NATIONAL INSTITUTE OF TECHNOLOGY MEGHALAYA

Minutes of Fifth Meeting of the Senate held on 31.10. 2014

The Vth meeting of the Senate of NIT Meghalaya was held on 31st Oct, 2014 at 11.00 a.m. in the Conference Room of the Institute at Bijni Complex, Shillong and the following members were present:

1.	Professor D. K. Saikia, Director, NIT Meghalaya	- Chairman
2.	Professor B. P. Sinha, ACM Unit, ISI Kolkata	- Member
3.	Professor D. Chakraborty, Dean(R&D), IIT Guwahati	- Member
4.	Professor R. Sirohi, Former Director, IIT Delhi	- Member
5.	Dr. G. Panda, Head, EEE, NIT Meghalaya	- Spl. Invitee
6.	Dr. A. Dandapat, Head, ECE, NIT Meghalaya	- Spl. Invitee
7.	Dr. R. Ray, Head, CSE, NIT Meghalaya	- Spl. Invitee
8.	Dr. D. K. Sarma, Head, ME, NIT Meghalaya	- Spl. Invitee
9.	Dr. C. Marthong, Head, CE, NIT Meghalaya	- Spl. Invitee
10.	Dr. P. N. Chatterjee, Head, Chemistry, NIT Meghalaya	- Spl. Invitee
11.	Dr. S. Mukherjee, Head, Mathematics, NIT Meghalaya	- Spl. Invitee
12.	Dr. P. S. Mangang, Head, HSS, NIT Meghalaya	- Spl. Invitee
13.	Mr. D. J. Goswami, Registrar i/c, NIT Meghalaya	- Secretary

The other members of the committee, Professor S. M. Hazarika, Professor S. S. Khare and Professor H. Giri could not attend the meeting due to prior commitments.

At the outset, the Chairman welcomed the members to the Vth Meeting of the Senate. As it was also the Birth Anniversary of Sardar Vallabh Bhai Patel, all the members present in the Senate Meeting took pledge to mark "Rastriya Ekta Diwas". The agenda of the meeting was then taken up.

Item No. 1

Confirmation of the minutes of the Fourth Meeting of the Senate of NIT Meghalaya held on 16.06.2014.

The Fourth Meeting of the Senate of the Institute was held on 16.06.2014 in the Conference Room of Institute. The minutes of the meeting (Annexure-I) were circulated amongst the members of the Committee for their comments/ observations, if any.

The Senate was requested to consider any comments/ observations of the members and to confirm the minutes.

R1/SENATE-V/14: *The Senate **Resolved to Confirm** the minutes of the Fourth Meeting of the Senate as circulated.*

Item No. 2

Follow up action on the decision of the Fourth Meeting of the Senate

Actions taken on the decisions of the fourth meeting of the Senate held on 10.02.2014 are as below:

Sl. No.	Senate Resolution No.	Resolution	Action taken/status
1.	R1/SENATE-IV/14	Confirmation of the minutes of the Third meeting of the Senate of NIT Meghalaya held on 10.02.2014. *The Senate **Resolved to Confirm** the minutes of the Third meeting of the Senate as circulated.*	Implemented
2.	R2/SENATE-IV/14	Follow up action on the decisions made in the Third Meeting of the Senate. *The Senate NOTED the follow-up action as reported. The Senate further Resolved not to open up the vacant SC/ST state quota seats for admission to the general category candidates.*	Noted
3.	R3.1/SENATE-IV/14	***Resolved** to **Approve** the modification in the name of course no. ME 103 and the content of the course PH201 as recommended.*	Notified
	R3.2/SENATE-IV/14	Approval of Curriculum of B. Tech Programme in Mechanical Engineering and the Syllabi of the courses in the 2nd year: ***Resolved** to **Approve** the Curriculum for the B. Tech programme in Mechanical Engineering and the Syllabi of the courses required in the 2nd year.*	Notified
	R3.3/SENATE-IV/14	Approval of Curriculum of B. Tech Programme in Civil Engineering and the Syllabi of the courses in the 2nd year: ***Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.4/SENATE-IV/14	Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in ECE: ***Resolved** to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.5/SENATE-IV/14	Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in EEE: ***Resolved** to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.6/SENATE-IV/14	Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in CSE: ***Resolved** to **Authorize** the Chairman of the*	Notified after the syllabi were approved by the Chairman

		Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.	
	R3.7/SENATE-IV/14	Approval of the Curriculum for the M. Tech programme in Electronics and Communication Engineering and the Syllabi of the courses: ***Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.8/SENATE-IV/14	Approval of the Curriculum for the M. Tech programme in Computer Science and Engineering and the Syllabi of the courses: ***Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.9/SENATE-IV/14	Approval of the Curriculum for the M. Tech programme in Electrical Engineering (Power and Energy Systems) and the Syllabi of the courses: ***Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.*	Notified after the syllabi were approved by the Chairman
	R3.10/SENATE-IV/14	Recommend Approval of a set of new courses for the Ph. D. Programme: HS 701: Methodology for Research in Literature (3-0-0:3) HS 702: Literature and Interdisciplinary Approach (3-0-0:3) HS 703: Critical Readings for Research in Literature (3-0-0:3) MA 701: Measure Theory and Integration (3-0-0:3) MA 702: Functional Analysis (3-0-0:3) CH 701: Analytical Techniques in Chemistry (3-0-0:3) CH 702: Organic Materials and Their Applications (3-0-0:3) PH 704: Fundamentals of Nanoscience and Technology (3-0-0:3) ***Resolved** to **Approve** the syllabi of the proposed new courses for the Ph. D. Programme.*	Notified
4.	R4.1.1/SENATE-IV/14:	RC Recommended that the Chairman of the Doctoral Committee (DC) of a Ph. D. Scholar should be a Senior Faculty Member nominated by	Ph. D. Regulations Amended.

		the Departmental/ Centre's Research Committee (DRC/ CRC) instead of the Supervisor. The Supervisor should be the Convenor. ***Resolved** to **Approve** the recommendation.*	
	R4.1.2/SENATE-IV/14:	RC Recommended that in the eligibility for admission to the Ph.D. programme the qualifying marks for BE/ B. Tech candidates should be lowered to 75% in aggregate from current 80%. ***Resolved** to **Approve** the recommendation.*	
	R4.1.3/SENATE-IV/14:	RC Recommended that a Comprehensive Examination on the subject area of research should be taken after a scholar completes the course works. The scholar should be allowed to register only after he/ she is able to clear the comprehensive examination in no more than two attempts. The scholar should be intimated about the date of the comprehensive examination, along with a syllabus, at least two months in advance. ***Resolved** to **Approve** the recommendation.*	
	R4.1.4/SENATE-IV/14:	RC Recommended that the change of category (Part-time/ Full-time) of a candidate should require approval of chairman of the Senate. ***Resolved** to **Approve** the recommendation.*	
	R4.1.5/SENATE-IV/14:	RC Recommended that while submitting the thesis the candidate should enclose a report produced with standard anti-plagiarism software. ***Resolved** to **Approve** the recommendation.*	
	R4.1.6/SENATE-IV/14:	A form should be provided for the scholar to obtain clearance from the Institute for publishing the thesis in book form. ***Resolved** to **Approve** the recommendation.*	
	R4.1.7/SENATE-IV/14:	The Senate further **resolved** the following: *i.* The minimum credits required on course works for the candidates with BE/ B. Tech (without a master degree) shall be 16. *ii.* There shall be no upper limit fixed on the course work credit. The DC/ DRC shall decide on the courses required to be done by a candidate subject to the minimum limit as specified in the regulations.	

