hostel dues for the current semester, and

7.3.3 Not been debarred from registering on any specific ground.

7.4. During registration following conditions must be fulfilled:

7.4.1 A student must pass all first year courses before registering for the third year courses.

7.4.2 Normally, the number of credits registered for during a semester should not be less than 36 credits and should not exceed 52 credits. The L-T-P loading for a semester should not exceed 32 contact hours per week.

7.4.3 Capable students of 5th Semester onwards for B.Tech having CPI of at least 8.0 may be allowed to credit an extra course per semester over the prescribed list of courses of the department for the concerned semester and beyond the upper limit of 52 credits. The credits earned in the extra course will be added to the CPI of the student like other credit courses. The grade in the extra course will not be counted towards eligibility for the Institute medals.

7.5. Students obtaining grade 'F' in any compulsory subject in any semester may clear it in the subsequent summer term examination or must repeat it in the next appropriate semester when it is offered.

7.5.1 Those who obtain grade 'F' in an elective subject may similarly clear the backlog in the summer term examination or, alternatively, register for any elective subject from within the same group of electives offered in the next semester.

7.5.2 In case of failure in Laboratory/Practical subject the student will have to reregister for it in the next appropriate semester.

7.5.3 Similarly, in case of failure in Extra Academic Activities the student will have to re- register for it in the appropriate semester of the next academic session.

7.6. A student who obtains a CPI lower than 5.00 with grade 'DD' in some subjects or grade 'F' in some subjects may be permitted by the Dean of Academic Affairs on the recommendations of

the DUPC to repeat one or more DD graded subjects along with the failed subjects, provided, the subject(s) is /are being offered therein.

7.7. When a student re-registers for a subject, in accordance with paras 7.5 and 7.6 above, his/her new grade will be used for SPI calculation, whereas for CPI calculation, the better of the two grades (the old and the new) of that subject will be considered.

7.8. Students may add and drop subject(s) with the concurrence of the Faculty Advisor, and under intimation to the concerned course instructors and the academic section provided this is done within the date mentioned in the Academic Calendar and as per the conditions given in para above.

8. Duration of the Programme

Normally a student should complete all the requirements for undergraduate programme in eight semesters. However, academically weaker students who do not fulfill some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to 12 consecutive semesters (from the first semester registration) to complete all the requirements of the degree.

9. Temporary Withdrawal from the Institute

9.1. A student who has been admitted to an undergraduate programme of the Institute may be permitted to withdraw temporarily from the Institute on the grounds of prolonged illness or grave calamity in the family for a period of one semester or more, provided:

9.1.1 He applies to the Institute within at least 6 weeks of the commencement of the semester or from the date he last attended his/her classes whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.

9.1.2 The Institute is satisfied that, counting the period of withdrawal, the student is likely to complete his/her requirements of the B. Tech. Degree within the time limits specified in para 8 above.

9.1.3 There are no outstanding dues or demands in the Institute / Hostel / Department / Library/ NCC / NSS / NSO.

9.2. A student who has been granted temporary withdrawal from the Institute under the provisions of para 9.1 will be required to pay fees/charges (except tuition fees and hostel dues) till such time as his/her name is on the Roll List. However, fees once paid will not be refunded.

9.3. Normally, a student will be permitted only one such temporary withdrawal during his/her tenure as a student of the undergraduate programme.

10. Termination from the Programme

10.1. Student is required to leave the Institute on the following grounds:

10.1.1 If a student fails to secure a CPI of 4.0 at the end of any semester. However, a student securing a CPI below 4.0 may be allowed to continue in the following semester on the recommendation of DUPC and with the approval of IUPC. Subsequently the student will be issued a warning. Students who secure a CPI below 4.0 in two consecutive semesters will not be allowed to continue in the undergraduate programme.

10.1.2 If a student is absent for more than 6 (six) weeks in a semester without sanctioned leave his/her name will be struck off the rolls.

10.1.3 A student may also be required to leave the Institute on disciplinary grounds.

10.1.4 On having been found to have produced false documents or having made false declaration at the time of seeking admission.

10.1.5 On having been found to be pursuing regular studies and/or correspondence courses (leading to degree or diploma) in any other college, university or an educational institution.

10.1.6 On having been found to be concurrently employed and performing duty or carrying out business in contravention to academic schedules of the Institute and without approval from the Institute.

11. Grading System

11.1. Based on the performance of a student, each student is awarded a final letter grade in each subject at the end of the semester. The letter grades and the corresponding grade points are as follows:

Grade	Grade Point
AA	10
AB	9
BB	8
BC	7
CC	6
CD	5
DD	4
FF	0

In addition, there shall be two transitional grades I and X used by the instructors.

11.2. In addition, there shall be two transitional grades I and X used by the instructors. A student is considered to have completed a subject successfully and earned the credits if he secures a letter grade other than I, X or F in that subject. A letter grade F in any subject implies a failure in that subject.

11.3. The Transitional Grades I and X

11.3.1 The teacher of a subject may award the grade 'I' to a student if the latter was compelled to absent himself from the end semester examination on account of:

a) Illness or accident which disabled him from appearing at the examination.

b) A calamity in the family at the time of the examination, which, in the opinion of the Institute, required the student to be away from the campus. A student will be

eligible for the award of grade 'I' only if his/her attendance at classes and performance in other components of assessment are complete and satisfactory.

11.3.2 The teacher of a subject may award the grade 'X' to a student if the overall performance of the student in the course is good, but is likely to get grade 'F' based on his/her end semester examination.

11.3.3 All 'I' and 'X' grades awarded by teachers must be converted by them to appropriate letter grades and communicated to the Academic Section (through Head of the Department) within two days of the respective make up examination. Any outstanding 'I' and 'X' grades two days after the last scheduled make up examination will be automatically converted to an 'F' grade.

11.4. A Semester Performance Index (SPI) will be computed for each semester. The SPI will be calculated as follows:

$$SPI = (C_1*G_1 + C_2*G_2 + C_3*G_3 + \ldots + C_n*G_n) / (C_1 + C_2 + C_3 + \ldots + C_n)$$

where, n is the number of courses registered during the semester, C_i is the number of credits allotted to a particular course, and G_i is the grade points corresponding to the grade awarded for the course.

11.5. A Cumulative Performance Index (CPI) will be computed at the end of each semester and communicated to the students along with the SPI and the grades obtained by them for that semester. The CPI gives the cumulative performance of the student from the first semester up to the end of the semester to which it refers, and will be calculated as follows :

$$CPI = (C_1*G_1 + C_2*G_2 + C_3*G_3 + \ldots + C_m*G_n) / (C_1 + C_2 + C_3 + \ldots + C_m)$$

where, m is the number of courses registered during the semester, C_i is the number of credits allotted to a particular course, and G_i is the grade points corresponding to the grade awarded for the course.

Whenever a student repeats or substitutes a course in any semester, the lower grade(s) obtained by him/her in the course is to be ignored in the computation of CPI from that semester onwards.

11.6. Both SPI and CPI will be rounded off to the second place of decimal and recorded as such. Whenever these CPI are to be used for the purpose of determining the merit ranking of a group of students, only the rounded off values will be used.

11.7. When a student gets the grade 'I' or 'X' for any course during a semester, the SPI for that semester and the CPI at the end of that semester will be tentatively calculated ignoring 'I' and 'X' graded course(s). After conversion of 'I' and 'X' grade(s) to appropriate grade(s), the SPI and CPI for that semester will finally be recalculated after taking the converted grade(s) into account.

11.8. There are, however, a few other academic requirements for undergraduate programmes where student will be awarded following two grades viz., 'PP' - Passed and 'NP' – Not Passed. All non-credit subjects (such as NCC/NSO/NSS, industrial training, field visits and Extra Academic Activities) belong to this category. No grade points are associated with these grades and performance in these subjects is not taken into account in the calculation of the SPI or CPI. However, the award of the degree is subject to obtaining a 'PP' grade in all such subjects.

11.9. The faculty advisor may permit a student to register for an audit course provided the course instructor allows auditing a course. The word "AU" shall be written alongside the Course Name in the Grade Card. The audit course & the grade "AU" shall not carry any credits and grade points. Pass or fail status will be shown in the grade card as "PP" for passed and "NP" for not passed. However, a student is not required to register again for passing a failed audit course.

12. Examinations

12.1. In assessing the student's attainment in subjects (Theory, Laboratory, Sessional, seminars, project work etc., the system of continuous assessment is adopted by the Institute. In conformity with this practice, there will be one mid semester examination and an end semester examination for every theoretical subject -- in addition to the teachers' assessment and quizzes etc.

12.2. A student may be debarred from appearing in the end semester examination due to the following reasons:

12.2.1 If any disciplinary action is taken against him/her.

12.2.2 On recommendation of a teacher, if

a) His/her attendance in the Lecture/Tutorial/Practical classes has not been satisfactory during the semester, and/or,

b) His/her performance in the sessional work done during the semester has been unsatisfactory.

12.3. In the event of a final year student failing in a Laboratory and/or Sessional subjects, the teacher concerned may, at his/her discretion, grant the student an extension of time not exceeding 3 months and award an 'I' grade. If no such extension is given to a student he/she will have to re-register for the same requirement in the earliest succeeding semester in which it is offered.

12.4. Changes in Grades Already Awarded: If a student feels that he/she has not been awarded a deserving grade in a course, he/she may request the instructor of the course within one week of the start of the next semester, to show him/her the end-semester answer script in order to ensure that all the questions have been evaluated properly. In case of any change in grade, the same with due justification has to be communicated by the Instructor to the Head of the Academic Section.

13. Make up Examinations

13.1. Students who have missed an end semester examination on valid reasons and awarded "I"

grade are eligible for make-up examination. They should make an application to the Dean of Academic Affairs through the Instructor/HOD within seven days from the date of examination missed explaining the reasons for their absence.

13.2. No make-up examination will be scheduled for the mid semester examination and quizzes. It is entirely upto the teacher to ascertain the proficiency of the student by whatever means considered appropriate to him/her if he/she is satisfied of the bonafides.

13.3. Official permission to take a make-up examination will be given under exceptional circumstances such as admission to a hospital due to illness and a calamity in the family at the time of examination. Students residing in the hostels should produce a medical certificate issued by the Institute Medical Officer only. Students who are permitted to stay outside the campus or who have been authorized to be away from the Institute should produce a medical certificate from a Medical Officer not below the rank of a Civil Surgeon and endorsed by the Institute Medical Officer. Certificates from private medical practitioners will not be accepted. The Dean of Academic Affairs can use his/her discretion in giving permission to a student to take a make-up examination.

13.4. Students who are awarded "X" grade by the teachers are also eligible for the make-up examination.

13.5. Make up examination will be held as per dates notified in the Academic Calendar. Make up examinations at any other time can be held only with the permission of the Dean of Academic Affairs.

14. Withholding of Grades

Grades shall be withheld when the student has not paid his/her dues or when there is a disciplinary action pending against him/her.

15. Eligibility for the Award of B. Tech. / B. Des. Degree

15.1. A student shall be declared to be eligible for the award of B. Tech. degree if he/she has:

15.1.1 Completed all the credit requirements for the degree with a grade "DD" or higher grade in each of the subjects (Theoretical, Laboratory, Workshop, Sessional, Seminar, Project etc.);

15.1.2 Satisfactorily completed all the non-credit requirements for the degree viz Extra Academic Activities, Industrial Training, etc. (if any);

15.1.3 No dues to the Institute, Department, Hostels, NCC, NSS and NSO;

15.1.4 No disciplinary action is pending against him/her.

15.2. The award of B. Tech. degree must be recommended by the Senate and approved by the Board of Governors of the Institute.

16. Departmental Undergraduate Programme Committee (DUPC)

SL. No.	Composition	
i	Head of the Department (ex-officio)	Chairman
ii	Six faculty members to be nominated by the HOD of which one will be nominated by the HOD as the member secretary. (Note : If faculty strength of a department is less than or equal to six, then all the faculty members will be members of the DUPC)	Member
iii	One faculty member from another department. The department will be chosen by the committee. The faculty member from the chosen department will be nominated by the HOD of that department.	Member
iv	Two students with CPI not less than 7.5 to be elected by the undergraduate students of the 2nd, 3rd and 4th years. One student member from any other department may be co-opted if necessary.	Members

16.1. Tenure: Two years for faculty members and one year for student members.

16.2. Functions:

16.2.1 To oversee the conduct of all undergraduate courses of the department.

16.2.2 To ensure academic standard and excellence of the courses offered by the department.

16.2.3 To discuss and recommend the syllabi of all the undergraduate courses offered by the department from time to time before sending the same to the Institute Undergraduate Programme Committee (IUPC)

16.2.4 To consider any matter related to the undergraduate programme of the department.

17. Institute Undergraduate Programme Committee (IUPC)

SL. No.	Composition	
i	Dean of Academic Affairs (ex-officio)	Chairman
ii	One member from each department nominated by the HOD and approved by the Senate Nomination Committee	Member
iii	DR (Academic) or AR (Academic)	Non-Member

17.1. Tenure: Two years.

17.2. Functions:

17.2.1 To oversee the conduct of all undergraduate courses of the Institute.

17.2.2 To consider the proposals from the departments and make recommendations to the Senate for consideration and approval.

17.2.3 To issue guidelines to various departments on evaluation pattern of the courses to maintain uniformity.

17.2.4 To consider and recommend the assessment procedure to be adopted by various departments.

17.2.5 To consider and recommend any other matter concerning the undergraduate programme of the Institute.

HOSTEL CONSTITUTION

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SENAPATI, MANIPUR

HOSTEL CONSTITUTION

Indian Institute of Information Technology Senapati, Manipur
Manipur - 795002, India

Hostel is a residential unit of the Institute, which provides living accommodation to bonafide students. Residential environment of the hostel aims to provide a conducive platform for the overall development of the students. Hostel atmosphere should foster community feeling, healthy competitive spirit and cohesive cultural growth among the residents. The culture of the hostel should not only be concerned with academic development but also co-curricular growth.

Each hostel is self-managed by a committee of elected bonafide students of the respective hostel and nominated faculty/staff members. Hostels should be financially independent and functionally as well as administratively linked with other units of the Institute.

1. Definitions of Relevant Terms

(a) **Hostel**: A Hostel is a place of residence provided by the Institute for all the bonafide students. Upon authorization by the Hostel Affairs Board (HAB), a hostel may also accommodate temporarily persons such as participants of various seminars/delegates for conferences organized by the Institute/project staff/internship students etc, as and when requested, subject to availability of seat in the hostel.

(b) **Warden:** A Warden of a hostel is a faculty member of the Institute appointed by the competent authority of the Institute (referred hereafter as the Institute), as laid down in the IIITM Statutes, to carry out duties as mentioned in sections 7 and 8 of the Hostel Constitution for a period of maximum two years.

(c) **Associate Warden:** An Associate Warden of a hostel is a faculty member of the Institute appointed by the Institute, as laid down in the IIITM Statutes, to carry out duties as mentioned in sections 9 of the Hostel Constitution for a period of maximum two years.

(d) **Bonafide Student:** A bonafide student is a student having a valid roll number and registered for the purpose of pursuing studies in any of the academic programs of the Institute.

(e) **Bonafide Resident of the Hostel:** A bonafide resident of the hostel is a person duly authorized to stay in the hostel by the HAB.

(f) **General Body of the Hostel**: The general body of the hostel is the apex body of the hostel comprising all the bonafide students residing in the hostel and the Warden and the Associate Warden. The functions of the general body are as mentioned in Section 6 of the Hostel Constitution.

(g) **Hostel Management Committee (HMC):** Hostel Management Committee is a body of elected representatives of the General Body of the hostel and chaired by Warden. The composition of the HMC is as laid down in Section 2 of the Hostel Constitution. The function and responsibilities of the HMC are given in Section 3 of the Hostel Constitution.

(h) **Hostel Representative:** The Hostel Representative is a bonafide full time student of the Institute residing in the hostel elected to be the member of the Hostel Management Committee (HMC) and shall be the Secretary of the same HMC. He/she carries out all the duties and responsibilities as mentioned in Sections 2, 3, and 5 of the Hostel Constitution.

(i) **Hostel Disciplinary Committee (HDC):** (Annexure B): A committee at the HAB level to look into the matters relating to misconduct/indiscipline by hostel inmates.

(j) **Hostel Caretaker:** A Hostel Caretaker is an Institute employee assigned to assist the Warden/Associate Warden and the HMC to carry out their duties. His/her responsibilities and duties are as stipulated in Section 9 of the hostel Constitution.

(k) **Mess Manager:** A Mess Manager is an employee of the Mess Contractor who has been awarded the contract by the Institute for providing food to the hostel residents on the recommendation of the Mess Contract Awarding Committee. His/her duties will be stipulated in the conditions of the contract of the Mess Contractor and stipulated by the Mess Management Committee.

(l) **Hostel Affairs Board (HAB):** HAB is the apex body related to hostel affairs. It acts as the central coordinating authority for all hostels. Its main function is to coordinate and execute all activities related to hostels through HMCs of each hostel. This body passes all policy matters related to the hostels and has the overall responsibility of ensuring the implementation of hostel constitution.

(m) **General Secretary, Hostel Affairs Board (GSHAB):** The General Secretary, Hostel Affairs Board is an elected member to the Students' Affairs Council (SAC) from amongst all the bonafide students of the Institute residing in one of the hostels of the Hostel Affairs Board and should be a bonafide full time resident of one of the hostels of the institute.

(n) **Mess Management Committee (MMC):** (Annexure 3.A) A mess management committee in each hostel shall look into all the aspects for a smooth, efficient, functioning of the concerned hostel mess.

2. The Hostel Management Committee (HMC)

2.1. The HMC shall consist of the following members (Office Bearers):

1.	Warden	Chairman
2.	Associate Warden	Vice Chairman
3.	All Hostel Representatives	Members
4.	General Secretary, Hostel Affair Board	Member, Secretary

2.2. All elected office bearers have tenure of one year.

2.3. In consultation with the Warden, the Hostel Representative shall call a monthly HMC meeting, draw up the agenda and finalize the day and time of the HMC meeting.

2.4. A minimum of 48 hours' notice shall be given to convene a HMC meeting.

2.5. The quorum for a HMC meeting shall consist of the Chairman and/or Vice Chairman, the Hostel Representative and two other members.

2.6. An extraordinary HMC meeting shall be called by the Hostel Representative at the request of any two members of the HMC or the Chairman of HMC. The minimum notice for calling an extra-ordinary meeting shall be two hours. However, the decisions arrived at such an extra ordinary meeting have to be ratified at the next ordinary HMC meeting.

2.7. The HMC is responsible for drawing up the annual budget for the hostel.

2.8. Generally, all decisions shall be taken by consensus among the members of the HMC.

2.9. Every member of the HMC shall have one vote each in case the decisions are to be voted upon. The Chairman of the HMC shall cast his/her vote only when there is a tie.

2.10. Decisions regarding controversial issues which require reference to the Institute policies, rules and regulations shall be minuted but kept pending until the Chairman obtains the necessary clarification. All pending cases should be settled within next HMC meeting or fifteen days, whichever is earlier. In special cases, the matter may be referred to the HAB for appropriate action.

2.11. In the absence of the Warden, the Associate Warden shall be the Chairman of the HMC meeting. In the absence of both, the Coordinator SAC or his/her faculty nominee shall be the Chairman of the HMC.

2.12. The Hostel Representative shall be responsible for recording the minutes of the meeting.

2.13. The decisions of the HMC meetings shall be made known to the hostel residents by displaying them on the notice board within one week of the meeting.

2.14. A minute book shall be maintained by the hostel caretaker wherein the minutes of the HMC meetings are recorded. The Hostel Representative and the Warden shall sign the same after confirming them at the next meeting. A copy of the HMC minutes should be sent to the Chairman, HAB for the purpose of information.

2.15. The Hostel General Secretary may take a decision on routine matters subject to the ratification by the HMC.

2.16. Giving at least one-hour notice on the initiative of the Hostel Representative, Warden can convene an emergency HMC meeting. The quorum of such a meeting shall be as stipulated in Clause 2.5.

2.17. General Secretary (Hostel Affairs Board) can attend any HMC meeting as an invitee. Hostel Representative will have the responsibility of informing GSHAB about the HMC meeting 24hrs before its commencement.

3. Functions of the HMC

3.1 The HMC is a managerial body of the hostel working according to the Hostel Constitution. As a managerial unit, it is both the functional as well as a deciding body. It shall be responsible for the overall smooth management of the hostel including:

1. Mess management
2. Maintenance of hostel amenities
3. Sports activities
4. Cultural Activities
5. Technical Activities
6. Computer networking
7. Any other activity approved by the General Body of the hostel. Elected office bearers shall look after these activities.

3.2 The HMC decisions will be final and binding with respect to the concerned hostel.

3.3 Arrangement for auditing of accounts submitted by the Secretaries shall be the responsibility of the HMC.

3.4 In the absence of any Secretary, a secretary nominated by the HMC shall be responsible for the respective duties.

3.5 In the absence of Hostel Representative, any other Secretary nominated by the Warden shall carry out related duties.

3.6 In the event of the post of Hostel Representative falling vacant by resignation or otherwise, the HMC shall either hold fresh elections for the post in case the remaining period is more than two months as per the procedure laid down in the Section 4. If the period is less than two months, HMC may nominate one of the Secretaries as the Hostel Representative.

3.7 In the event of the post of an of the elected members of the HMC falling vacant by resignation or otherwise, the HMC shall either hold fresh elections for the post in case the remaining period is more than two months as per the procedure laid down in the Section 4. If the period is less than two months, co-opting a bonafide student of the Institute residing in that Hostel could fill up the vacancy.

3.8 In case a majority of the HMC including the Representative of the Hostel is of the opinion that a said secretary of the HMC is not performing his/her function properly, the same may be given vide a letter to the HMC Chairman by the Representative of the Hostel, with the signature of the majority of the members of the HMC calling for impeachment of the said secretary.

3.8.1 The HMC Chairman on receipt of the call for impeachment of the secretary shall instruct the General Secretary to convene an Extraordinary General Body Meeting for the same.

3.8.2 In the Extra-ordinary General Body Meeting for the impeachment of the secretary, the General body of the Hostel shall through a voice vote in accordance to clause 6.8 to either accept or reject the motion. The HMC shall thereafter decide one among the elected secretaries to perform the function of the impeached secretary till the new secretary is elected in accordance to clause 3.6.

3.8.3 The Decision of the General Body shall be final and binding on the HMC.

3.8.4 In case the quorum of the General Body is not met as per clause 6.7 the decision of the Chairman – HMC shall be final.

3.8.5 In case a majority of the HMC wants to bring forth impeachment proceedings against the General Secretary of the Hostel, the General Secretary – HAB will officiate all the proceedings of the hostel in the place of the Hostel General Secretary for Clause 3.8.

3.9 In case of any difference of opinion/dispute between the members of the HMC and the Warden/Associate Warden, the matter may be referred to the HAB.

3.10 Other than the Mess Management Committee (refer Annexure A), the respective secretary can form any functional committee approved by HMC to take care of various functional units of the hostel. All functional committees can take necessary measures (including imposition of fines to residents up to a fixed amount as prescribed by HAB) for smooth running of the unit. HMC will prescribe the duties and obligations of different units (excluding the Mess Management Committee).

4. Elections

4.1 Elections to the various posts in the HMC shall be held before 7th Feb every year and the elected members shall assume their responsibilities not later than 01st April. However, the

election of General Secretary (Hostel Affairs Board) will be done along with the Institute Gymkhana election.

4.2 Exact Date of all HMC Election will be notified by Chairman, HAB. Election shall be supervised by a panel consisting of the Warden, Associate Warden and General Secretary (Hostel Affairs Board).

4.3 The election shall not be held during Institute vacation period.

4.4 Only bonafide students of the Institute residing in the hostel are eligible to vote.

4.5 Only bonafide students residing in the Hostels of the Institute for a period of at least one year will be allowed to contest.

4.6 No student who has already completed the normal duration of the academic program at the time of election shall be eligible to contest.

4.7 A student contesting for election should have a further period of one year of stay in the hostel by virtue of his/her academic program.

4.8 No student shall be allowed to contest for more than one post.

4.9 The Warden in consultation with the Associate Warden and the General Secretary, Hostel Affairs Board, will nominate returning officer(s) to conduct the elections.

4.10 There should be a gap of at least five days between the official announcement of the elections and the date of the elections.

5. HAB Procedures and Resolutions (HABPR)

5.1 A document that shall contain all the procedures those are to be followed for the smooth functioning of the HAB and the individual Hostel HMCs.

5.2 This document shall work within the purview of the Hostel Constitution and can be modified by the HAB.

5.3 Any amendment of the HABPR that is passed by the HAB in accordance to clauses 11.8, 11.9 & 11.10 and has to be approved by the President of the Gymkhana Council, so that there is no conflict with any other Institute Policy.

5.4 In case of any conflict the same may be sent back to the HAB.

5.5 In cases wherein amendment of Institute Policies is essential the amendment shall be kept in hold and sent to SAC for further discussion.

6. General Body and General Body Meeting

6.1 The General Body of the hostel shall consist of all the bonafide students of the Institute residing in the hostel.

6.2 A General Body Meeting shall be held at least once during every academic semester, the minutes of which should be sent to Chairman, HAB.

6.3 The Warden shall be the Chairman of the General Body Meetings. If the Warden is not present, the Associate Warden shall be the Chairman of the General Body Meetings.

6.4 The Hostel General Secretary shall call for a General Body Meeting after due approval of the HMC, with a prior notice of minimum of 3 days.

6.5 An extra-ordinary General Body Meeting may be called by the Hostel General Secretary in consultation with the Warden to discuss particular issues after an extra- ordinary HMC Meeting is held. Extra-ordinary General Body Meeting shall be convened by giving at least

three hours' notice to the residents.

6.6 Any decision taken at the extra-ordinary General Body Meeting shall be binding on the HMC, subject to Clauses 6.9 and 6.13.

6.7 The quorum for an extra-ordinary General Body Meeting shall be 60% of the total hostel residents as per Clause 6.1.

6.8 All the decisions shall be arrived at with two-third majority of the hostel residents present in the meeting or 50% of the hostel residents or whichever is less.

6.9 An extra-ordinary General Body Meeting shall transact only the items listed in the agenda for the meeting.

6.10 In case the quorum is not met for the extra-ordinary General Body Meeting, the HMC and/or the person who has proposed the item shall explain the issue to the members present at the meeting. There shall, however, be no decision taken on the issue. The HMC shall seek a decision through a secret ballot by a simple majority on the next working day and suggest alternative solution to the issue.

6.11 The Hostel General Secretary shall call an extra-ordinary General Body Meeting in consultation with the Warden when 30% of the hostel residents submit a written and signed request for calling such a meeting on a particular issue. The quorum for such an extra-ordinary General Body Meeting shall be as mentioned earlier in Clause 6.8.

6.12 The Warden can, on his/her own, call an extra-ordinary General Body Meeting under special circumstances.

6.13 Decisions regarding controversial issues arrived at any extra-ordinary General Body Meeting which involves Institute policies, rules and regulations shall be minuted, but kept pending until the Chairman obtains the necessary clarifications. However, in special cases the matter may be referred to the HAB, for appropriate action by the Chairman.

7. Responsibilities of the Warden

7.1 The Warden as a Chairman of HMC should be responsible for overall functioning of the hostel. He/she shall look after all the activities directly which are not taken care by the Associate Warden.

7.2 The Warden on the recommendations of the HMC can recommend the inter-hostel transfer of any student to the HAB.

7.3 The Warden shall be the Chairman of the HMC Meetings and General Body Meetings. In his/her absence, the Associate Warden shall perform these duties.

7.4 Depending on the need, Warden may also dissolve the HMC of the hostel. However, existing HMC may appeal to the HAB. During the period of the appeal the said HMC shall be in suspension and will be dissolved if approved by the HAB.

7.5 For any reason, if all the office bearers of the HMC resign or HMC stands dissolved the Warden shall initiate a fresh election. He/she may also appoint an ad-hoc body for the interim period.

7.6 The Warden shall provide accommodation to students and others on the recommendations of Chairman HAB.

7.7 The Warden as the Chairman HMC can appoint an enquiry committee to investigate any matter of concern to the hostel and can take necessary action as deemed fit.

7.8 The Warden may, on special occasions, appoint an ad-hoc committee to look into certain issues pertaining to the hostel. The committee shall submit its report to the HMC for

necessary follow-up action.

7.9 The Warden shall be the ex-officio Chairman of the survey committee constituted by the Institute for periodic stock verification of items belonging to the hostel. The survey committee shall inspect all items declared as unusable by the hostel and make suitable recommendations to the Institute.

7.10 In case of a no-confidence motion against the HMC or any elected member of the HMC, the Warden shall call an extra-ordinary General Body Meeting to discuss the issues and seek opinion.

7.11 The Warden shall forward confidential report of the Hostel Caretaker to the Institute authorities as and whenever required.

7.12 Warden shall inform the HAB and nominate Associate Warden as Warden-in-charge whenever he/she is out of station.

7.13 If under extraordinary circumstances both Warden and Associate Warden have to be on leave at the same time, the Warden should meet the Chairman HAB with his/her Hostel Caretaker for making alternative arrangements. Under the circumstances no alternate arrangements are in place, the Chairman HAB will take over charge of the hostel temporarily.

8. Responsibilities of the Associate Warden

8.1 The Associate Warden shall be in independent charge of some of the basic amenities of the hostel. He/she should also plan for development of future amenities.

8.2 He/she shall generally look after common room, hostel library, computer network and maintenance of the hostel.

8.3 The concerned student secretary and Hostel Caretaker shall assist the Associate Warden in his/her duties.

8.4 The Associate Warden shall advise the concerned secretary related to overall functioning and preparation of the budget.

8.5 All the bills pertaining to the portfolio of the Associate Warden should be forwarded through him/her.

8.6 In the absence of the Warden, the Associate Warden shall discharge the duties of the Warden in addition to his/her normal duties.

8.7 The Associate Warden shall inform Warden and Chairman HAB whenever he/she is out of station.

8.8 The Assoc. Warden shall jointly do the duties with the Warden as mentioned in 7.4 to 7.10.

9. Hostel Caretaker

9.1 Hostel Caretaker is an Institute employee assigned to hostel to assist Warden, Associate Warden and HMC.

9.2 The Hostel Caretaker shall maintain all records, files and accounts of the hostel.

9.3 The Hostel Caretaker shall assist members of the HMC in matters of correspondence and documentations.

9.4 The Hostel Caretaker is responsible for the cleanliness and regular maintenance of the hostel building, mess, common room, garden and other premises of the hostel.

9.5 The Hostel Caretaker will maintain the stock register of all movable items and kitchen equipment/utensils.

9.6 The Hostel Caretaker shall look into complaints of residents with regard to amenities concerned with accommodation.

9.7 The Hostel Caretaker shall arrange for advances to Secretaries for hostel works after obtaining necessary sanction from the Chairman HMC duly recommended by the concerned Secretary and Hostel General Secretary.

9.8 The Hostel Caretaker shall take stock furniture, appliances, stereo equipment or any other assets of the hostel/Institute at the end of each semester. He/she shall also perform the same as and when directed by HAB.

9.9 The Hostel Caretaker shall carry out all cash transactions.

9.10 The Hostel Caretaker will follow the work schedule as outlined by HAB.

9.11 The Hostel Caretaker shall discharge any other duty assigned to him/her by the Warden/ Associate Warden.

10. Mess Manager

10.1 A person for the purpose of overall management of the mess shall be appointed by the Mess Contractor on approval by the HMC as per contract given by the Mess Contract Awarding Committee.

10.2 The Mess Manager shall prepare monthly mess bills of all the residents of the hostel, and submit them to Hostel Caretaker.

10.3 The Mess Manager shall be responsible for the general supervision of the health, hygiene and discipline of the mess workers of the contractor, assigning duties to these workers, maintaining proper upkeep of the cooking equipment and facilities provided by the Institute, ensure quality of preparation and service of food, hygiene and cleanliness in the mess.

10.4 The Mess Manager shall be responsible for the implementation of recommendations of the Mess Management Committee.

10.5 The Mess Manager shall take charge of all the kitchen equipment and facilities from the Hostel Caretaker and report to the Hostel Caretaker any defects in the equipment and lack of facilities in the hostel kitchen and dining hall.

11. Hostel Affairs Board (HAB)

Hostel Affairs Board is the apex body pertaining to all hostel matters. HAB shall consist of following members:

1.	Chairman/Coordinator, Hostel Affairs Board	Chairman
2.	All Wardens	Members
3.	All Associates Wardens	Members
4.	General Secretary, Hostel Affairs Board	Member Secretary

5.	Vice President, Students Gymkhana Council	Member
6.	All Hostel Representative	Members
7.	Dy. Registrar/Asst. Registrar	Non Member, Jt. Secretary

11.1 The Chairman/Coordinator, HAB (referred henceforth as "Chairman" unless otherwise explicitly stated) is a faculty member nominated by the Chairman, SAC and make him a senate member.

11.2 In consultation with Chairman/Coordinator HAB, General Secretary (Hostel Affairs Board) will call the HAB meetings, draw up the Agenda and finalize the date and time of the meeting.

11.3 A minimum of 4 days notice shall be required to convene a HAB Meeting.

11.4 The quorum for an HAB Meeting shall consist of the Chairman and at-least one representative from each hostel. The representative may be Warden, Associate Warden or Hostel Representative.

11.5 An extraordinary HAB Meeting shall be called by the General Secretary (Hostel Affairs Board) at request of one-third members of the HAB. The minimum notice for calling an extra-ordinary meeting shall be 24Hrs. However, the decisions of such extra-ordinary General Body Meeting will have to be ratified at the next ordinary HAB Meeting.

11.6 Generally, all decisions shall be taken by consensus among the members of the HAB.

11.7 The Chairman/Coordinator – HAB will normally preside over the HAB Meeting.

11.8 Every member of the HAB shall have one vote each in case the decision is to be voted upon. However, in such decisions that require voting, the Chairman will not exercise his vote.

11.9 Decisions regarding controversial issues which require reference to the Institute policies, rules and regulations shall be minuted but kept pending until the Ex-officio Chairman and Functional Chairman obtains the necessary directives from Students Affairs Council (SAC)/the Senate. Other controversial cases may be referred to all HMCs for wider opinion on the matter, after which the same to be settled in the immediate next HAB meeting.

11.10 The Secretary shall be responsible for recording the minutes of meetings in consultation with the Chairman/Coordinator, HAB. It is his/her responsibility to circulate the minutes within seven days of the meeting and hand over the signed copy of the same to the Chairman/Coordinator, HAB for safe custody.

11.11 The Secretary would circulate copies/excepts of the ratified minutes of the HAB Meetings to all hostels for necessary actions and information.

11.12 A minute book shall be maintained by the HAB office wherein the minutes of the HAB Meetings are recorded.

11.13 The Chairman may take a decision on routine matters and inform HAB, if the matter demands so.

11.14 In case HAB Chairman/Coordinator is out-of-station, he/she may nominate a Warden to take care of the routine matters of HAB in his/her absence.

12. Functions of the HAB

12.1 To formulate policies, rules and regulations, coordinate and review all matters concerning the hostels.

12.2 To ensure implementation of procedures in all hostels with respect to discipline, maintenance of accounts, auditing bills, mess bills, regular payment of hostel dues by hostel residents etc.