	R4.2/SENATE-IV/14:	The RC Recommendation on Changes in the Guidelines for Operation of the Sponsored Research Projects and Consultancy Projects: *i.* The 25% of the overhead amount meant for the Department concerned should be deposited in the Departmental Promotional Fund (DPF). *ii.* The 40% of the overhead amount meant for the PI/ Co-PI should be placed in the Professional. ***Resolved** to **Forward** the recommendations to the Board of Governors for approval.*	The Board of Governors has approved the recommendations. The Guidelines for Operation of the Sponsored Research Projects and Consultancy Projects Amended.
5.	R5/SENATE-IV/14	*The Senate **Resolved to Recommend** that legal expert be consulted on the Ordinance and be brought back to the Senate.*	Legal Advise remains to be taken.
6.	R6/SENATE-IV/14	*The Senate **Resolved to Reduce** the qualifying percentage for admissions to Ph. D. Programme in Humanities and Social Sciences to 55%.*	Change incorporated in the Ph. D. Regulations.
7.	R7/SENATE-IV/14	*The Senate **Resolved to Approve** the Academic Calendar for the Academic Year 2014-15 as proposed.*	Implemented
8.	R8/SENATE-IV/14	*The Senate **Resolved to Recommend** the proposed revised fees structure for the Ph. D. Programme for approval by the Board of Governors.*	BoG approved the recommendation. Implemented.
9.	R9.1/SENATE-IV/14	*The Senate **Resolved to Declare** the results of the Spring Semester 2014 results as tabled.*	Notified.
	R9.2/SENATE-IV/14	*The Senate **Resolved to Authorise** the Chairman of the Senate to declare the semester results as per the date of declaration of results specified in the Academic Calendar and place same in the subsequent meeting of the Senate for ratification.*	Recorded
10.	R10/SENATE-IV/14	*The Senate **Resolved to Recommend** the proposals for setting-up of the Centres of Excellence by HP India and NI India at NIT Meghalaya to the Board of Governors for Approval.*	The BoG has approved the recommendation. MoU has been signed with HP with provision for 2 years extended training. Discussions are on with NI.
11.	R11/SENATE-IV/14	*The Senate **Resolved** to **Ratify** the decision of the Director on revision of the B. Tech fees structure.*	New fees structure implemented from the batch admitted in

			2014.
12.	R12/SENATE/IV/14	*The Senate **Resolved** to **Ratify** the decision of the Director on the fee structure for the M. Tech programme.*	Implemented
13.	R13/SENATE/IV/14	*The Senate **Resolved** to **Ratify** Ordinance-V and Ordinance-VI as approved by the members by circulation.*	Notified
14.	R14/SENATE/IV/14	*The Senate **Resolved** to **Ratify** the approval of the members on the Senate Nominees to the faculty selection committees as above.*	Implemented

R2/SENATE-V/14: *The Senate **Resolved to Confirm** the follow up action on the decision of the 4th meeting of the Senate.*

Item No. 3: Recommendations of 2nd Meeting of the Academic Programmes Committee

The second meeting of the Academic Programmes Committee (APC) was held on 24th Sept, 2014. The recommendations of the APC were circulated along with the agenda items. The Senate had detailed discussions on the recommendations and resolved as tabulated below:

Sl. No.	Item	Brief Details	Recommendation
1.	**Curriculum Structure of M. Tech (ECE/CSE/EEE)**	The Curriculum Structure of the M. Tech programme was approved by the Senate vide Resolution No. R6/SENATE-III/14 and the Model Semester-wise Distribution of the courses for the M. Tech programme for the individual disciplines vide Resolution Nos. R3.7, R3.8 and R3.9 in the IV-th meeting of the SENATE. However, as per the Ordinance on Academic Programmes of the Institute, it is required to have a general Curriculum for the M. Tech programme in each of the disciplines in which the various courses in the different categories are listed along with the respective credit structures and the prerequisites. The departments have submitted these structures **(Reference: Annex-II-A)** for consideration of the APC. The APC discussed the curriculum structures submitted by the	**R-3/APC-2/14:** The APC resolved to recommend the Curriculum Structures submitted by the departments for approval by the Senate. **R3.1/SENATE-V/14**: *The Senate **Resolved** to **Approve** the Curriculum Structure with the incorporation of minor changes.* ***Annex. II-A*** ***(Pg 25)***