12.3 To assist hostels in the matters of procurement of major stores, furniture, etc.

12.4 To consider matters pertaining to hostel security, cleanliness, fire safety and any other matter relating to hostels.

12.5 To formulate the policy for hostel allotment to all bonafide students and eligible members of the institute.

12.6 HAB shall handle all correspondence and propose agenda items for the consideration of the Senate.

12.7 The HAB may propose amendments to the Hostel Constitution from time to time for consideration of the Senate.

12.8 Broad guidelines related to disciplinary measures at different level in hostels will be formulated by HAB from time to time. In case of monetary punishment, the quantum of punishment at different levels will be fixed by HAB.

12.9 HAB can constitute a committee comprising of faculty members outside the HAB for deciding the following awards for the institute hostels, every year:

1. Maintenance
2. Sports
3. Cultural activities

The awards may be announced at the last hostel day celebration.

12.10 The HAB shall allot hostel rooms to all bonafide students of the Institute subject to availability.

12.11 The HAB shall allot accommodation (on availability) to the Institute project staff and the delegates/sponsored persons/trainees from other Institutions/ all others who are authorized to stay in the hostels for specified periods of duration in the hostels. All correspondence related to accommodation in hostels should be addressed to the Chairman/Coordinator HAB.

12.12 The HAB shall be responsible for the implementation of all the decisions of the Institute concerning students' hostels.

13. Responsibilities of Chairman/Coordinator – HAB

13.1 The HAB Account will be under the custody of the Chairman/Coordinator. This bank account will be operated jointly by the Chairman and a Warden nominated by HAB. The cheque / pass book of the same will be in the custody of the Chairman.

13.2 The Chairman/Coordinator will forward the recommendations of the Mess Contract Awarding Committee (refer Annexure C) to the Institute authority for the award of the contract to the mess caterer(s).

13.3 The Chairman/Coordinator will forward recommendations of the HAB to the Institute Authority for awarding contract of Security and cleaners.

13.4 The Chairman/Coordinator will have full disciplinary control over all the Hostel employees.

13.5 The Chairman/Coordinator on behalf of HAB can levy fine on any resident so far as the late payment of mess dues is concerned. He can waive fine on any student so far as his/her mess dues are concerned on recommendations of Chairman, HMC.

13.6 The Chairman/Coordinator HAB shall permit transfer of a student from one hostel to another on the recommendation of the concerned Wardens.

14. Warden Council

14.1 The Warden Council shall consist of all the Wardens and Associate wardens of all the Hostels that fall under the HAB of the Institute.

14.2 The Warden Council shall have the HAB Chairman/Coordinator as its Chairman.

14.3 The Warden Council shall be convened by the HAB Chairman/Coordinator at least once a semester.

15. Amendment of the Hostel Constitution

Amendment to the Hostel Constitution shall be recommended by HAB and subsequently be approved by the SAC. No amendment shall be ratified unless it is circulated to all HMCs and at least one HAB meeting has been devoted for discussing all aspects of the matter to be amended.

Annexure 3A: General Guidelines for Mess Management

The culture of taking food in the mess creates an atmosphere of togetherness, discipline, and community feeling. Also, its management inculcates among students entrepreneurship, managerial skills and leadership. Keeping these points into consideration, it is clear that the mess should be an integral part of the hostel and must be managed by a committee of students elected among them.

Mess Management Committee (MMC):

1. The mess committee will consist of seven resident members of which one will be the convener (one of the hostel representative in mutual consent). The elected Convener of MMC will select the MMC members in consultation with warden and Hostel representative of that hostel choosing at least one member from each hostel.

2. **Tenure of the mess management committee**: The mess committee will have a term of one semester.

3. **Duties and obligations of mess management committee**: The mess management committee should look into all the aspects for a smooth & efficient, functioning of the mess. General guidelines are as follows:

    a. To decide the menu

    b. To monitor the quality of food, mess timing and hygiene

    c. To check the process of preparation of proper food.

    d. The mess committee will prepare a report on the performance of the caterer regarding its quality, hygiene, implementation of menu etc. The report will be handed over to the Coordinator of Hostel affairs board.

    e. The Committee shall interact with Mess Manager/Caterer regularly for proper functioning of the mess. Any discrepancy will be reported to Warden/HMC.

    f. The committee will also look after day-to-day functioning of the Hostel Canteen, if any.

4. **Imposition of fines in case of non-payment of mess subscription by registered boarders of Hostel**: In case any boarder fails to pay the mess subscription for a month, the HAB can impose fine on the Boarder. However, the structure of the fines and procedures to be followed for the same shall be in accordance with HAB Procedures and Resolutions (HABPR).

Annexure 3B: Hostel Disciplinary Committee

1. **Composition**

1.	Chairman/Coordinator, Hostel Affairs Board	Chairman
2.	Warden of concerned hostel	Member Secretary
3.	Associate Warden of concerned hostel	Member
4.	Hostel Representative of concerned hostel	Member
5.	General Secretary, Hostel Affairs Board	Member, Jt. Secretary
6.	Caretaker of concerned hostel	Invitee

2. Functions

1. The committee will look into such acts of the hostel inmates, which constitute to gross violation of the code of conduct and invoke disciplinary action(s).

2. Depending on the seriousness of the case the HDC may take disciplinary action at its level or refer the case to Students Disciplinary committee.

3. Commensurate with the gravity of the offence appropriate punishment like fine, community work, etc may be imposed.

4. Chairman/Coordinator, HAB will nominate one Warden in addition to the Warden the said hostel on a case by case basis (by providing sufficient notice to the concerned Warden).

Annexure 3C: Students Affairs Council (SAC)

SAC is the overall apex policy making body of the Institute to look after all student hostel, welfare and extra-curricular activities.

Composition

1. Director	Chairman
2. Dean/Coordinator of Students' Affairs	Secretary
3. Associate Dean/Co-coordinator of Students' Affairs	Member
4. Registrar/Dy. Registrar/Asst. Registrar	Non-Member Secretary
5. Dean/Coordinator of Academic Affairs	Member
6. Chairman/Coordinator, Cultural Board	Member
7. Chairman/Coordinator, Sports Board	Member
8. Chairman/Coordinator, Technical Board	Member
9. Chairman/Coordinator, Hostel Affairs Board	Member
10. Warden of all Hostels	Member
11. Vice President, Students' Gymkhana Council	Jt. Secretary
12. General Secretary, Cultural Board	Member
13. General Secretary, Sports Board	Member
14. General Secretary, Technical Board	Member
15. General Secretary, Hostel Affairs Board	Member

STUDENTS' AFFAIRS COUNCIL

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SENAPATI, MANIPUR

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1. Introduction

The different Councils and Boards under the Students' Affairs Council are intended to work as an organization for fostering extra-curricular and co-curricular activities including cultural, sports, and other technical and personality developmental activities of the students of the institute.

The Councils/Boards will work towards the overall development of the student community of the Institute for fostering a healthy atmosphere of learning.

The guiding principle shall be the greater well-being of the entire student community.

2. Definitions and Terms Relevant to the Students' Affairs Council

Chairman
The Director of the Institute shall be the Chairman of the Students' Affairs Council.

President
The Dean/Coordinator of Students' Affairs (DoSA) shall be the Secretary of the Students' Affairs Council and the President of the Gymkhana Council, responsible for the general administration of the Students' Affairs Council. He will report to the Director of the Institute.

Gymkhana Council
The Gymkhana Council is the body that will promote the objectives of fostering extracurricular and co-curricular activities, welfare of students and their stay on the campus. It comprises of four Boards Viz. Cultural Board, Sports Board, Technical Board, and Hostels' Affairs Board.

Cultural Board
It comprises of Chairman/Coordinator, Cultural Board and elected student representatives.
Its main function is to coordinate and execute all cultural activities through the various clubs and to coordinate and execute all activities related to the cultural festivals.

Sports Board
It comprises of Chairman/Coordinator, Sports Board and elected student representatives.
Its main function is to coordinate and execute all sports activities through the various clubs and to coordinate and execute all activities related to the annual sports competitions.

Technical Board
It comprises of Chairman/Coordinator, Technical Board and elected student representatives. Its main function is to coordinate and execute all activities of technical clubs and to coordinate and execute all activities related to the annual technical festival.

Hostels' Affairs Board

The Hostels' Affairs Board is the body that will coordinate and execute all activities related to the residential stay, boarding and lodging of students in the hostels on the campus.
It comprises of Chairman/Coordinator, Hostels' Affairs Board, Wardens and Associate Wardens of all hostels and concerned student representatives.
Their main function is to coordinate and execute all activities related to hostels and Hostel Management Committees of hostels.

Students' Executive Committee
Students' Executive Committee is elected by Students' general body. The committee shall consist of Vice-president and General Secretaries of Cultural Board, Sports Board, Technical Board, and Hostel Affairs Board.

Senator
The constituent members of Student Senate elected by the general body of students are called Senators. The Senators jointly shall execute the duties of Students' Senate.

Bonafide Student
A bonafide student is a student having a valid roll number and registered for the purpose of pursuing studies in any of the academic programs of the institute during the semester/year under consideration.

Members
All bonafide students of the institute shall constitute the Students' General Body.

3. ORGANIZATION OF STUDENTS' AFFAIRS COUNCIL

3.1 Students' Affairs Council
The Students' Affairs Council (SAC) will be the apex policy making body under whose purview will be matters related to Gymkhana Council.

3.2 Composition:

1. Director	Chairman
2. Dean/Coordinator of Students' Affairs	Secretary
3. Associate Dean/Co-coordinator of Students' Affairs	Member
4. Registrar/Dy. Registrar/Asst. Registrar	Non-Member Secretary
5. Dean/Coordinator of Academic Affairs	Member
6. Chairman/Coordinator, Cultural Board	Member
7. Chairman/Coordinator, Sports Board	Member
8. Chairman/Coordinator, Technical Board	Member
9. Chairman/Coordinator, Hostel Affairs Board	Member

10. Warden of all Hostels	Member
11. Vice President, Students' Gymkhana Council	Jt. Secretary
12. General Secretary, Cultural Board	Member
13. General Secretary, Sports Board	Member
14. General Secretary, Technical Board	Member
15. General Secretary, Hostel Affairs Board	Member

3.2.1 It will function with the active participation of nominated members from amongst the members of the faculty and elected student representatives holding designated responsibilities for the different sub functions.

3.2.2 The Students' Affairs Council will make operative various activities of Gymkhana Council including NCC/NSS/NSO, Centre for Career Development and Students' Academic Board.

3.3 Functions of Students' Affairs Council

1. To formulate all policy matters concerning students' affairs as a whole.
2. To review the working, and effect constitutional changes of the various student bodies.
3. To review management of the different councils /boards/cells under SAC.
4. To consider and advise on all matters referred to it by the different councils/boards/cells under its purview.
5. To add /delete clubs and committees in the various Councils/Boards under it.
6. To recommend to the Board of Governors amendments in the Statutes of the Council.

3.4 Faculty nominations to various Councils / Boards / Cells

1. The Director in the capacity of Chairman of SAC shall nominate members of the Faculty for heading the different Councils / Boards / Cells operative under SAC.
2. The different Councils / Boards / Cells of SAC shall be headed by Faculty members with the following designations:

Council	**Headed by**
Gymkhana Council	Dean/Coordinator of Students' Affairs
Sports Board	Chairman/Coordinator, Sports Board
Cultural Board	Chairman /Coordinator, Cultural Board
Technical Board	Chairman /Coordinator, Technical Board
Hostels' Affairs Board	Chairman /Coordinator, Hostel Affairs Board

3.5 Elected Student Representatives of the Bodies under SAC

Elected student's representatives will play an active role in the different designated activities facilitated through:

1. Students' Senate
2. Students' Executive Committee

4. THE STUDENTS' SENATE

4.1 The Students' Senate shall discharge its responsibilities mainly through itself and its Standing/Ad-hoc Committees.

4.2 The Students' Senate shall be the central representative body of students of IIIT Senapati, Manipur and shall guide the activities of all four boards of the Gymkhana Council. It shall:

1. Serve as the main forum of expression of students' opinion.
2. Be in continuous touch with the general body, consult the students and act as a feedback system.
3. Ensure that the executive wings carry out all their functions under the guidance of the Students' Senate.

However, it should not interfere in matters of minor importance in order that the free functioning of the executive wings within the general policy framework defined by the Senate is not affected.

4.3 The Vice-President shall be the Chairman of the Students' Senate. All meetings will be convened and chaired by him / her.
He /she shall also be the Chairman of the Students' Executive Committee and shall supervise and coordinate the general affairs of all the boards.

4.4 The Vice-President shall keep the President informed about the schedule, agenda, and minutes of Students' Senate meetings.
The Vice-President shall direct the appropriate persons, with approval from the President, for the successful implementation of the decisions of Students' Senate.

4.5 Democratic principles shall be adhered to at all levels in decision making.
4.6

a. In matters of general interest of the Students, the Clubs/ Committees of the different Boards shall be subordinate to the Students' Senate, and Students' Senate shall be subordinate to the General body.
b. The general interest of the students shall be placed above the interest of any individual student.

4.7 Majority decisions shall be binding on all. Persons holding different views, shall have the right to appeal and report directly to all higher bodies up to and including the general body. But the decisions taken shall be executed until and unless higher bodies undo them.

4.8 The Vice-President of the Students' Senate shall refer a matter to the general body if so requested by at least 1/3 of the total strength of the Students' Senate.

4.9 In case where some decision of the Students' Senate has been passed with a large majority and substantial minority, (more than 1/3 of the Senators present voted against it) the Chairman of the Students' Senate may refer the matter to the General body.
The Students' Senate in such an event shall not be able to table a no-confidence motion against him.

4.10 The Vice-President as the Chief Executive of the Gymkhana shall have the right to attend meetings of representatives of all boards/committees of the Students' Senate as a full-fledged member and over rule any decision taken by them. Any such decision will however have to be ratified by the Students' Executive Committee in its next meeting. In the event of the Vice-President doing so, he shall be obliged, if requested by the concerned body, to requisition a meeting of the Students' Senate and place his decision before it.

4.11 During summer and winter vacations, when many of the Senators are not present, the Vacation Students' Senate (consisting of all Senators present in Campus) shall normally discuss matters of urgent importance.
Other matters if discussed shall require endorsement by the full Students' Senate when it meets next.

4.12 In the handing over session, which shall be jointly attended by the members of both the outgoing and incoming Students' Senate as full-fledged members, the annual Gymkhana report, which shall consist of reports of all boards/committees, shall be presented in writing before the House.

4.13

a. Every Senator is expected to intimate to the Vice-President the reasons for his /her inability to attend a meeting and take permission prior to the meeting for absenting himself /herself. If a senator is absent without permission for two Students' Senate meetings, consecutive or non-consecutive, the Vice-President shall issue a warning to that senator. Thereafter, if a senator is absent without prior permission from two or more meetings, he /she shall cease to be a senator. A Senator entering the meeting twenty minutes after it is called to order shall be considered to be absent for that meeting if prior permission for delayed attendance is not taken.
b. Every Executive should intimate to the Vice-President the reasons for his /her inability to attend the meeting and should take permission prior to the meeting for absenting himself /herself. If an Executive is absent without permission from two Students' Senate meetings, consecutive or non-consecutive, the Vice President shall issue a show cause notice to the concerned Executive. Thereafter, if an Executive fail to provide a satisfactory explanation or is absent without prior permission, the Vice-President shall issue a warning. As a result of unsatisfactory explanation to the Students' Senate (according to the 2/3 of the total house) or further absence without prior permission, the senator shall cease to hold the post.

4.14 Amendment to the SAC Statutes may be considered by the Students' Senate and recommended to the Students' Affairs Council for its consideration. Any such recommendation will require the support of three-fourths of the strength of the Senate.

4.15 Students' Executive Committee

4.15.1 Composition

Vice President	Chairman
General Secretary, Cultural	Member
General Secretary, Sports	Member
General Secretary, Hostel Affairs	Member
General Secretary, Technical	Member

4.15.2 The Students' Executive Committee (SEC) shall act on behalf of the Students' Senate. It shall carry out the day-to-day affairs of the Gymkhana Council. It shall also be a body through which the activities of the different Boards of the Gymkhana Council shall be coordinated.

4.15.3 The SEC shall meet regularly, at least once a month.

4.15.4 The SEC shall examine all proposals for consideration of the Senate and it shall take necessary actions if so authorised by the Senate.

5. COUNCIL/CELLS OF THE STUDENTS' AFFAIRS COUNCIL

5.1 **Gymkhana Council**

5.1.1 Composition

1.	Dean/Coordinator, Students' Affairs	President
2.	Associate Dean/Co-coordinatorof Students' Affairs	Member
3.	Dy. Registrar/Asst. Registrar	Non-Member Secretary
4.	Chairman/Coordinator, Cultural Board	Member
5.	Chairman/Coordinator, Sports Board	Member
6.	Chairman/Coordinator, Technical Board	Member
7.	Chairman/Coordinator, Hostel Affairs Board	Member
8.	Warden/Associate Warden	Member
9.	Vice President, Students Gymkhana Council	Secretary
10.	General Secretary, Cultural	Member
11.	General Secretary, Sports	Member
12.	General Secretary, Technical	Member
13.	General Secretary, Hostel Affairs	Member

5.1.2 The aim of the Gymkhana Council is to help the President in discharging his duties with relation to activities of the Gymkhana. It shall act as the executive wing of the Students' Affairs Council. The Students' Executive Committee (SEC) shall interact closely with the Gymkhana Council. All matters requiring co-ordination among the Boards of the Gymkhana and requiring participation of the faculty members of the Gymkhana shall be discussed and examined in the Council.

5.1.3 It shall review the working of Cultural, Sports, Technical, and Hostels' Affairs Boards.

5.2 Cultural Board

5.2.1 Composition

Chairman/Coordinator, Cultural Board	Chairman
General Secretary, Cultural	Member Secretary
Secretaries of various subcommittees (clubs/cells/societies)	Members

5.2.2 The aim of the Cultural Board is to organize and promote all extra-curricular cultural activities and any other items referred by the Students' Senate.

5.2.3 Chairman/Coordinator, Cultural Board, shall head the Board.

5.2.4 The General Secretary, Cultural shall be the Secretary of the Board and shall supervise and coordinate all cultural activities.

5.2.5 The Board may call upon the Cultural Secretary of any or all hostels to attend Board meetings and coordinate with it.

5.2.6 The General Secretary, Cultural shall be the Convener of any intra-cultural activity. The Cultural Board shall be the main organizing Board.

5.2.7 The following clubs and committees may be part of the Cultural Board. The General Secretary can resolve changes and execute after approval by respective Board Chairman/Coordinator and DoSA/CoSA.

- Music Club
- Performing Arts Club
- Movie Club
- Photographic Club
- Literary Club
- Fine Arts Club
- Publication Subcommittee
- Anchoring Club

- SPANDAN/EBSB Committee
- Choreography Club
- Youth Empowerment Club
- Social Service Club
- Interaction Club

5.3 Sports Board

5.3.1 Composition

Chairman/Coordinator, Sports Board	Chairman
General Secretary, Sports	Member Secretary
Secretaries of various sub-committees (clubs/ cells/ societies)	Members

5.3.2 The aim of the Sports Board is to organize and promote all extra-curricular activities in the field of Sports and any other items referred by the Students' Senate.

5.3.3 Chairman/Coordinator, Sports Board, shall head the Board.

5.3.4 The General Secretary, Sports shall be the Secretary of the Board and shall supervise and coordinate all its activities.

5.3.5 The Board may call upon the Sports Secretary of any or all hostels to attend meetings and coordinate with it.

5.3.6 The General Secretary, Sports shall be the Convener of the intra-college sports competition. The Sports Board shall be the main organizing Board.

5.3.7 The following clubs and committees may be part of the Sports Board. The General Secretary can resolve changes and execute after approval by respective board Chairman/Coordinator and DoSA/CoSA.

- Cricket Club
- Football Club
- Volleyball Club
- Athletics Club
- Badminton Club

5.4 Technical Board

5.4.1 The aim of the Technical Board is to organize and promote all extra-curricular activities including hobbies technical and scientific in nature and any other items referred by the Students' Senate.

This Board shall come into existence whenever two or more technical clubs are started under the Students' Gymkhana.

5.4.2 Composition

Coordinator, Technical Board	Chairman
General Secretary, Technical	Member Secretary
Secretaries of various subcommittees (clubs/cells/societies)	Members

5.4.3 The Chairman/Coordinator, Technical Board, shall head the Board.

5.4.4 The General Secretary, Technical shall be the Secretary of the Board and shall supervise and coordinate all activities.

5.4.5 The following clubs and committees may be part of the Technical Board. The General Secretary can resolve changes and execute after approval by respective board Chairman/Coordinator and DoSA/CoSA.

- Robotics Club
- Astronomy Club
- Entrepreneurial Development Cell
- Science and Quiz Club
- Environment Club
- Electronics Club
- Coding Club
- Automobile Club

5.5 Hostels' Affairs Board

5.5.1 The aim of the Hostels' Affairs Board is to act as the central coordinating authority for all hostels.
Its main function is to coordinate and execute all activities related to hostels through the Hostel Management Committees of all hostels.

5.5.2 Composition

Chairman/Coordinator, Hostel AffairsBoard	Chairman
General Secretary, Hostel Affairs	Member Secretary
Representative of all Hostels	Members
Vice President, Students Gymkhana	Member
Wardens of all Hostels	
Associate Wardens of all hostels	Members
Dy. Registrar/Asst. Registrar	Non Member, Jt. Secretary

5.5.3 Chairman/Coordinator, Hostel AffairsBoard, shall head the Board.

5.5.4 The General Secretary, Hostel Affairs shall be the Convener of the Hostels' Affairs Board and shall supervise and coordinate all hostel activities.

5.5.5 The concerned Warden/ Associate Warden shall conduct all Elections for hostel representatives.

5.5.6 The rules and regulations for management of the hostels will be as per the "Hostel Affairs' Constitution", a separate document approved by the Board of Governors.

6. GENERAL ELECTIONS FOR STUDENT BODIES

6.1

1. Elections shall be conducted by Election Council headed by the Chief Election Officer to be appointed by committee consisting of DoSA/CoSA.
2. The general elections shall be conducted between 15th to 25th January.
3. The elected members shall take charge after the Handover Ceremony in the first week of March. A joint session of the Students' Senate will be held prior to the hand-over i.e. on 10th February.

6.2

The general elections will be held for the following posts:

1. Vice-President, Gymkhana Council
2. General Secretary, Cultural
3. General Secretary, Sports
4. General Secretary, Technical
5. General Secretary, Hostel Affairs

6.3

All bonafide students of the institute shall have a right to vote in general elections.

6.4

The Students' Affairs Section shall conduct all elections, except elections for hostel representatives.

The concerned Warden/ Associate Warden shall conduct elections for hostel representatives.

6.5

In the event of a post falling vacant midterm, by-elections shall be held only for the posts of executives and Vice President.

In case of vacancy arising for other posts, the Students' Senate shall propose the name of a candidate, who shall then be appointed by the President.

6.6

No student shall be allowed to contest for more than one post in the elections.
At any point of time, a student may hold only one post in any of the committees/boards.
In very special cases, the President may permit a student to hold more than one post.

6.7

Each candidate, prior to filing of nomination papers for a post, shall have to submit to the President a plan of activities he/she wishes to pursue.
On being elected to a post, they shall have to submit a detailed activity calendar for the entire term, by a date to be decided by the Vice President.
The Students' Senate shall use this document for regular appraisals of the working of the elected representatives.

6.8

The procedure for selection of Club Secretaries is as follows:

- After the general elections the General Secretary of each Board shall propose the various positions for clubs as per requirement for smooth execution of the Board activities throughout the year in the joint students' senate meeting on 10th February. Nominations for the same can be called after approval from respective board Chairman/Coordinator and DoSA/CoSA.
- The students who have sent nominations for a post will be interviewed by a committee consisting of Coordinator, General Secretary of respective board and Vice-President.
- The Club Secretaries who are nominated by the committee will be ratified in students' senate.

7. FINANCES OF THE GYMKHANA COUNCIL

7.1 Income

The total funds of the Students' Gymkhana shall comprise of:

- Contributions made by the Students as annual Gymkhana fees, approved by the institute.
- Contribution made by the Institute, as may be deemed necessary by the institute, provided for in the budget estimates for the particular year.
- Funds from other sources such as membership fees of clubs, sale of tickets for professional programmes, sponsorship, ad-hoc contribution from the institute etc.

7.2 Budget

7.2.1

The Boards shall finalize their annual budget and the executive concerned shall present it to the Students' Senate for ratification.

7.2.2

If the Students' Senate advises some changes in the budget of any Board, the corresponding executive shall meet their Board members to modify the budget proposal, which shall be put up to the Students' Senate for ratification.

7.2.3

Students' Senate shall pass the Annual Budget, and present it to the Gymkhana Council. The Council may send the budget back to the Senate if it is against Institute policies and norms. The Council will place the Budget to the Director for approval.

7.2.4

The budget estimate shall be reviewed after six months of working and a revised budget will be prepared.

7.2.5

The guiding spirit in the expenditure of the Gymkhana shall be economy at all stages and in all possible ways.

7.3 Annual Report

The Students' Executive Committee shall present an Annual Report before a joint session of theStudents' Senate at the end of a year in April, comprising outgoing and incoming members of the Senate. Each club / committee / Board shall prepare a report of their activities and these shall form part of the Annual Report.

The Annual Report must include:

a. Report on the Activities of all the constituents of the Students' Gymkhana
b. A balance sheet (of income/ expenditure)
c. Recommended actions

8. BY LAWS

8. 1

Recommendation for amendment of articles of the Statutes shall require the support of at least three fourths of the total strength of the Students' Senate.

8.2

Amendment of Rules and Procedures of the Students' Senate (Appendix I) shall require the support of at least 2/3 of the total strength of the Students' Senate.

8. 3

The Students' Senate can terminate any student executive from office by passing a no confidence motion supported by at least 2/3 of its total strength.

8. 4

Any executive, Students' Senate functionary or member of councils/committees can be censured for his action with the support of at least 1/2 of the total strength of the Students' Senate.

8. 5

The Vice-President shall call and chair general body meetings. He/ she shall be obliged to call a general body meeting if requisitioned by the President or at least 1/3 of the total strength of the Students' Senate or at least 1/4 of the total strength of the general body.

8. 6

a. The Vice-President of the Students' Senate shall be obliged to call a meeting of the Students' Senate within 48 hrs. If requisitioned by the President or by at least 1/3 of the total strength of the Students' Senate.

b. In case a meeting of the Students' Senate is requisitioned with a public notice under Article 9.06(a) to take up a no-confidence motion against the Vice-President, the Vice-President must have the issue discussed and voted upon by the Students' Senate within 48 hrs. Or within the time limit specified by the President. Failing this 2/3 or more than 2/3 of the total strength of the Students' Senate, may by President's consent and a public notice terminate the Vice-President and appoint a new Vice President.

8. 7

The Chairman/Coordinator/Convener of any Board/ standing or ad-hoc committee of the Students' Senate shall be obliged to call a meeting of the same if requisitioned by at least 1/3 of its total strength.

8.8

For general students' opinion on a particular issue, the Students' Senate may go for a referendum. All referendums shall be conducted by a referendum-in-charge to be appointed by the President.

Referendums can be held only with the approval of the Chairman SAC.

8.9

Notwithstanding any other provisions for a referendum existing in the Constitution, a referendum to impeach an executive can be held only if 1/2 or more of the total strength of the Students' Senate votes in favour of this.

Appendix 3D

STUDENTS' SENATE

RULES AND PROCEDURES

1. SESSIONS OF THE STUDENTS' SENATE

1.1 Frequency

The Students' Senate shall meet on 10th of every month, except in summer and winter holidays.

1.2 Notification

A minimum notice of three days shall be given before every session of the Students' Senate to:

a. All members of the Students' Senate and

b. The General Body of the Students.

1.3 Agenda

a. The agenda of the Sessions of the Students' Senate shall be finalized by the Students' Executive Committee. The agenda shall be circulated to the members of the Students' Senate and general body of students by the Vice-President at least three days in advance. Late additions to the agenda are, however, permitted at the discretion of the Vice-President. The agenda may be over-ruled by a simple majority in the Students' Senate.

b. The agenda cannot be overruled in a requisition meeting called under Article 9.06 of the Constitution.

c. Every Board general secretary must submit plan of action for upcoming months and report of events held in previous month. The plan of action, report should contain date, time, venue and budget of the event with.

d. General Secretary, HAB should submit the minutes of GBM, HMC meetings held in all the hostels in previous month.

1.4 Quorum

One-half of the total strength of the Students' Senate shall constitute the quorum. The quorum shall be required at the commencement of each session. Members shall not leave during sessions without the permission of the Vice-President. If the quorum is not met at the beginning of any session, the Vice-President shall adjourn the session for lack of quorum without transacting any business. In such an eventuality, Vice President shall reconvene a session within a week. For the reconvened meeting, if there is no quorum, the Vice President shall reconvene the session after half an hour and such a session shall not require any quorum. For a requisition meeting called under Article 9.06 of the Statutes, adjourned once due to lack of quorum, the Vice-President will call another meeting within 3 days. For such a meeting if the quorum requirements of

Article 1.4(a) of the rules and procedures are not met then the matter shall be referred to the general body.

1.5 Attendance

In case any member of the Students' Senate is unable to attend a session, he/ she shall communicate the reasons of the same to the Chairman of the Students' Senate in advance of the Session and this communication shall be read out at the session. Any member who absents himself/ herself without explanation from two consecutive or non-consecutive sessions shall be served a show-cause notice by the Chairman of the Students' Senate. If the member is unable to provide an explanation to the satisfaction of the Students' Senate, the Chairman of the Students' Senate shall propose a censure notice against the defaulting member.

1.6 Presence of the General Body

All sessions of the Students' Senate shall ordinarily be open to the General Body of the Students. However, the Students' Senate may resolve to hold a closed door session on the basis of a simple majority. Members of the General body may express their views either through the members of the Students' Senate or ask for permission to speak themselves. The Chairman of the Students' Senate shall request all members of the general body of the Students to leave in case any confidential matter comes up for discussion. The Chairman of the Students' Senate shall request a General Body member to leave if found violating the code of conduct as per Art. 1.7 below.

1.7 Code of Conduct during the presence of the General Body

a. Members of the General Body should address the Chairman of the Students' Senate during the course of discussion.

b. Members of General Body shall have to take the permission of the Chairman of the Students' Senate before expressing a viewpoint for maintaining the order.

c. Members of the General Body should not make any irrelevant personal comment on the floor of the house or make any coarse remark of offensive nature.

1.8 Minutes

a. The responsibilities for the recording of the minutes of the sessions of the Students' Senate shall rest with the Chairman of the Students' Senate. The actual recording of the minutes shall be done by a senator present at the meeting. The recorded minutes shall constitute a draft and not an official record.

b. Circulation:

The draft minutes shall be published and circulated by the Chairman of the Students' Senate amongst:

Members of the Students' Senate.

DoSA/CoSA

The General Body of the Students.

Within a period of two weeks of the session in question, if this has not been done, all subsequent sessions of the Students' Senate shall be compulsorily adjourned if so demanded by even one member of the Students' Senate.

c. Ratification:

When procedure laid down in Art. 1.9(b) above has been followed the draft minutes shall be placed for ratification at the first subsequent session of the Students' Senate. However, if less than twenty-four hours have elapsed since the circulation of the draft minutes, ratification shall be done in the next session if so demanded by even one member of the Students' Senate. Ratification of the draft minutes shall constitute the first item on the agenda. Changes if any, shall be included in full in the minutes of session in which ratification is done. On ratification, the Chairman of the Students' Senate shall sign the ratified minutes, whereupon they shall become official.

2 Office of the Students' Senate

a. An office of the Students' Senate shall be maintained by the coordinator of the Students' Senate, who shall be responsible for the up to date maintenance of the following:

1. The Statutes of the Students' Affairs Council with amendments.
2. Minutes of the sessions of the Students' Senate.
3. Reports of the sub-committees of the Students' Senate.
4. All correspondence relating to the convening and functioning of the Students' Senate.

b. The Chairman of the Students' Senate shall be responsible for the production, on demand, of all the above documents in original to the following:

1. Members of the Students' Senate.
2. Members of the General Body of the Students.
3. Any other person or body authorized by the Students' Senate.
4. President
5. Any faculty member who is a member of the SAC.

3 Sub-Committees of the Students' Senate

3.1 General Provisions

a. The Students' Senate may appoint as and when necessary an investigative subcommittee to investigate any particular matter and report to it. These sub-committees may be either adhoc or standing.

b. No sub-committees of the Students' Senate shall have any executive function whatsoever unless otherwise explicitly specified in the terms of reference.

c. Members of all the sub-committees of the Students' Senate shall ordinarily be Senators, but in special circumstances the Students' Senate may, by resolution, also include any other General Body member in a sub-committee.

d. All adhoc sub-committees of the Students' Senate shall go out of existence when the outgoing Students' Senate hands over charge to the successor Students' Senate. The standing sub-committee however, will continue till charge is handed over to successor committees.

3.2 Formation

a. Prior to the appointment of any sub-committee, the Students' Senate shall decide by a simple majority the following:

1. its terms of reference

2. its strength, and

3. in the case of an ad-hoc sub-committee, its period of existence.

b. The Chairman of the Students' Senate shall invite nominations for membership of a sub-committee under formation from senators. Senators shall nominate themselves and no seconding shall be necessary. If the number of nominations received is in excess of the proposed strength of the subcommittee, the Chairman of the Students' Senate shall call withdrawals, if any. If the remaining number of nominations is still in excess of the proposed strength, the Chairman of the Students' Senate shall hold an election on the basis of one vote for every member of the Students' Senate. The voting shall be by secret ballot if so demanded by even one member of the Students' Senate.

c. The Chairman of the Students' Senate shall declare the result of the election immediately on conclusion of the same. Unless otherwise resolved in the terms of reference, the sub-committee shall come into existence immediately after declaration of the results of the election.

d. If the number of nominations received is less than the proposed strength of the sub-committee, the Chairman of the Students' Senate shall make a second call for the same. If the number is in excess of the proposed strength, the procedure laid down in Art.3.2(b) above shall be followed. Otherwise, the Chairman of the Students' Senate shall declare the members of the sub-committee duly elected.

e. In case no nominations are received even after the second call, the Chairman of the Students' Senate shall officiate as the Convener of that sub-committee and shall appoint one UG and one PG Senator to discharge the functions of that sub-committee. The Students' Senate must ratify the sub-committee thus formed.

f. The Students' Senate shall elect the Convener of the Sub-Committee from amongst the members of that Sub-Committee as per the procedure specified in Art.3.2(b), (c) and (d) above. No Sub-Committees shall be formed without the specific nominations of a Convener, unless specified in the terms of reference.

g. In case any post of a Sub-Committee of the Students' Senate falls vacant in the middle of its term, the Convener will call for nominations for that post.

3.3 Duties of a Convener

The Convener of a Sub-Committee shall be responsible for the proper functioning of the same. He/ she shall:

a. Convene and preside over all sessions of that sub-committee.

b. Coordinate its activities and ensure its compliance with the terms of reference.

c. Be responsible for the preparation of the sub-committee's report to the Students' Senate within the time specified in terms of reference.

d. Ensure that an adequate opportunity has been provided to the general body of the Student to express their views both before and after the preparation of the sub-committee's draft report.

e. Submit the final report of the sub-committee to the Chairman of the Students' Senate who shall, circulate the entire text of the report as a part of the agenda for a subsequent session of the Students' Senate amongst all those listed in Art.1.9(b). Unless this has been done, the Students' Senate shall not proceed to discuss the report of the committee if so demanded by even by one member of the Students' Senate.