		departments of CSE, ECE and EEE. The structures submitted by the departments were found in order.	
2.	**Courses & Syllabi of 500 level (CSE)**	The DAC of the Computer Science and Engineering Department has recommended several Elective Courses of 500 levels along with the Syllabi. **(Reference: Annex-II-B).** The APC noted that comments of the experts have been incorporated in the syllabi.	**R-4/APC-2/14:** The APC resolved to recommend the syllabi of the CSE Courses of 500 level for approval by the Senate. **R3.2/SENATE-V/14:** ***The Senate Resolved** to **Approve** the Syllabi of the CSE Courses of 500 level except for CS 512. The Senate **Resolved** to **Authorize** the Chairman to approve the **Syllabus of CS512** after comments from domain experts are obtained and incorporated as applicable.* ***Annex. II-B (Pg 31)***
3.	**Courses & Syllabi of 500 level (EEE)**	The DAC of the Department of Electrical and Electronics Engineering has recommended Syllabi of several 500 level courses **(Reference: Annex-II-C).** The APC noted that comments of the experts have been incorporated in the syllabi.	**R-5/APC-2/14:** The APC resolved to recommend the syllabi of the 500 level elective courses proposed by EEE department to the Senate for approval. **R3.3/SENATE-V/14:** *The Senate **Resolved** to **Approve** the 500 level elective courses with few minor changes except for the course EE 520. It **Resolved** to **Authorize** the Chairman to approve the **Syllabus of EE520** after comments from domain experts are obtained and incorporated as applicable.* ***Annex. II-C(Pg-34)**.*

Item No. 4: List of B. Tech Candidates Qualifying for Award of Degree.

The First Batch of 83 B. Tech. candidates have completed the requirements of the programme in June this year. Out of these 31 are in Electronics and Communication Engineering, 29 are in Electrical and Electronics Engineering and 23 are in Computer Science and Engineering. The Senate may consider approval of the Lists of the First Batch B. Tech candidates for the award of degrees.

ECE		EEE		CSE	
Sl. No	Name of the student	Sl. No	Name of the student	Sl. No	Name of the student
1	Garun Kumar	1	Hemant Modi	1	Dhruba Baishya
2	Piyush Kumar	2	Pranay Gupta	2	Dame Lapynsan Lyngdoh
3	Vivek Kumar	3	Yuvraj Singh	3	Reema Roy
4	Supriya Das	4	Robin G Thomas	4	Arpan
5	Anil Kumar Ram	5	Shailendra Kumar Satyarthi	5	Joydeep Das
6	Arvind Kumar Yadav	6	Sunil Singha	6	Ram Aakarshan Bhatt
7	Gajraj Singh Rathore	7	Kadimbini Verma	7	Bhaswatee Likhok
8	Devender Singh Inaniya	8	Abdullah AL Faruque	8	Ankita Brahmachari
9	Abhishek Biyani	9	Arshita Paul	9	Rajneesh Meena
10	Prashant Kumar	10	Dushyant Kumar	10	Vinod Kumar
11	Arpit Shekhar	11	Saikat Chakrabarty	11	Tileshwar Nath
12	Pankaj Tiwari	12	Vikash Kumar	12	Sanoj
13	Minakshi Sharma	13	Deepak Kumar Ahlawat	13	Kallol Ghose
14	Dhruba Das Roy	14	Binay Das	14	Jitendar Kushwaha
15	Ankit Krishnan	15	Mahendra Singh Taragi	15	Avdhesh Garg
16	Sunasheer Bhattacharjee	16	Anshul Jain	16	Mayank Trivedi
17	Angshuman Hazarika	17	Joshua Marbaniang	17	Saketh Ram Potturi
18	Sajjan Upadhyay	18	Sandeep Ratnoo	18	Subhash Kumar Yadav
19	Anurag Kumar Madheshiya	19	Ananya Choudhury	19	Yogesh Negi
20	Sweta Prasad	20	Dileep Kumar Sahu	20	Vatti Praveen Kumar
21	Chandrahas Balleda	21	Hemant Kumar	21	Paromita Roy
22	Anup Kumar	22	Keshav Shukla	22	Priya
23	Gurinder Singh	23	Saurabh Jain	23	Mansoor Alam Chovdhury
24	Naveen Kumar Jain Chhajer	24	Jitesh Kumar Gupta		
25	Shashi Kant	25	Shivendra Pandey		
26	Shubham Jain	26	Jawed Hasan		
27	Yogesh Pal Singh	27	Chitra Bahadur Thapa		
28	Dhruv Sharma	28	Irshad Ali Ansari		
29	Vivek Sharma	29	Sharmila Lama		
30	Pushpendra Bharti				
31	Rohit Suryawanshi				