3.4 Functions

a. The Convener of a sub-committee may ask for a preliminary discussion on the floor of the Students' Senate if he/ she thinks that the same is necessary.

b. Ordinarily, all recommendations of a sub-committee shall be on the basis of a consensus. In case of dissent the dissenting members shall attach a note of dissent to the report of the sub-committee for the consideration of the Students' Senate.

c. The Convener of a sub-committee shall be directly responsible for all communications within the subcommittee. He/ she shall route all business with other individuals or bodies through the Chairman of the Students' Senate, who shall be obliged to render the assistance asked for.

4 Procedures

4.1 Changes in Rules and Procedures

a. Inadequacies in the Rules and Procedures shall be referred by the Chairman of the Students' Senate to the Convener of Rules and Procedures committee for corrections.

b. Any Rule and Procedure may be amended in any session of the Students' Senate provided the following have been included previously in the agenda for the same:

Written notice of the proposed action, giving the text of the desired modification together with the statement of its purpose and effect.

Any such modification shall require approval by 2/3 of the members of the Students' Senate and subsequent approval by the President

4.2 Point of Order

a. A Member may raise a point of order, if, in the opinion of the member

1. any constitutional provision or rules or procedure is being transgressed.
2. any established convention of the Students' Senate is being transgressed.
3. an objectionable procedure is being followed.

b. If any member wishes to raise a point of order, the Chairman of the Students' Senate shall permit him/ her to do so immediately.

4.3 Order of Business

a. The order of business at sessions of the Students' Senate shall be as follows:
    1. Ratification of draft minutes.
    2. Announcements.
    3. Remarks by the Vice-President and reports by all Executives.
    4. Reports of sub-committees.
    5. Unfinished business.
    6. New business.

b. The order of business may be over-ruled by a simple majority in the Students' Senate.

ANNEXURE-4

PH.D. ORDINANCES AND REGULATIONS

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
SENAPATI, MANIPUR

ORDINANCES

1. The Indian Institute of Information Technology Manipur awards the degree of Doctor of Philosophy (PhD) in Engineering/Humanities and Basic Sciences to a candidate who has successfully completed the stipulated Programme of Research.
2. The Programme of Research with the governing rules and regulations are formulated by the Academic Council of the Institute. The Academic Council can modify or change the structure, the governing rules and regulations from time to time.
3. A candidate to be awarded the PhD degree has to submit a thesis embodying the findings of his/her research carried out under this programme. The thesis should make an original contribution of high quality to the advancement of knowledge as judged by the experts in the relevant area.
4. A candidate becomes eligible for the award of the PhD degree after fulfilling all the academic requirements prescribed by the Academic Council of the Institute.
5. The award shall be made upon the recommendation of the Academic Council of the Institute after ratification by the Board of Governors of the Institute.
6. The PhD degree shall be awarded in the discipline of the Department which registers the student for the PhD programme.

REGULATIONS

1. CATEGORIES OF PhD STUDENTS

The Institute admits PhD students under the following categories

1.1 REGULAR

A student in this category works full-time for his/her PhD degree. He/she receives assistantship from the Institute or fellowship from CSIR/UGC or any other recognized funding agency.

1.2 SPONSORED

A student in this category is sponsored by a recognized R&D organization, academic institution, government organization or industry for doing research in the Institute on a full-time basis. The Institute does not provide any assistantship/fellowship to such a student.

1.3 SELF-FINANCED

A student in this category works full-time or part-time towards the PhD Programme. The Institute does not provide any assistantship/fellowship to such a student.

1.4 PROJECT-STAFF

This category refers to a student who is working on a sponsored project in the Institute and is admitted to the PhD Programme to work on a full-time or part-time basis. The remaining duration of the project at the time of admission should be at least one year. If the project gets completed before the student completes his/her PhD Programme, his/her category will be converted to that of SELF-FINANCED unless he/she is granted an assistantship/fellowship from the Institute or any other agency.

1.5 PART-TIME

A student in this category is a professionally employed person (including the staff of IIIT Manipur), who pursues the PhD Programme while continuing the duties of his/her service. The Institute does not provide any assistantship/fellowship to such a student.

1.6 EXTERNAL

This category refers to a student employed in an R&D organization/academic institution/industry having adequate research facilities. The research work leading to the PhD degree may be carried out largely in the parent organization of the candidate under a Local Supervisor from the organization but with the overall guidance provided by a faculty member (Institute Supervisor) of the Department in which he/she is registered. The
Institute does not provide any assistantship/fellowship to such a student.

1.7 QUALITY IMPROVEMENT PROGRAMME

This category refers to a student selected under the Quality Improvement Programme (QIP) of the AICTE. The student works full-time in the PhD Programme as per the rules and regulations of QIP.

1.8 VISITING

A student in this category is a registered student in another university/institute in India or abroad. The Institute does not award any degree to such a student.

2. CHANGE OF CATEGORY

The Chairman, Institute Postgraduate Programme Committee (IPPC) on recommendation of the Department Postgraduate Programme Committee (DPPC) approves change from one category to another (except to regular category). Only the Chairman, Academic Council approves change to the regular category from any other category.

3. ADMISSION TO PhD PROGRAMME

3.1 Eligibility Criteria

The details of the eligibility criteria for admission to various PhD programmes are given in Appendix-I. These criteria are revised by the Academic Council from time to time.

3.2 ADMISSION PROCEDURE

3.2.1 Admission to the PhD Programme of the Institute normally takes place in January and July every year. Advertisements are issued in September/October for the even semester (January-April) and February-March for the odd semester (July/August November).

3.2.2 Admission to all categories of students is granted on the basis of interview/admission test held usually during the month of December and May July every year.

3.2.3 The following documents are to be furnished along with the application by candidates falling under Sponsored, Project Staff, Part-time and External categories:
Form I: Sponsorship letter for Sponsored category.
Form II: No objection certificate from Dean (R&D), IIIT Manipur, for Project Staff category
Form III: No objection certificate from the employer for Part-time category.
Form IV: Sponsorship certificate for External category.

4. ASSISTANTSHIP

4.1 Institute assistantships will be available to eligible students as per Technical Education Quality Improvement Programme (TEQIP) phase-III norms.

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

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

4.4 The continuation of the assistantship/fellowship is subject to satisfactory performance of the assigned duties and satisfactory progress of the student in the PhD Programme.

5. LEAVE RULES

5.1 Ordinary Leave:

A full-time PhD student is eligible for 30 days leave for every completed year (calculated in terms of two consecutive semesters, from the time of his/her joining the programme) Saturdays, Sundays or holidays during the leave period are counted towards leave, except for prefixed or suffixed holidays. Of the 30 days leave, a maximum of 15 days of leave is permitted in a semester. However, a maximum of 5 days of such leave is allowed to avail at a stretch if student having any teaching assignment. However, a student can accumulate leave, and avail a maximum of 30 days' leave at a time in a year. The maximum number of carried-over leave, from one completed year to another, is 15 days. Head of the Department sanctions leave on recommendation of the Supervisor.

5.2 Maternity/Paternity Leave

A student is eligible for 4 months maternity leave or 15 days of paternity leave as applicable only once during the PhD Programme.

The Head of the Department sanctions maternity/paternity leave on recommendation of the Supervisor and submission of a certificate from Senior Medical Officer /Medical Officer of the institute.

5.3 Academic leave

Academic leave is permitted on the following grounds.

5.3.1 To attend conferences/seminars/workshops/trainings/short-term courses. A maximum of 15 days of leave is permissible in a calendar year.A maximum of 30 days of leave in a calendar year is permissible for field trips such as data collection, survey work, etc. The Head of the Department sanctions academic leave on recommendation of the Supervisor. Academic leave exceeding 30 days but up to a maximum of 60 days in a calendar year is approved by the Chairman, IPPC on recommendation of the Supervisor and the Head of the Department.

5.3.2 Academic leave of more than 60 days but up to a maximum of 12 months is also permissible to carry out part of the research in another institute/R&D Lab/industry in India or abroad. For sanction of such a leave, a letter of consent from the host institute is required. This leave is permissible only after the student has passed the comprehensive examination and has done part of the research work at IIIT Manipur. On recommendations of the Supervisor, the doctoral committee (DC), the DPPC and Chairman, IPPC, the Chairman, Academic Council approves such an academic leave. Such cases are also to be reported to the Academic Council. A student granted academic leave for one or more semesters, pays prescribed fees in every semester.If a registration

date falls during the period of academic leave, a student completes the registration procedures at the expiry of his/her academic leave.

6. SUPERVISOR(S)

6.1 Every student admitted to the PhD Programme undertakes research under the guidance of a faculty member of the Department in which he is admitted. The faculty member is called his/her Supervisor. In the case of an external category there is also a Supervisor in the parent organization (Local Supervisor).

6.2 A student (external category excluded) may have a second Supervisor from the same or another Department. One of the supervisors will act as the Coordinating Supervisor. The Coordinating Supervisor has to be from the Department where the student is registered. The Chairman DPPC/Head of the nominates the Coordinating Supervisor.

6.3 The following categories of persons can act as one of the Supervisors but not as a Coordinating Supervisor

i. A faculty nearing superannuation with less than 3 years of service left at the Institute.

ii. A faculty on contract (including a Visiting Faculty) with less than 3 years of service left at the time of appointment as a Supervisor.

iii. Professionals from industry for students other than external category. On recommendation of the DPPC and the Chairman IPPC, the Chairman Academic Council approves appointment of such a Supervisor.

6.4 In special cases, a student admitted to a Department A can have as his sole supervisor, a faculty F from another Department B, unless either of the departments A or B do not agree. The reasons of disagreement must be given in writing and the matter will then be decided in a joint meeting of the Heads and DPPC Secretaries of the two departments, the Dean

6.5 Academic Affairs, and the Director. A faculty member F can take at most one student from outside his / her department in one academic year. The faculty F, and the department A will be identified before the admission takes place. In order to encourage such cross- disciplinary guidance, Department A may be allowed an increase in intake capacity if required. The DPPC Secretary of Department A will handle the official processes and faculty F will interact with this convenor directly (without going through his / her Head) for matters relating to the concerned student. Reservation of slots can also apply in such cases.

7. APPOINTMENT OF SUPERVISOR(S)

7.1 The DPPC appoints Supervisor(s) to a student after obtaining mutual consent of both the student and the Supervisor(s).

7.2 The Supervisor(s) is identified and appointed at the earliest and within six months from the date of admission.

7.3 A student under external category has one Supervisor from the Department in which he is admitted and another from the parent organization (Local Supervisor). On recommendation of the DPPC, the Chairman of the IPPC approves the appointment of the Local Supervisor.

8. CHANGE/ADDITION OF SUPERVISOR(S)

8.1 If a student has only one Supervisor and the Supervisor goes on leave for more than 15 (fifteen) months, another Supervisor is appointed by the DPPC. Mutual consent of both the student and Supervisor(s) is taken for such cases.

8.2 If the Supervisor of a student under external category proceeds on a leave for more than 15 (fifteen) months, the Secretary, DPPC or the Head of the looks after the routine administrative issues. Otherwise, the DPPC may appoint a new Supervisor. Mutual consent of both the student and Supervisor(s) is taken for such cases.

8.3 The Chairman, Academic Council may permit a student to change his/her Supervisor(s) for valid reasons. Mutual consent of the student and supervisor(s) and recommendations of the DPPC and IPPC are required. Such cases are reported to the Academic Council.

9. DOCTORAL COMMITTEE (DC)

9.1 To monitor the progress of research of a student, there will be a Doctoral Committee with the following composition:

(i) A faculty member other than the Supervisor(s) to be nominated by the DPPC Chairman

(ii) Supervisor(s) Member(s)

(iii) Two other faculty members of which one should preferably be from another department Members.

9.2 The DC is constituted by the DPPC in consultation with the Supervisor(s) within one month from the date of appointment of the Supervisor(s). The list is sent to the Chairman, IPPC for approval.

9.3 Until the DC is constituted, the DPPC performs the duties of the DC.

10. COURSE WORK

10.1 The DC of a student prescribes the courses a student has to register for every semester. However, the DPPC prescribes courses if the DC is not yet constituted.

10.2 10.2 A student of Engineering/Technology Department with an entry level qualification of two- year Master's degree (after completion of 4-year Bachelor's degree) or three-year Master's degree (after completion of 3-year Bachelor's degree) registers for a minimum of 4 courses with at least 24 credits and has to obtain a CPI of at least 6.5. Similarly, a student of Science Department with an entry level qualification of Master’s degree registers for a minimum of 4 courses with at least 24 credits and has to obtain a CPI of at least 6.5

10.3 A student with entry-level qualification other than those under Clause 10.2 above registers for a minimum of 6 courses with at least 36 credits and has to obtain a CPI of at least 6.5.

10.4 Two of the registered courses may be taken as seminar courses. In a seminar course, a student delivers 2-4 seminars. A brief report is submitted at least one week before the due date of every seminar. The DC members act as examiners for such seminars. One of the DC members coordinates the seminar course. Before registration, the DC and the DPPC decides the number (one or two) and the type of the course taken as a seminar course.

10.5 For students having MTech/MDes degree from IITs, coursework is not mandatory. The DC/DPPC may recommend such a student to do some course work after due assessment.

10.6 For a student inducted to the PhD programme while pursuing MTech/MDes, coursework is not mandatory. However, the DC/DPPC may recommend some courses after due assessment.

10.7 Under normal circumstances, a student is required to complete all course work within two semesters, and registering for at least two courses in the first semester. In each semester, the Cumulative Performance Index (CPI) should not be less than 6.0.

10.8 If at the end of any semester, a student maintains a SPI of 6.0, but fails in a course, he/she is allowed to repeat/substitute it in the following semester(s).

10.9 A repeat/substitute course may be registered during the summer term.

10.10 A student is not allowed to register for B.Tech or MSc level courses. However, he may be allowed to audit these courses.

10.11 A student, who is not exempted from course work, can opt for a Credit Waiver Written Comprehensive Examination (CWWCE) only without undertaking any normal course work (see clause 11.5).

The DPPC evaluates and approves the above option of the student. Otherwise, the student will follow normal course work and system of comprehensive examination.

11. COMPREHENSIVE EXAMINATION

11.1 To test the overall competence and academic preparation of a student in the PhD Programme, a Comprehensive Examination is held within 18 months for students with master's degrees and within 24 months for the students only with Bachelor degrees from the date of admission.

11.2 Comprehensive Examination is held only after successful completion of course work.

11.3 A student, for whom course work is waived, takes the Credit Waiver Written Comprehensive Examination (CWWCE) within six months from the date of admission.

11.4 The mode of Comprehensive Examination (oral or written or both) as well as the modus operandi (common to all students in a Department) is decided by the DPPC and is intimated to the students (other than the rigorous written comprehensive examination).

11.5 The Credit Waiver Written Comprehensive Examination (CWWCE) (as mentioned in clause 10.11) will be as follows:

i. Will consist of at least three papers of 3-hours each.

ii. The syllabi will cover broadly undergraduate curriculum of the concerned discipline (other than electives)

iii. The syllabi will be approved by the Academic Council

iv. A student takes the examination within six months from the date of admission.

11.6 The date of the Comprehensive Examination is informed to the student at least one month prior to the date of examination. The DPPC conducts Comprehensive Examinations for all PhD Students.

11.7 A student failing in the Comprehensive Examination in the first attempt is given a second attempt not before one month and within six months from the date of the first attempt. If the student fails in the second attempt, he/she is not allowed to continue in the PhD programme.

11.8 If a student inducted to the PhD programme while pursuing MTech/MDes fails in the Comprehensive Examination, he/she is allowed to complete project work of the MTech/MDes and will get an MTech/MDes degree. He receives assistantship as per MTech/M.Des regulations.

11.9 If a student inducted to the PhD programme while pursuing B.Tech, he/she will be allowed to replace the B.Tech Projects by PhD level courses or he/she will be allowed to drop the B.Tech Projects. Such a student can drop out of the dual degree programme at any time, but he/she will be awarded a B.Tech degree only after he/she passes the PhD comprehensive

examination which must be of the Credit Waiver Written Comprehensive Examination (CWWCE) type. A student not wishing to keep his/her option of dropping out in the middle of the PhD programme, will be able to take the ordinary comprehensive examination if he/she so desires.

11.10 All cases of failure in the Comprehensive Examination are reported to the Academic Council.

12. STATE-OF-THE-ART SEMINAR

12.1 Within 6 months of the successful completion of the Comprehensive Examination, a student presents a State-of-the-Art Seminar (SOAS). The presentation is open to all. In this, he/she presents literature survey and broad areas of research.

12.2 A student submits a write-up to the DC members at least one week before the date of the SOAS.

12.3 A report on the successful completion of the SOAS, is submitted by the DC to the Secretary DPPC who communicates the same to the Chairman, IPPC.

12.4 Within a month, a student delivers another SOAS if the first SOAS is not satisfactory.

13. PROGRESS REVIEW

13.1 After the State-of-the-Art Seminar (clause 12), a student submits at-least one progress report for yearly evaluation to the DC. The DC schedules a meeting where the student presents his/her progress report. All such presentations are open to all. However, the DC may schedule more such meetings depending on the progress of the student.

13.2 The DC reviews the progress and submits a report to the Chairman, IPPC through Secretary, DPPC after every such review.

13.3 Based on needs, the DC may fix a minimum number of working days (up to fifteen) twice a year for a student in part-time and external category to be present in IIIT Manipur for his/her research work.

14. ENROLMENT

14.1 Students of all categories will have to enroll in person every semester on the stipulated date till the submission of their theses.