R4/SENATE-V/14: *The Senate **Resolved to Recommend** the list of 1st Batch of B. Tech candidates qualifying for award of the degree to the Board of Governors.*

Item No. 5: Nominees for the Institute Gold Medals:

As per the Ordinance-V, the successful candidates securing the highest CGPA in each discipline satisfying the following conditions are to be awarded Institute Gold Medal:

i. Should have secured a CGPA of at least 8.5.
ii. Must have completed the programme within the minimum stipulated period.
iii. Should not have been under academic probation during the programme.
iv. Should not have any record of disciplinary action during the programme.

Accordingly, the following candidates qualified to receive the Institute Gold Medals:

Sl. No.	Discipline	Name
1.	Computer Science and Engineering	Ms. Ankita Brahmachari
2.	Electronics and Communication Engineering	Mr. Gurinder Singh
3.	Electrical and Electronics Engineering	Mr. Dileep Kumar Sahu

The Senate considered the list and decided to recommend these candidates to the Board of Governors for the award of the Institute Gold Medals in their respective disciplines.

R5/SENATE-V/14: *The Senate **Resolved to Recommend** the list of candidates to the Board of Governors for the award of the Institute Gold Medals.*

Item No. 6: Nominee for President's Gold Medal

As per the Ordinance-V, among the successful candidates the candidate with the best all round performance to be awarded President's Gold Medal. Based on the selection criteria stipulated in the Ordinance, a Committee constituted by the Director recommended the name of Ms. Ankita Brahmachari of the Department of Computer Science and Engineering for award of the medal in 2014.

The Senate considered the recommendation of the committee and decoded to forward the name of Ms. Ankita Brahmachari to the Board of Governors for award of the President's Gold Medal in the B. Tech programme for the year 2014.

R6/SENATE-V/14: *The Senate **Resolved to Recommend** the name of Ms. Ankita Brahmachari to the Board of Governors for award of the President's Gold Medal in the B. Tech programme for the year 2014.*

The Senate also recommended that the nominations to the selection committee for the President's Gold Medal should come from the Departments.

Items for Ratification:

Item No. 7: Two 700 level courses:

The director approved the following 700 level courses subject to ratification by the Senate (in **Annex-IV)**:

1. CS 707 SELECTED TOPICS IN WIRELESS SENSOR NETWORKS (3-0-0 : 3)
2. EE 709 BIO-MEMS (3-0-0 : 3)

The Senate decided to ratify the decision taken by the Director with minor modification in the course EE 709.

R7/SENATE-V/14: *The Senate **Resolved** to **Ratify** the decision of the Director with minor changes in the Syllabus of **EE709**.*

Any Other Item with the permission of the Chair

As there was no other item to discuss, the meeting concluded with thanks from and to the Chair.

Annexure-I

NATIONAL INSTITUTE OF TECHNOLOGY MEGHALAYA

Minutes of Fourth Meeting of the Senate held on 16.06. 2014

The 4th meeting of the Senate of NIT Meghalaya was held on 16th June, 2014 at 10.00 a.m. in the conference room of the Institute at Bijni Complex, Shillong and the following members were present:

14. Professor D. K. Saikia, Director, NIT Meghalaya	- Chairman
15. Professor B. P. Sinha, ACM Unit, ISI Kolkata	- Member
16. Professor D. Chakraborty, Dean(R&D), IIT Guwahati	- Member
17. Professor S. M. Hazarika, CSE, Tezpur University	- Member
18. Professor R. Sirohi, Former Director, IIT Delhi	- Distinguished Invitee
19. Dr. G. Panda, Head, EEE, NIT Meghalaya	- Spl. Invitee
20. Dr. A. Dandapat, Head, ECE, NIT Meghalaya	- Spl. Invitee
21. Dr. A. Chakraborty, Head i/c, CSE, NIT Meghalaya	- Spl. Invitee
22. Dr. D. K. Sarma, Head, Mechanical, NIT Meghalaya	- Spl. Invitee
23. Dr. C. Marthong, Head, Civil, NIT Meghalaya	- Spl. Invitee
24. Dr. A. Bhattacharjee, Head, Physics, NIT Meghalaya	- Spl. Invitee
25. Dr. P. N. Chatterjee, Head, Chemistry, NIT Meghalaya	- Spl. Invitee
26. Dr. S. Mukherjee, Head, Mathematics, NIT Meghalaya	- Spl. Invitee
27. Dr. P. S. Mangang, Head, HSS, NIT Meghalaya	- Spl. Invitee
28. Mr. D. J. Goswami, Registrar i/c, NIT Meghalaya	- Secretary

The other members of the committee, Professor S. S. Khare and Professor H. Giri could not attend the meeting due to prior commitments.

At the outset the Chairman welcomed the members to the 4th meeting of the Senate. The Chairman also extended special welcome to the distinguished invitee Professor R. Sirohi and introduced the members and the Heads of the Departments to him. The agenda of the meeting was then taken up.

Item No. 1 Confirmation of the minutes of the third meeting of the Senate of NIT Meghalaya held on 10.02.2014.

The Third Meeting of the Senate of the Institute was held on 10.02.2014 in the Conference Hall of Institute. The minutes of the meeting were circulated amongst the members of the Committee for their comments/ observations, if any.

The members of the Senate discussed the minutes and agreed to confirm the same as circulated.

R1/SENATE-IV/14: *The Senate **resolved to confirm** the minutes of the third meeting of the Senate as circulated.*

Item No. 2 Follow up action of the decision of third meeting of the Senate.

Actions taken on the decisions of the second meeting of the Senate held on 10.02.2014 were read out by the Registrar. The Senate noted the actions taken.

On the resolution no. R7/SENATE-III/14 regarding the proposal to open up the vacant SC/ST state quota seats for admission to the general category candidates after the second round of admissions, the BoG has advised for reconsideration of the decision. The Senate decided not to open up the seats to the general category.

R2/SENATE-IV/14: *The Senate NOTED the follow-up action as reported. The Senate further Resolved not to open up the* open up the vacant SC/ST state quota seats for admission to the general category candidates.

Item No. 3 Recommendations of 1st Meeting of the Academic Programmes Committee

The recommendations of the first meeting of the Academic Programmes Committee (APC) held on 22nd May, 2014 were placed before the Senate for its consideration. The Senate considered the recommendations and resolved as tabulated:

Sl. No.	Item	APC Recommendation	Senate Resolution
1.	Modification	Recommend: a. Change Course Name of ME103 to- Workshop Practice-I b. Change in Syllabus of PH201-Physics of Materials: Separate units added for Mechanical and Civil Engineering.	**R3.1/SENATE-IV/14:** **Resolved** to approve the modification in the name of course no. ME 103 and the content of the course PH201 as recommended.
2.	Curriculum and Syllabi of Courses for the 2nd year B. Tech Mechanical Engineering	Recommend Approval of the Curriculum for the B. Tech programme in Mechanical Engineering and the Syllabi of the courses required in the 2nd year.	**R3.2/SENATE-IV/14:** **Resolved** to approve the Curriculum for the B. Tech programme in Mechanical Engineering and the Syllabi of the courses required in the 2nd year.

3.	Curriculum and Syllabi of Courses for the 2nd year B. Tech Civil Engineering	Recommend Approval of the Curriculum for the B. Tech programme in Civil Engineering and the Syllabi of the courses required in the 2nd year.	**R3.3/SENATE-IV/14:** **Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
4.	Syllabi of Courses for 3rd year B. Tech programme in ECE	Recommend Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in ECE.	**R3.4/SENATE-IV/14:** **Resolved** to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
5.	Syllabi of Courses for 3rd year B. Tech programme in EEE	Recommend Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in EEE.	**R3.5/SENATE-IV/14:** **Resolved** to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
6.	Syllabi of Courses for 3rd year B. Tech programme in CSE	Recommend Approval of the Syllabi of the courses required in the 3rd year of the B. Tech programme in CSE.	**R3.6/SENATE-IV/14:** **Resolved** to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
7.	Curriculum and Syllabi of Courses for the M. Tech Programme in ECE	Recommend Approval of the Curriculum for the M. Tech programme in Electronics and Communication Engineering and the Syllabi of the courses.	**R3.7/SENATE-IV/14:** **Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.