14.2 They are required to pay the prescribed fees till the submission of their theses within stipulated dates.

14.3 A student may be exempted from the prescribed fees for the last semester if he submits thesis within 30 days from beginning of the semester.

14.4 Semester drop: Up to two semesters may be dropped in the entire duration of the PhD Programme, on bonafide grounds. Except on medical grounds, semester drop is not permissible before successful completion of Comprehensive Examination by a student.

14.5 On recommendation of the Supervisor, Chairman, DPPC and Chairman, IPPC, the Chairman, Academic Council e approves a semester drop. Cases of semester drop are reported to the Academic Council.

14.6 No assistantship is provided during the period of a semester drop. The period of semester drop is not counted in the prescribed time limit for completion of the PhD Programme.

15. CONDUCT AND DISCIPLINE

15.1 Regulations for Conduct and Discipline are common for all students of IIIT Manipur, and these are the same as that prescribed in the B.Tech Rules and Regulations.

15.2 15.2 In addition, unauthorized absence for more than one month leads to disciplinary action, in the form of reduction of assistantship or even termination of studentship.

16. CANCELLATION OF STUDENTSHIP

16.1 The PhD studentship is liable to be cancelled for any of the following reasons:

i. Giving false information at the time of application/admission.
ii. Not conforming to the regulations of the programme.
iii. Failure in coursework requirement.
iv. Failure in Comprehensive Examination.
v. Consistent lack of progress in research.
vi. Violation of discipline and conduct rules of the Institute.
vii. Not submitting a thesis within the stipulated period.
viii. Not enrolling for a semester within stipulated dates.
ix. Regular, Sponsored (Full-time) and QIP category students, remaining absent for more than 6 (six) weeks in a semester, without sanctioned leave.

17. DURATION OF THE PHD PROGRAMME

17.1 The duration of the PhD programme is as follows:

i. The minimum duration of the PhD Programme (excluding dropped semester(s)/maternity leave) is four semesters.

ii. The maximum duration of the PhD programme is 6 years from the date of admission for a full-time student and 7 years for a part-time student.

18. SYNOPSIS OF THESIS

18.1 Prior to the submission of the thesis, a student submits the synopsis of thesis to the DC. The synopsis contains outline of the research contained in the thesis.

18.2 The student makes a presentation of his/her thesis work before the DC in an open seminar (named as Synopsis Seminar). The synopsis is submitted one week before the Synopsis Seminar date.

18.3 If the DC approves the synopsis, the student is allowed to submit the synopsis of the thesis. The Coordinating Supervisor sends report of the Synopsis Seminar and Synopsis to the Chairman, IPPC through the Chairman, DPPC.

18.4 If a student fails to submit the thesis within 3 months from the date of the Synopsis Seminar, he /she shall present another Synopsis seminar. His/her synopsis has to be approved by the DC and sent to the Chairman, IPPC.

19. PANEL OF EXAMINERS

19.1 Two external experts, one from India and the other from abroad, examine a thesis.

19.2 At least fifteen days prior to the submission of the thesis, the DC submits to the Chairman, DPPC a panel of eight examiners, four each from India and abroad. The Chairman, DPPC

forwards it to the Chairman, IPPC. The Chairman, IPPC will recommend the same to the Chairman, Academic Council e, for approval.

19.3 The list of examiners remains confidential with the office of the Chairman, IPPC. The office of the Chairman, IPPC makes all correspondence with the examiners. The name of the Indian examiner is made available to the HOD/HOC and the thesis Supervisor(s) after both the reports have been received. The name of the foreign examiner may also be made available to the concerned Supervisor, subject only to a written consent received from the examiner to that effect.

20. SUBMISSION OF THESIS

Within three months of the acceptance of the synopsis by the DC, the student submits seven (or eight, if there are two supervisors) copies of his/her thesis in prescribed format to the Academic Section.

21. THESIS REPORTS

21.1 Examiners are expected to send reports on the thesis within two months from the date of receipt of the thesis.

21.2 If an examiner does not send his/her report within two months, reminders are sent. If the report is not received in spite of reminders, the Chairman, IPPC replaces the examiner.

21.3 If both the thesis examiners recommend the thesis for award of the PhD degree, the Chairman, IPPC approves the conduct of a Viva Voce. Corrections in the thesis, responses to comments of examiners are ratified by the DC.

21.4 If an examiner suggests re-submission of the thesis, the student is allowed to resubmit the thesis after due revision within the time stipulated by the DC.

21.5 If one examiner recommends the thesis, and the other rejects, the report of the first examiner is sent to the second examiner and vice-versa. The examiners are requested to review their recommendations. If after this, there is one acceptance and one rejection, the matter is placed before the Academic Council for possible replacement of the examiner who has rejected.

21.6 If both the examiners do not recommend the thesis for the award, the reports are sent to the DC which can decide on one of the following based on their assessment.

21.6.1 If the DC is satisfied with the work already done and the contents of the thesis already submitted, it may request the Chairman, Academic Council that the thesis may be sent to another set of examiners. Such a request has to be recommended by the DPPC and Chairman, IPPC.

21.6.2 The DC may advise the student to augment the research and submit the synopsis again. If both the examiners do not recommend the thesis for the award for second time, the student is not awarded the degree and the registration is cancelled.

22. VIVA VOCE

22.1 In a Viva Voce, a student makes an oral presentation on his/her thesis. The presentation is open to all.

22.2 The following is the composition of the Viva Voce Board (VVB).

Chairman of the DC	Chairman
Supervisor(s)	Member(s)

One examiner of the thesis within the country, or a specialist in the subject nominated by the Chairman, IPPC, from the approved panel of examiners.	Member
A faculty member of another department to be nominated by the DPPC.	Member
One faculty member of the Department with knowledge of the subject of the thesis.	Member

The other members of the DC of the student will be invitees to the Oral Examination.

22.3 The VVB conducts the defense of the thesis by the candidate ensuring that he/she answers all the queries of the thesis examiners satisfactorily.

22.4 If the VVB finds the performance of the student unsatisfactory, the student will be asked to reappear for another oral examination at a later date (not earlier than a month and not later than six months from the date of the first oral examination).

22.5 If the VVB finds the performance of the student unsatisfactory on the second occasion also, then the matter will be referred to the Academic Council for a decision.

22.6 The VVB may also recommend revisions to be made in the final version of the thesis after taking into consideration the suggestions of the examiners who evaluated the thesis and the discussion at the Viva Voce. The Chairman of the VVB shall forward the report to the Chairman, IPPC, certifying that the recommended revisions by the VVB, if any, have been incorporated in all copies of the thesis, for award of the degree.

23. AWARD OF PhD DEGREE

23.1 If the Viva Voce Board recommends award of the degree, a student will be awarded the PhD degree on the recommendation of the Academic Council with the approval of the Board of Governors of the Institute.

24. LEGAL OTHER MATTERS

24.1 All other cases, not covered by the above, shall be referred to the Academic Council.

24.2 Any legal matter relating to Rules and Regulation under 1-24 shall be subjected to jurisdictions of Court(s) in Manipur.

ELIGIBILITY CRITERIA FOR ADMISSION INTO PHD PROGRAMME

The details of the eligibility criteria (i.e. minimum qualifications and experience) for admission to various PhD programmes are given in this appendix. The Academic Council reviews the same for admission to the PhD programme from time to time. Relaxation in academic qualification for reserved categories of students is as per Government of India guidelines.

A MINIMUM QUALIFICATIONS

A.1 **PhD in Engineering**

For admission to the PhD Programme in Engineering departments, a candidate must satisfy one of the following criteria:

A.1.1 Master's degree in Engineering/Technology in a relevant area with a minimum Cumulative Performance Index (CPI) of 6.5 or 60% of marks both in the Master's and Bachelor's degrees.

A.1.2 Bachelor's degree in Engineering/Technology in a relevant area with a minimum CPI of 7.5 or 70% of marks.

A.1.3 Bachelor's degree from an Indian Institute of Technology (IIT) in a relevant area with a minimum CPI of 7.0.

A.2 **PhD in Humanities and Basic Sciences**

For admission to the PhD Programme in the department of Humanities and Basic Sciences, a candidate must satisfy one of the following criteria:

A.2.1 Master's degree in Arts/Science in a relevant area with a minimum of 6.5 or 60% marks or equivalent of marks both in the Master's and Bachelor's degrees.

NOTE: - The candidate applying for PhD admission should have also qualified the GATE/NET Examination.

ANNEXURE-5

Indian Institute of Information Technology Senapati, Manipur

PhD Course Structure and Syllabus

1. Electronics and Communication Engineering (ECE)

Course Code	Course Name	L	T	P	C
EC 504	Probability and Stochastic Processes	3	0	0	6
EC 533	Wireless Communication	3	0	0	6
EC 540	Advance Electromagnetic Theory & Antennas	3	0	0	6
EC 636	Detection and Estimation Theory	3	0	0	6
EC541	RF Circuits and Systems	3	0	0	6
EC707	Research Methodology	3	0	0	6
EC532	Information and Coding Theory	3	0	0	6

Course Content and Syllabus:

i. ***EC 504 - Probability and Stochastic Processes***

Axiomatic definitions of probability; conditional probability, independence and Bayes theorem, continuity property of probabilities, Borel-Cantelli Lemma; random variable: probability distribution, density and mass functions, functions of a random variable; expectation, characteristic and moment-generating functions; Chebyshev, Markov and Chernoff bounds; jointly distributed random variables: joint distribution and density functions, joint moments, conditional distributions and expectations, functions of random variables; random vector- mean vector and covariance matrix, Gaussian random vectors; sequence of random variables: almost sure and mean-square convergences, convergences in probability and in distribution, laws of large numbers, central limit theorem; random process: probabilistic structure of a random process; mean, autocorrelation and autocovariance functions; stationarity - strict- sense stationary and wide-sense stationary (WSS) processes: time averages and ergodicity; spectral representation of a real WSS process-power spectral density, cross-power spectral density, linear time-invariant systems with WSS process as an input- time and frequency domain analyses; examples of random processes: white noise, Gaussian, Poisson and Markov processes.

Texts / References:

1. H. Stark and J. W. Woods, *Probability and Random Processes with Applications to Signal Processing*, Prentice Hall, 2002.
2. A. Papoulis and S. U. Pillai, *Probability, Random Variables and Stochastic Processes*, 4th Edn., McGraw-Hill, 2002.
3. B. Hajek, *An Exploration of Random Processes for Engineers*, ECE534 Course Notes, 2011. http://www.ifp.illinois.edu/~hajek/Papers/randomprocesses.html

ii. ***EC 533 - Wireless Communication***

Overview of current wireless systems and standards; wireless channel models- path loss and shadowing models; statistical fading models; narrowband and wideband fading models; MIMO channels. Diversity in wireless communications - Non-coherent and coherent reception; error probability for uncoded transmission; realization of diversity: time diversity; frequency diversity: DSSS and OFDM; receiver diversity: SC, EGC and MRC; transmit diversity: space-time codes; Information theory for wireless communications- Capacity of fading channels: ergodic capacity and outage capacity; high versus low SNR regime; waterfilling algorithm; capacity of MIMO channels; Multiuser wireless communications: multiple access: FDMA, TDMA, CDMA and SDMA schemes; interference management: power control; multiuser diversity, multiuser MIMO systems.

Texts / References:

1. A. J. Goldsmith, *Wireless Communications*, Cambridge University Press, 2005.
2. D. Tse and P. Viswanath, *Fundamentals of Wireless Communications*, Cambridge University Press, 2005.
3. A. Molisch, *Wireless Communications*, John Wiley & Sons, 2005.
4. S. Haykin and M. Moher, *Modern Wireless Communications*, Pearson Education, 2005.
5. T. S. Rappaport, *Wireless Communications*, Prentice Hall, 1996.
6. G. L. Stuber, *Principles of Mobile Communications*, Kluwer, 1996.
7. T. Cover and J. Thomas, *Elements of Information Theory*, John Wiley & Sons, 1991.

iii. ***EE540 Advance Electromagnetic Theory & Antennas***

Review of Maxwell's Equation and boundary conditions; time harmonic electromagnetic fields; vector potentials; electromagnetic theorems and concepts: uniqueness, image theory, field equivalence principle, reciprocity; Plane, cylindrical and spherical waves ;radiation and scattering ; dipole antennas and arrays, aperture antennas: radiation from open ended rectangular and circular waveguides, horn antennas, parabolic antennas, slot antennas and arrays, microstrip antennas.

Texts / References:

1. C. A. Balanis, "*Advanced Engineering Electromagnetics*," John Wiley & Sons, 2009.
2. R. F. Harrington, *"Time Harmonic Electromagnetic Fields*," McGraw Hill, 2001.
3. C. A. Balanis, "*Advanced Engineering Electromagnetics*," John Wiley & Sons, 1989.
4. R. E. Collin, "*Antenna and radio wave propagation*," McGraw Hills, 1985.
5. C. A. Balanis, "*Antenna Theory: Analysis and Design*," John Wiley & Sons, 2009.
6. R. J. Marhefka, A. S. Khan and J. D. Kraus, "*Antennas and Wave Propagation*", Tata McGraw - Hill Education 2010.
7. M. Sachidananda and A. R. Harish "*Antennas and Wave Propagation*" Oxford University Press, USA 2007.

iv. ***EC 636 - Detection and Estimation Theory***

Review of random process, problem formulation and objective of signal detection and signal parameter estimation; Hypothesis testing: Neyman-Pearson, minimax, and Bayesian detection criteria; Randomized decision; Compound hypothesis testing; Locally and universally most powerful tests, generalized likelihood-ratio test; Chernoff bound, asymptotic relative efficiency; Sequential detection; Nonparametric detection, sign test, rank test. Parameter estimation: sufficient statistics, minimum statistics, complete statistics; Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, Bhattacharya bound; Linear models; Best linear unbiased estimation; Maximum likelihood estimation, invariance principle; Estimation efficiency; Least squares, weighted least squares; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

Texts / References:

1. H. V. Poor, *An Introduction to Signal Detection and Estimation*, 2nd edition, Springer, 1994.
2. S. M. Kay, *Fundamentals of Statistical Signal Processing: Detection* Theory, Prentice Hall PTR, 1998.
3. S. M. Kay, *Fundamentals of Statistical Signal Processing: Estimation Theory*, Prentice Hall PTR, 1993.
4. H. L. Van Trees, *Detection, Estimation and Modulation Theory, Part I*, John Wiley, 1968.
5. D. L. Melsa and J. L. Cohn, *Detection and Estimation Theory*, McGraw Hill, 1978.
6. L. L. Scharf, *Statistical Signal Processing: Detection, Estimation, and Time Series Analysis*, Addison-Wesley, 1990.

7. V. K. Rohatgi and A. K. M. E. Saleh, *An Introduction to Probability and Statistics*, 2nd edition, Wiley, 2000.

v. ***EC541 - RF Circuits and Systems***

Course Contents:

Various parameters of interest in RF systems: NF, IIP3, SFDR etc. ; Scattering parameters of n-port networks; Various implementation of transmission lines in RF/microwave circuits; Review of some high speed RF devices; Microwave passive circuits: filters, impedance transformers, hybrids, isolators etc.; Microwave active circuits: amplifiers, mixers, PLLs; Phase shifters.

Texts / References:

1. D. M. Pozar, "*Microwave Engineering*," 4th Edition, Wiley, 2012.
2. C. Bowick, "*RF circuit design*," 2nd Edition, Newnes, 2007.
3. R. C. Li, "*RF Circuit Design*," 2nd Edition, John Wiley & Sons, 2012.
4. G. Gonzalez, "*Microwave Transistor Amplifiers: Analysis and Design,*" 2nd Edition, Prentice Hall, 1996.
5. T. H. Lee, "*Planar Microwave Engineering: A Practical Guide to Theory, Measurement, and Circuits*," Cambridge University Press, 2004.
6. D. M. Pozar, "*Microwave and RF Design of Wireless Systems*," John Wiley & Sons, 2001.

vi. ***EC707 - Research Methodology***

a. General research methodology: methods and techniques generally followed in various type of research work in relevant disciplines,

b. Research planning, execution and validity of outcomes,

c. Basic and applied research techniques.

Texts/References:

1. Kothani C. R., 1985, Research Methodology- Methods and Techniques, Wiley Eastern, New Delhi, India.
2. Lambart J. and Lambart D. A., 1986, How to find Information in Science and Technology, Clive Bingley Ltd. London.
3. Das Debajyoti, 1981, Statistics in Biology and Psychology, Academic Publishers, Calcutta.
4. Related books and journals

vii. ***EC532 - Information and Coding Theory***

Course Contents:

Information Theory: Entropy, relative entropy and mutual information for discrete ensembles; Asymptotic equipartition property; Markov chains; Shannon's noiseless coding theorem; Encoding of discrete sources. Discrete memoryless channels; Shannon's noisy coding theorem and converse for discrete channels; Differential entropy; Calculation of channel capacity for Gaussian channels. Coding Theory: Linear Codes, distance bounds, generator and parity check matrices, error-syndrome table; Cyclic codes, generator and parity

check polynomials; BCH codes and Reed-Solomon Codes; An overview of convolutional codes; Maximum likelihood decoding; MAP decoder; Introduction to turbo codes and LDPC codes.

Texts / References:

5. T. M. Cover and J. A. Thomas, *Elements of Information Theory*, John Wiley, New York, 1991.
6. R. H. Morelos-Zaragoza, *The Art of Error Correcting Coding*, John Wiley, New York, 2006.
7. R. W. Yeung, *A First Course in Information Theory*, Kluwer Academic,2002.
8. R. G. Gallager, *Information Theory and Reliable Communication*, John Wiley, 1968.
9. R. B. Ash, *Information Theory*, Dover Publications, 1990.
10. D. J. Mackay, *Information Theory, Inference and Learning Algorithms*, Cambridge University Press, 2003.
11. W. Ryan and S. Lin, *Channel Codes: Classical and Modern*, Cambridge University Press, 2009.