8.	Curriculum and Syllabi of Courses for the M. Tech Programme in CSE	Recommend Approval of the Curriculum for the M. Tech programme in Computer Science and Engineering and the Syllabi of the courses.	**R3.8/SENATE-IV/14:** **Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
9.	Curriculum and Syllabi of Courses for the M. Tech Programme in Electrical Engineering (Power and Energy Systems)	Recommend Approval of the Curriculum for the M. Tech programme in Electrical Engineering (Power and Energy Systems) and the Syllabi of the courses.	**R3.9/SENATE-IV/14:** **Resolved** to **Approve** the **Curriculum** and to **Authorize** the Chairman of the Senate to approve the Syllabi after comments from Domain experts are obtained and incorporated as applicable.
10.	Syllabi of New Courses for Ph. D. Programme	Recommend Approval of a set of new courses for the Ph. D. Programme: HS 701: Methodology for Research in Literature (3-0-0:3) HS 702: Literature and Interdisciplinary Approach (3-0-0:3) HS 703: Critical Readings for Research in Literature (3-0-0:3) MA 701: Measure Theory and Integration (3-0-0:3) MA 702: Functional Analysis (3-0-0:3) CH 701: Analytical Techniques in Chemistry (3-0-0:3) CH 702: Organic Materials and Their Applications (3-0-0:3) PH 704: Fundamentals of Nanoscience and Technology (3-0-0:3)	**R3.10/SENATE-IV/14:** **Resolved** to **Approve** the syllabi of the proposed new courses for the Ph. D. Programme.

Item No. 4 Minutes of First Meeting of the Research Committee

The First meeting of the Research Committee was held on 15.03.2014. The recommendations of the meeting vide resolution no. **R1/RC-I/2014** were placed before the Senate for its consideration**.**

Sl. No.	Item	Research Committee Recommendation	Senate Resolution
1.	Changes in the Ph. D. Regulations	i. The Chairman of the Doctoral Committee (DC) of a Ph. D. Scholar should be a Senior Faculty Member nominated by the Departmental/ Centre's Research Committee (DRC/ CRC) instead of the Supervisor. The Supervisor should be the Convenor.	**R4.1.1/SENATE-IV/14:** **Resolved** to approve the recommendation.

		ii. In the Board of Examiner's of Thesis (BET) one of the two external examiners should preferably be from abroad.	Senate noted that the provision already exists.
		iii. In the eligibility for admission to the Ph.D. programme the qualifying marks for BE/ B. Tech candidates should be lowered to 75% in aggregate from current 80%.	**R4.1.2/SENATE-IV/14:** **Resolved** to approve the recommendation.
		iv. A Comprehensive Examination on the subject area of research should be taken after a scholar completes the course works. The scholar should be allowed to register only after he/ she is able to clear the comprehensive examination in no more than two attempts. The scholar should be intimated about the date of the comprehensive examination, along with a syllabus, at least two months in advance.	**R4.1.3/SENATE-IV/14:** **Resolved** to approve the recommendation.
		v. The change of category (Part-time/ Full-time) of a candidate should require approval of chairman of the Senate.	**R4.1.4/SENATE-IV/14:** **Resolved** to approve the recommendation.
		vi. While submitting the thesis the candidate should enclose a report produced with a standard anti-plagiarism software.	**R4.1.5/SENATE-IV/14:** **Resolved** to approve the recommendation.
		vii. A form should be provided for the scholar to obtain clearance from the Institute for publishing the thesis in book form.	**R4.1.6/SENATE-IV/14:** **Resolved** to approve the recommendation.
	R4.1.7/SENATE-IV/14: The Senate further **resolved** the following: i. The minimum credits required on course works for the candidates with BE/ B. Tech (without a master degree) shall be 16. ii. There shall be no upper limit fixed on the course work credit. The DC/ DRC shall decide on the courses required to be done by a candidate subject to the minimum limit as specified in the regulations.		
2.	Changes in the for Operation of the Sponsored Research Projects and Consultancy Projects:	i. The 25% of the overhead amount meant for the Department concerned should be deposited in the Departmental Promotional Fund (DPF) ii. The 40% of the overhead amount meant for the PI/ Co-PI should be placed in the Professional Development Fund (PDF) of the faculty member(s) concerned which should be made	**R4.2/SENATE-IV/14:** **Resolved** to **Forward** the recommendations to the Board of Governors for approval.