2. Computer Science and Engineering (CSE)

Course Code	Course Name	L	T	P	C
CS529	Topics and Tools in Social Media Data Mining	2	0	2	6
CS566	Speech Processing	3	0	0	6
CS563	Principles Of Robotics	3	0	0	6
CS567	Pattern Recognition	3	0	0	6
CS562	Machine Learning	3	0	0	6
CS543	Information Transmission And Security	3	0	0	6
CS571	Human Computer Interaction	3	0	0	6
CS570	Fundamentals Of Information Retrieval	3	0	0	6
CS568	Data Mining	3	0	0	6
CS574	Computer Vision Using Machine Learning	3	0	0	6
CS549	Computer And Network Security	3	0	0	6
CS509	Computational Number Theory and Cryptography	3	0	0	6
CS561	Artificial Intelligence	3	0	0	6
CS534	Approximation Algorithms	3	0	0	6
CS707	Research Methodology	3	0	0	6

Course Content and Syllabus:

i. ***CS529*** **Topics and Tools in Social Media Data Mining:**

Syllabus :

Social media have transformed the way people interact, influence, and perform business. This course aims to introduce research topics in social media mining and discuss relevant theoretical foundations, methods, and tools. The Lab component of the couse will engage students with various state-of-the-art big data analytical framework for mining social media content. The class will involve reading papers, presentations, and team projects/assignments.

Course contents:

Content mining: Topics on social media content mining including retrieval, ranking, trends detection, event detection, event forecasting, opinion mining, and any other relevant topics.

Link mining: Topics on social media link analysis including centrality, community, link prediction, influence analysis and any other relevant topics.

Log analysis: Topics related to user's behavioral analysis, personlization, recommendation, and any other relevant topics.

Lab Component: Various state-of-the-art big data analytics tools for mining social media data.

ii. **CS566 Speech Processing**

Syllabus:
Introduction to Speech Processing, human and machine speech production:Models for speech production. Various types of speech sounds and their characteristics, Speech hearing: Mechanism for human hearing: Learning to recognize human sounds, acquired knowledge vs vocabulary - based methods. Analysis of speech: Frequency and time domain based methods: FFT, computation of pitch, spectrograms, LPC, cepstrum, ZCR, etc. Representation of acoustic events. Components of a Speech recognition system: Input, feature analysis, modelling and decision rule, vocabulary. Data compression: Vector Quantization, codebook design, Lloyd's quantizer design, K-means algorithm, LBG algorithm for speech. Speech modelling: Stochastic processes: Markov processes, Hidden Markov modelling. Components of an HMM, training and building of HMMs: Viterbi algorithm, Baum-Welch algorithm, etc. Implementation of a speech recognition system: Time/space consideration, designing the interface, self-learning mechanism.
Texts:
1. L. Rabiner and B. H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1993.
2. L. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.
3. K. Sayood, Introduction to Data Compression, 2nd Ed, Morgan Kaufmann, 2000.
References:
1. D. O'Shaughnessy, Speech Communications: Human and Machine, 2nd Ed, IEEE Press, 2000.
2. A. Gersho and R. M. Gray, Vector Quantization and Signal Compression, Kluwer Academic, 1991.
3. Selected research papers.

iii. **CS563 Principles of Robotics**

Syllabus:
Introduction to robot manipulation. Forward and inverse kinematics of robots and some case studies. Manipulator dynamics. Basics of robot control. Task planning with emphasis on computational geometry methods for robot path finding,robot arm reachability, grasp planning etc. Overview of robot vision.
Texts:
1. R. J. Schilling, Fundamentals of Robotics: Analysis and Control, Prentice-Hall India 1996.
References:
1. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.

2. R. P. Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981.
3. J. C. Latombe, Robot Motion Planning, Kluwer Academic Publishers, 1991.

CS567 Pattern recognition

Syllabus :
Introduction to Pattern Recognition: Learning paradigms, Supervised and unsupervised learning; Bayesian decision theory: Minimum error rate classifier; Parameter estimation: Maximum likelihood and Bayesian Estimation; Hidden Markov models; Nonparametric techniques: Nearest neighbor rules, Parzen windows; Decision trees: Axis-parallel, Oblique, Impurity measures; Feature selection: Forward, backward search; Component analysis and discriminant functions: Principal component analysis, Fisher linear discriminant, Perceptron, Support vector machines; Generalization ability of learning methods: Bias and variance, Regularization; Bootstrapping, Boosting, Bagging; Unsupervised learning and clustering: k-Means methods.
Texts :
1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern classification, John Wiley & Sons, 2002.
References:
1. C. M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
2. V. N. Vapnik, The Nature of Statistical Learning Theory, Springer, 2000.
3. N. Cristianini and J. Shawe-Taylor, An Introduction to Support Vector Machines, Cambridge University Press, 2000.
4. Selected Research Papers.

iv. **Computer Vision**

Syllabus :
Course Contents: Introduction to computer vision: Image classification and clustering, Linear classification, Higher-level representations, Object detection, Bag of words, Object recognition/categorization, Segmentation; Introduction to Neural Networks: Linear regression, Backpropagation, Cross-validation process, Optimization, Debugging; Convolutional Neural Networks: Architectures, convolution / pooling layers, Understanding and visualizing CNN; Beyond image classification: localization, detection, segmentation; Recurrent Networks : Image captioning example.
Texts:
1. Image and video text recognition using convolutional neural networks: Study of new CNNs architectures for binarization, segmentation and recognition of text images, byZohra Saidane, Publisher: LAP LAMBERT Academic Publishing (April 5, 2011)
2. Face Image Analysis with Convolutional Neural Networks, byStefan Duffner, Publisher: GRIN Verlag (October 18, 2013)
3. Fundamentals of Deep Learning, Designing Next-Generation Artificial Intelligence Algorithms By Nikhil Buduma, Publisher: O'Reilly Media (June 2015)
References:
1. Neural Networks and Deep Learning, by Michael Nielsen, Online Book: http://neuralnetworksanddeeplearning.com.
2. ImageNet Classification with Deep Convolutional Neural Networks, Alex Krizhevsky, Ilya Sutskever, Geoffrey E Hinton, NIPS 2012.
3. Going Deeper with Convolutions, Christian Szegedy, Wei Liu, Yangqing Jia, Pierre Sermanet, Scott Reed, Dragomir Anguelov, Dumitru Erhan, Vincent Vanhoucke, Andrew Rabinovich, 19-Sept-2014.
4. Learning Hierarchical Features for Scene Labeling, Clement Farabet, Camille Couprie, Laurent Najman and Yann LeCun, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2013.
5. Learning Convolutional Feature Hierachies for Visual Recognition,Koray Kavukcuoglu, Pierre Sermanet, Y-Lan Boureau, Karol Gregor, Michal Mathieu and Yann LeCun, Advances in Neural Information Processing Systems (NIPS 2010), 23, 2010.
6. Ciresan, Dan, Ueli Meier, and Jrgen Schmidhuber.Multi-column deep neural networks for image classification.Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on. IEEE, 2012.

v. **CS 562 Machine Learning**

Syllabus:
Definitions, goals and history of Machine Learning. Taxonomies of methods and research paradigms. Knowledge-level vs. symbol-level learning. Major approaches of learning: Inductive concept acquisition (version-space, ID3, and AQ algorithms); inductive bias, minimum description length principle. Formal models of learnability. learning in the limit. PAC learnability. Ockham's razor. Learning by observation and discovery (e.g., conceptual clustering in CLUSTER and COBWEB) Scientific and mathematical discovery (e.g., AM and BACON) Explanation-based learning: macro-operators (STRIPS), explanation generalization (as in EBG, EGGS, and SOAR); Connectionist (i.e. neural network) learning (perception and back-propagation), Analogy and case-based reasoning (exemplars, structure mapping).
Texts:
1. J. Shavlik and T. Dietterich (Ed), Readings in Machine Learning, Morgan Kaufmann, 1990.
2. P. Langley, Elements of Machine Learning, Morgan Kaufmann, 1995.
References :

vi. **CS 543 Information Transmission And Security**

Syllabus :
Information theory Fundamentals: Error Correcting Codes: Mathematical Preliminaries Linear Block Codes Cyclic Codes BCH Codes Arithmetic Codes Convolutional Codes Unidirectional Error Correcting Codes Applications of Error Correcting Codes. Cryptography: Cryptographic techniques Mathematical Preliminaries Symmetric Key cryptography Block Cipher and Stream Cipher Public Key Cryptography Attacks Message Authentication: Digital signatures, MD5, SHA etc. Key Exchange Schemes E-cash/Money. Data Compression: Compression Techniques Mathematical Preliminaries Hoffman Coding Arithmetic Coding Dictionary Techniques Static Dictionary, Adaptive Dictionary Lossless Image Compression Scalar and Vector Quantization Differential Encoding MPEG JPEG Video Compression
Texts:
1. T. R. N. Rao and E. Fujiwara, Error Control Coding for Computer Systems, Englewood Cliffs, NJ: Prentice Hall, 1989.
2. B. Schneier, Applied Cryptography, 2nd Ed, John Willey and Sons, 1996.
3. K. Sayood, Introduction to Data Compression, 2nd Ed, Morgan Kaufmann, 2000.
References:
1. M. Y. Rhee, Cryptography and Secure Data Communications, McGraw Hill, 1994.
2. S. Lin and D. J. Costello, Error Control Coding, 2nd Ed, Prentice Hall, 2005.
3. S. B. Wicker, Error Control systems for Digital Communication System and Storage, Prentice Hall, 1995.
4. T. C. Bell, J. G. Cleary and I. H. Witten, Text Compression, Advanced Reference Series, Englewood Cliffs, NJ: Prentice Hall, 1990.
5. R. M. Gray, Entropy and Information Theory, New York: Springer-Verlag, 1990.
(Full text available at http://www-ee.stanford.edu/~gray/it.pdf)

vii. **CS571 Human Computer Interaction**

Syllabus :
HCI foundation: history, human abilities, state of the art in computing technology, interaction styles and paradigms; Design process: interaction design basics, HCI in software process, design rules and guidelines, implementation support (UI software), universal design; Interaction styles: direct manipulation, WIMP, web interface, natural language interaction; Evaluation techniques; Models in HCI: formal models, linguistic models, cognitive models (KLM/GOMS), cognitive architectures, hybrid models; Task analysis; Dialogue design; Advanced topics (overview) pervasive computing, CSCW, virtual reality, tangible user interface, multimedia.
Texts :
1. A. Dix, J. Finlay, G. D. Abowd and R. Beale, Human Computer Interaction, 3rd edition, Pearson Education, 2005.
References:

1. J. Preece, Y. Rogers, H. Sharp, D. Baniyon, S. Holland and T. Carey, Human Computer Interaction, Addison-Wesley, 1994.
2. C. Stephanidis (ed.), User Interface for All: Concepts, Methods and Tools. Lawrence Erlbaum Associates, 2001.
3. J. M. Caroll (ed.), HCI Models, Theories and Frameworks: Towards a Multidisciplinary Science (Interactive Technologies), Morgan Kauffman, 2003.
4. W. O Galitz, The Essential Guide to User Interface Design, John Wiley & Sons, Inc, 2002 (Indian Edition).
5. B. Shneiderman, Designing the User Interface, Addison Wesley, 2000 (Indian Reprint).

viii. **CS 5790 Fundamentals of Information Retrieval**

Syllabus:
This course is intended for both undergraduate and postgraduate students. The domain of Information Retrieval (IR) is concerned with the extraction of relevant information from large collections of documents. It has applications to proprietary retrieval systems as well as the WWW, Digital Libraries and commercial recommendation systems. The objective of the course is to introduce students to the theoretical underpinnings of IR and practical experience in the construction of IR systems through a series of programming assignments. Introduction: concepts and terminology of information retrieval systems, Information Retrieval Vs Information Extraction; Indexing: inverted files, encoding, Zipf's Law, compression, boolean queries; Fundamental IR models: Boolean, Vector Space, probabilistic, TFIDF, Okapi, language modeling, latent semantic indexing, query processing and refinement techniques; Performance Evaluation: precision, recall, F-measure; Classification: Rocchio, Naive Bayes, k-nearest neighbors, support vector machine; Clustering: partitioning methods, k-means clustering, hierarchical; Introduction to advanced topics: search, relevance feedback, ranking, query expansion.
Texts:
1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schtze, Introduction to Information Retrieval, Cambridge University Press. 2008.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval, Addison Wesley, 1st edition, 1999.
References:
1. Soumen Chakrabarti, Mining the Web, Morgan-Kaufmann Publishers, 2002.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer, Corr. 2nd printing edition, 2009.
3. David A. Grossman, Ophir Frieder, Information Retrieval: Algorithms and Heuristics, Springer, 2nd edition, 2004.
4. William B. Frakes, Ricardo Baeza-Yates, Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
5. G. Salton, M. J. McGill, Introduction to Modern Information Retrieval, McGraw-Hill, 1986.
6. C. J. Van Rijsbergen, Information Retrieval, Butterworth-Heinemann; 2nd edition, 1979.

ix. **CS 568 Data Mining**

Syllabus:
Types of data mining problems. The process of data mining. Statistical evaluation of big data: statistical prediction, performance measures, pitfalls in data-mining evaluation. Data preparation: data models, data transformations, handling of missing data, time-dependent data, textual data. Data reduction: feature selection, principal components, smoothing data, case subsampling. Predictive modeling: mathematical models, linear models, neural nets, advanced statistical models, distance solutions, logic solutions, decision trees, decision rules, model combination. Solution analyses: graphical trend analyses, comparison of methods. Case studies. Future trends: text mining, visualization, distributed data. Practical sessions using open-source software.
Texts:
1. S. Weiss and N. Indurkhya, Predictive Data-Mining: A Practical Guide, Morgan Kaufmann, 1998.

References:
1. S. Weiss, N. Indurkhya, T. Zhang and F. Damerau, Text Mining: Predictive Methods for Analyzing Unstructured Information, Springer, 2004.

x. CS574 Computer Vision Using Machine Learning

Pre-requisites : NIL
Syllabus :
Course Contents: Introduction to computer vision: Image classification and clustering, Linear classification, Higher-level representations, Object detection, Bag of words, Object recognition/categorization, Segmentation; Introduction to Neural Networks: Linear regression, Backpropagation, Cross-validation process, Optimization, Debugging; Convolutional Neural Networks: Architectures, convolution / pooling layers, Understanding and visualizing CNN; Beyond image classification: localization, detection, segmentation; Recurrent Networks : Image captioning example.
Texts:
1. Image and video text recognition using convolutional neural networks: Study of new CNNs architectures for binarization, segmentation and recognition of text images, byZohra Saidane, Publisher: LAP LAMBERT Academic Publishing (April 5, 2011)
2. Face Image Analysis with Convolutional Neural Networks, byStefan Duffner, Publisher: GRIN Verlag (October 18, 2013)
3. Fundamentals of Deep Learning, Designing Next-Generation Artificial Intelligence Algorithms By Nikhil Buduma, Publisher: O'Reilly Media (June 2015)
References:
1. Neural Networks and Deep Learning, by Michael Nielsen, Online Book: http://neuralnetworksanddeeplearning.com.
2. ImageNet Classification with Deep Convolutional Neural Networks, Alex Krizhevsky, Ilya Sutskever, Geoffrey E Hinton, NIPS 2012.
3. Going Deeper with Convolutions, Christian Szegedy, Wei Liu, Yangqing Jia, Pierre Sermanet, Scott Reed, Dragomir Anguelov, Dumitru Erhan, Vincent Vanhoucke, Andrew Rabinovich, 19-Sept-2014.
4. Learning Hierarchical Features for Scene Labeling, Clement Farabet, Camille Couprie, Laurent Najman and Yann LeCun, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2013.
5. Learning Convolutional Feature Hierachies for Visual Recognition,Koray Kavukcuoglu, Pierre Sermanet, Y-Lan Boureau, Karol Gregor, Michal Mathieu and Yann LeCun, Advances in Neural Information Processing Systems (NIPS 2010), 23, 2010.
6. Ciresan, Dan, Ueli Meier, and Jrgen Schmidhuber.Multi-column deep neural networks for image classification.Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on. IEEE, 2012.

xi. CS549 Computer and Network Security

Syllabus:
Overview, vulnerabilities, risk assessment, incidents. Cryptography: Classical Cryptography, Symmetric Cryptography, Public Key (Asymmetric cryptography), Modern Cryptography, Hash Functions, Key Exchange. Review: Installing Unix and common service daemons (Unix Security, Windows NT Security, Ping, traceroute, TCP Dump, sniffer etc.), Networking. Security issues: Terminology (Integrity, Availability, Confidentiality, Non-repudiation, Authentication, Authorization/Access Control, accounting, auditing, Passive and Active Attacker, Interruption, Interception, Modification, Fabrication, Social Engineering), Vulnerabilities and Counter Measures (Viruses, worms, Trojan horses, backdoors, unused services, buffer overflows, RPC), Exploits (Buffer overflow, Port Scanning etc). Applications Security (System Security, Audit Logs Intrusion Detection, Wrappers, Password and remote authorization tools e.g. PGP, S/MIME, SSH, Netscape/SSL, SET, IPsec, Kerberos, Firewalls, VPN etc, Secure (commerce) Transaction over a network, Network Anonymity.
Texts:
1. W. Stallings, Cryptography and Network Security: Principles and Practice, 3rd Ed, Prentice Hall, 2003.
References:
1. B. Schneier, Applied Cryptography, 2nd Ed, John Wiley & Sons, Inc., 1996.

2. A. Menezes, P. van Oorshot and S. Vanstone, Handbook of Applied Cryptogrphy, CRC Press, 1997.
3. C. Kauffman, R. Perham and M. Speciner, Network Security: Private Communication in a Public World, Prentice-Hall, 1994.
4. H. C. A. van Tilborg, Fundamentals of Cryptology, Kluwer Academic Publishers, 2000.
5. P. Garrett, Making and Breaking Codes: An Introduction to Cryptology, Prentice-Hall, 2001.
6. P. Wayner, Disappearing Cryptography, 2nd Ed, Morgan Kaufmann, 2002.
7. W. Cheswick, S. Bellovin and A. Rubin, Firewalls and Internet Security. Repelling the Wiley Hacker, 2nd Ed, Addison-Wesley, 2003.
8. Related publications in Journals/Conferences.

xii. **CS 509 Computational Number Theory and Cryptography**

Pre-requisites : Nil
Syllabus :
Modular Arithmetic: Solving Modular Linear Equations, the Chinese Remainder Theorem, Modular Exponentiation, and Discrete Logarithm Problem GCD Computation: Euclid's Algorithm, Extended Euclid's Algorithm Key Exchange: Diffie Hellman, ElGamal, Massey-Omura, Computation of Generators of Primes Public Key Cryptosystem: RSA, Different Attacks & Remedies Primality Testing: Pseudoprimality Testing, Quadratic Residues, Randomized Primality Test & Deterministic Polynomial Time Algorithm Factorization: Quadratic-Sieve Factoring Algorithm, Pollard-Rho Method Elliptic Curve Cryptosystem: Theory of Elliptic Curves, Elliptic Curve Encryption & Decryption Algorithms, Security of Elliptic Curves Cryptography, Elliptic Curve Factorization Cryptographic Hash Functions: MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA-1), Security of Hash Functions & Birthday Attack Digital Signatures: Authentication Protocols, Digital Signature Standards (DSS).
Texts:
1. T. H. Cormen, C. E. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, 2nd Edition, Prentice Hall, 2002.
2. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York, May 2001.
References:
1. Oded Goldrich, Foundations of Cryptography-Basics, vol-1, Cambridge Univ. Press, 2005.
2. Oded Goldrich, Foundations of Cryptography-Applications, vol-2, Cambridge Univ. Press, 2005.
3. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
4. William Stallings, Cryptography and Network security: Principles and Practice, 3rd Ed, Prentice Hall, 2003.

xiii. **CS 561 Artificial Intelligence**

Pre-requisites : CS201
Syllabus:
Introduction to intelligent agents. Problem Solving: Searching, Intelligent search methods, Game Playing. Knowledge and Reasoning: Building a Knowledge Base. Inference in First Order Logic, Logical reasoning systems. Planning. Uncertain Knowledge and Reasoning, Probabilistic Reasoning Systems. Learning from Observations: Inductive Learning, Learning Decision Trees, Computational Learning Theory, Explanation Based Learning. Genetic algorithms, Artificial Neural Networks and Fuzzy Approaches. Introduction to Natural Language Processing. The course will include programming projects involving programming in Lisp, Prolog and C++.
Texts :
1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 2nd Ed, Prentice Hall, 2003

References:
1. E. Rich and K. Knight, Artificial Intelligence, McGraw Hill, 1991.
2. P. H. Winston and B. K. P. Horn, Lisp, 3rd Ed, Addison-Wesley, 1989.
3. P. Norvig, Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp, Morgan Kauffman, 1991.
4. I. Bratko, Prolog Programming for Artificial Intelligence, 3rd Ed, Addison-Wesley, 2001.

3. Humanities and Social Sciences

Subject: Linguistics

Course Code	Course Name	L	T	P	C
HS 733	Issues in Phonological Theory	3	0	0	6
HS 734	Perspectives in Linguistics	3	0	0	6
HS 749	Issues in Tone Languages	3	0	0	6
HS 769	Research Methods in Linguistics	3	0	0	6

i. HS 733: **Issues in Phonological Theory**

Description:
Segmental phonology in traditional generative grammar: the phonemic principle, rules and representations, rule-ordering, feeding and bleeding rules, domain-sensitive rules; Lexical phonology and morphology: Derived Environment (DE) rules, Strict Cyclicity Condition (SCC); Autosegmental Theory; Suprasegmental structure and non-linear phonology: stress, feet and metrical structure, syllabification, tone; Harmony processes; Optimality Theory: phonology and constraints; Typology of structural changes and repairs; Generalized alignment; Constraint-based metrical grammars; Reduplication and prosodic morphology; Output to Output Correspondence, base vs. cyclic identity; Opacity problems and non-classical variants of Optimality Theory.

Text Book:
1. Clark, John, Collin Yallop, Janet Fletcher. (2007). ***An Introduction to Phonetics and Phonology***. Wiley.
2. Goldsmith, John A. (2011). ***The Handbook of Phonological Theory***. Wiley-Blackwell.
3. Kager, René (1999) ***Optimality Theory***. Cambridge: Cambridge University Press.
4. Ladefoged, P. (1993). ***A Course In Phonetics***. Harcourt Brace Jovanovich.
5. Lass, Roger. (1984). Phonology: ***An Introduction to Basic Concepts***. Cambridge University Press.
6. Roca, I. And W. Johnson. (1999). A ***Course In Phonology***. Blackwell Publishers.

Reference:
1. Chomsky, Noam and Halle, Morris (1968) ***The Sound Pattern of English***. New York: Harper & Row.
2. Collins, Beverley and Inger M. Mees. (2013). ***Practical Phonetics and Phonology***: A Resource Book for Students. Routledge
3. Gillon, Gail T. (2017). ***Phonological Awareness***, Second Edition: From Research to Practice. The Guilford Press
4. Goldsmith, John (1976a) ***Autosegmental Phonology***. Doctoral dissertation. MIT, Cambridge, MA. [Published (1979), New York: Garland Press.]
5. Kenstowicz, Michael (1995) ***Cyclic vs. non-cyclic constraint evaluation***. Phonology 12, 397–436. [Available on Rutgers Optimality Archive, ROA-31.]
6. Kenstowicz, Michael and Kisseberth, Charles (1979) ***Generative Phonology: Description and Theory***. New York: Academic Press.
7. Tesar, Bruce and Paul Smolensky. (2000). ***Learnability in Optimality Theory***. The MIT Press.

8. Walker, Rachel. (2011). ***Vowel Patterns in Language***. Cambridge University Press.

ii. HS 734: **Perspectives in Linguistics**

Description:

Historical overview; Fields of inquiry and their focus: historical, descriptive and generative linguistics; Key concepts in interdisciplinary research: language in socio-cultural and ethnic context, cognitive, computational and psycho-neurolinguistics; Applications of linguistics; Linguistic research in India; Current trends: contribution of linguistic research towards better understanding of human mind.

Text Book:

1. Corder, S. P. (1973). ***Introducing Applied Linguistics***. Harmondsworth.
2. Fromkin, Victoria (Et Al) (2003). ***An Introduction to Language***. U.S.A: Heinle.
3. Hudson, R.A., ***Sociolinguistics***. (2nd Ed.) (2001). Cambridge: Cambridge University Press.
4. Lyons, J. (1968). ***Introduction To Theoretical Linguistics***. Cambridge University Press.
5. Ndimele, O-M. (1999). ***A First Course On Morphology And Syntax***. Port Harcourt: Emhai Books.

Reference:

1. Aronoff, Mark, Kirsten Fudeman (2011). ***What is Morphology***? (Fundamentals of Linguistics). Wiley-Blackwell.
2. Blake, Barry J., (1990). ***Relational grammar***. Routledge, London.
3. Ladefoged, Peter & Sandra Ferrari Disner. (2012). ***Vowels and Consonants***. Wiley-Blackwell.
4. Ladefoged, Peter. (2003). ***Phonetic Data Analysis: An Introduction to Fieldwork and Instrumental Techniques***. Wiley-Blackwell.
5. Stump, Gregory T., (2001) ***Inflectional Morphology: A Theory of Paradigm Structure***. Cambridge University Press.

iii. HS 749: **Issues in Tone Languages**

Description:

Basics of tone languages: definition, production of tones, tonal notations, tone contrasts, number and types of tones, level tones, contour tones, relationship to laryngeal features; Theories of tone: auto-segmental theory, optimality theory; Tonal typology: African languages, Asian languages, American languages; Indian tone typology: Punjabi and Sindhi, Bodo-Garo, Tani languages, Naga languages.

Text Book:

1. Fromkin, Victoria A. (2014). ***Tone: A Linguistic Survey***, Academic Press.
2. Weidert, Alfons, Tibeto-Burman. (1987). ***Tonology: A Comparative Analysis (Current Issues in Linguistic Theory)***. John Benjamins Publishing Company.
3. Yip, Moira. (2002). ***Tone***. Cambridge University Press.

Reference:

1. Goldsmith, John A., Elizabeth Hume, Leo Wetzels (Eds). (2011). ***Tones and Features: Phonetic and Phonological Perspective***, De Gruyter Mouton.
2. Johnson, Keith. (2011). ***Acoustic and Auditory Phonetics***. Wiley-Blackwell

iv. HS 769: Research Methods in Linguistics

Description:

v. Research methodology in Linguistics: Schools in Linguistic, data collection, data analysis; Schools: Prague school, Russian Academy, Generative school; Data collection: field methods, laboratory settings; data analysis: quantitative methods, descriptive statistics, probability distributions, hypothesis testing.

Text Book:

1. Abi, A. (2001). ***A Manual of Linguistic fieldwork and structures of Indian languages***. Lincolm Europa.
2. Chelliah, Shobhana and Willem J. de Reuse. (2010). ***Handbook of Descriptive Linguistic Fieldwork***. Springer.
3. Gonzales-Marquez, M. (2007). ***Methods in Cognitive Linguistics***. *Vol 18*. John Benjamins.
4. Gravetter, F and Wallnau, L. (2016). ***Statistics for the behavioral Sciences***, Cengage Learning.
5. Vaux, B, Cooper, J and Tucker, E. (2006). ***Linguistic Field Methods***. Wipf and Stock.

ANNEXURE-6

ACADEMIC CALENDAR FOR THE CALENDAR YEAR 2019

Events	Winter Semester of AY 2018-2019	Monsoon Semester of AY 2019 - 2020
Registration for New Students	……	**22 July 2019, Monday (Tentative)**
Registration for Continuing UG Students* and continuing PhD Students	**02 January 2019, Wednesday * (For 2017 & 2018 B.Tech. Batch)**	**22 July 2019, Monday * (For 2018 B.Tech. Batch)**
Registration for Continuing UG Students*/ All students with backlogs and New PhD students	**03 January 2019, Thursday * (For 2015 & 2016 B.Tech. Batch)**	**23 July 2019, Tuesday * (For 2016 & 2017 B.Tech. Batch)**
First day of Instruction	04 January 2019, Friday	24 July 2019, Wednesday
Last date for Registration with fine	**9 January 2019, Wednesday**	**29 July 2019, Monday**
Mid Semester Examination	**25 February-2 March , 2019**	**16-21 September 2019**
Last date of returning evaluated mid semester examination answer scripts to students	11 March 2019, Tuesday	30 September 2019, Monday
Last day of Instruction	26 April 2019, Friday	22 November 2019, Friday
End Semester Examination	**29 April-04 May, 2019**	**25 November-30 November 2019**
Last date of submission of grades to the Academic Section	9 May 2019, Thursday	5 December 2019, Thursday
Last Date of Re-examination for I and X graders and submission of conversion grades	10 May 2019, Friday	06 December 2019, Friday
Vacation for Continuing Students	**06 May 2019 to 21 July 2019**	**02 December 2019 to 01 January 2020**

Special Adjustments in Class Time Table	
August 30 (Friday) 2019	**Tuesday Time Table**
September 5 (Thursay) 2019	**Tuesday Time Table**
October 25 (Friday) 2019	**Tuesday Time Table**

Commencement Dates of Winter Semester of AY 2019 – 2020 (January – May 2020)	
Registration for Continuing 1st - 2nd year UG Students and continuing PhD Students	02 January 2020, Thursday
Registration for Continuing 3rd - 4th year UG Students and students with backlogs and New PhD students	03 January 2020, Friday
First Day of Instruction	06 January 2020, Monday
Last Date for Late Registration with Fine	9 January 2020, Thursday

List of Holidays for the Year 2019

The following is the list of holidays that will be observed by Indian Institute of Information Technology Senapati, Manipur during the calendar year 2019.

Sl. No.	**Holidays**	Date	**Day**
1.	Republic Day	26.01.2019	Saturday
2.	Mahashivaratri	04.03.2019	Monday
3.	Holi	21.03.2019	Thursday
4.	Mahavir Jayanti	17.04.2019	Wednesday
5.	Good Friday	19.04.2019	Friday
6.	Buddha Purnima	18.05.2019	Saturday
7	Idu'l Fitr*	05.06.2019	Wednesday
8	Idu'l Zuha (Bakrid)*	12.08.2019	Monday
9.	Patriots Day	13.08.2019	Tuesday
10.	Independence Day	15.08.2019	Thursday
11.	Muharram	10.09.2019	Tuesday
12.	Mahatma Gandhi's Birthday	02.10.2019	Wednesday
13.	Dussehra (Maha Navami)	07.10.2019	Monday
14.	Dussehra (Vijaya Dashami)	08.10.2019	Tuesday
15.	Diwali (Deepawali)	27.10.2019	Sunday
16.	Ningol Chakkouba	29.10.2019	Tuesday
17.	Prophet Mohammad's Birthday (ID-e-Milad)	10.11.2019	Sunday
18.	Guru Nanak's Birthday	12.11.2019	Tuesday
19.	Christmas Day	25.12.2019	Wednesday

N.B.: The dates of the holidays marked (*) are subject to change, if situation arises. This is issued with approval of the Director.

ANNEXURE-7

ATTENDANCE OF THE SENATE MEETING HELD ON 10TH APRIL 2019

भारतीय सूचना प्रौद्योगिकी संस्थान सेनापति, मणिपुर

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SENAPATI MANIPUR

Mantripukhri, Imphal – 795002, Manipur, India, www.iiitmanipur.ac.in

TECHNICAL EDUCATION QUALITY IMPROVEMENT PROGRAMME (TEQIP III)

ACADEMIC COUNCIL (SENATE) MEETING

ATTENDANCE

DATE: 10TH APRIL 2019

SN	NAME OF THE MEMBERS	DESIGNATION	EMAIL & PHONE NO.	SIGNATURE
1	Prof. Amarendra Kumar Das	Director/ Chairman	director@iiitmanipur.ac.in	
2	Prof. P K Das	Professor, CSE Department, IIT Guwahati	pkdas@iitg.ac.in 9435346030	
3	Prof. H B Nemade	Professor, ECE Department, IIT Guwahati	harshal@iitg.ac.in 9957831789	H Nemade
4	Prof. A Srinivasan	Professor, Physics Department, IIT Guwahati	asrini@iitg.ac.in 9435551042	10/4/2019
5	Prof. B K Sharma (On Skype)	Professor, Mathematics Department, IIT Guwahati		
6	Mr. U C Das	Ex Interim Registrar, IIIT Senapati Manipur (Invitee)	ucdas@iitg.ac.in 9864010107	
7	Mr. Dibya Jyoti Goswami	Interim Registrar, IIIT Senapati Manipur	djg11@rediffmail.com 7086028145	
8	Dr. Nagesh Ch	Asst. Professor, HOD ECE Department, IIIT Senapati Manipur	nagesh@iiitmanipur.ac.in 9678554904	
9	Dr. N Kishorjit Singh	Asst. Professor, HOD CSE Department, IIIT Senapati Manipur	kishorjit@iiitmanipur.ac.in 8974008610	

भारतीय सूचना प्रौद्योगिकी संस्थान सेनापति, मणिपुर

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SENAPATI MANIPUR

Mantripukhri, Imphal – 795002, Manipur, India, www.iiitmanipur.ac.in

TECHNICAL EDUCATION QUALITY IMPROVEMENT PROGRAMME (TEQIP III)

10	Dr. Kishor Kumar Das	Asst. Professor, HOD HBS Department, IIIT Senapati Manipur	kkdas@iiitmanipur.ac.in 7085058108	Kishor Kumar Das.
11	Dr.L Sarbajit Singh	Asst. Professor, HBS Department, IIIT Senapati	SARBAJIT@IIITMANIPUR.AC.IN 9436035379	
12	Dr. Bhargab Deka	Asst. Professor, HBS Department, IIIT Senapati	9864862307 bhargab@iiitmanipur.ac.in	
13	Dr. Sanjib Choudhury	Asst. Professor, HBS Department, IIIT Senapati	Sanjib@iiitmanipur.ac.in 9485200604	
14	Dr. Kavita Th	Asst. Professor, CSE Department, IIIT Senapati	kabita@iiitmanipur.ac.in 9436891895	
15	Dr. Navanath Saharia	Asst. Professor, CSE Department, IIIT Senapati	nsaharia@iiitmanipur.ac.in 9678073826	
16	Dr. Prerna Mohit	Asst. Professor, CSE Department, IIIT Senapati	prerna@iiitmanipur.ac.in 7209825881	Prerna Mohit
17	Dr. R C Mishra	Asst. Professor, ECE Department, IIIT Senapati	m.ramesh@iiitmanipur.ac.in Mob:-9678883568	RC Mishra
18	Dr. Gaurav Saxena	Asst. Professor, ECE Department, IIIT Senapati	saxena.g@iiitmanipur.ac.in 8257002500	
19	Dr Murli Manohar	Asst. Professor, ECE Department, IIIT Senapati	Murli@iiitmanipur.ac.in 7085058124	Murli Manohar
20	Dr Subasit Borah	Asst. Professor, ECE Department, IIIT Senapati	Subasitb@iiitmanipur.ac.in	
21	Mr. Himangshu Sarma	Technical Officer, CSE, IIIT Senapati	himangshu@iiitmanipur.ac.in	Sarma