		available for use by him/ her while he/she is in service in the Institute. Any item purchased through against this fund is to be returned to the Institute if he/ she leaves the Institute. iii. For any project position a duly selected Ph. D. scholar may be appointed directly, if he/ she satisfies the qualification requirements of the position. iv. There shall be flexibility in the nomenclature of the project positions if the sponsoring agency approves the same.	

Item No. 5 Creation of Ordinance-II: Ordinance on Students' Discipline

A draft for Ordinance-II: Ordinance on Students Discipline prepared to replace the Regulations on Students Code of Discipline was placed before the Senate for its consideration.

R5/SENATE-IV /14: *The Senate **resolved to recommend** that legal expert be consulted on the Ordinance and be brought back to the Senate.*

Item No. 6 Recommendation of HoD, HSS to Lower the Qualifying Percentage for HSS Ph. D. Admissions to 55%

In Humanities subjects it is difficult to secure 60% marks at master's level. Therefore most of the Universities, including CFTIs, keep the qualifying marks for admissions to Ph. D. Programmes in Humanities and Social Science subjects to 55% or lower. Therefore the Head of the Department of Humanities and Social Sciences has recommended that the qualifying percentage for admissions to the Ph. D. Programme in the Humanities and Social science Department in the Institute be brought down to 55% from current 60%. The admission brochures of some of the premier institutions in support of the case were placed before the Senate.

The Senate considered proposal and agreed to approve the recommendation.

R6/SENATE-IV/14: *The Senate **resolved to reduce** the qualifying percentage for admissions to Ph. D. Programme in Humanities and Social Sciences to 55%.*

Item No. 7 Academic Calendar for Session 2014-15

A draft Academic Calendar for the Academic Year 2014-15 as below was placed before the Senate for its approval.

ACADEMIC CALENDAR FOR THE ACADEMIC YEAR 2014-2015

AUTUMN SEMESTER (August-December, 2014)

1	Registration	July 30-31, 2014
2	Commencement of Classes	August 01, 2014
3	Last date of registration with fine	August 05, 2014
4	Supplementary Examinations	August 13-14, 2014
5	Last date for Change in Course Registration	September 16, 2014
6	Mid Term Examinations	September 22-27, 2014
7	Annual Technical Festival	October 17-18, 2014
8	Last day of Classes	November 28, 2014
9	Laboratory Examinations	December 02-05, 2014
10	End Term Examinations	December 08-13, 2014
11	Display of Grades	December 16-17, 2014
12	Declaration of Results	December 23, 2014
13	Winter Break	December 16, 2014 – January 15, 2015

SPRING SEMESTER (January-May, 2015)

1	Registration	January 16 & 19, 2015
2	Commencement of Classes	January 19, 2015
3	Last date of Registration with Fine	January 22, 2015
4	Supplementary Examinations	February 02-04, 2015
5	Institute Sports & Cultural Festival	February 05-07, 2015
6	Last date for change in Course Registration	February 25, 2015
7	Mid Term Examinations	March 09-14, 2015
8	Last day of Classes	May 15, 2015
9	Laboratory Examinations	May 18-22, 2015
10	End Term Examinations	May 25-30, 2015
11	Display of Grades	June 04-05, 2015
12	Declaration of Results	June 10, 2015
13	Summer Break	June 01- July 31, 2015

SUMMER TERM (June-July, 2015)

1	Registration	May 15-16, 2015
2	Commencement of Classes	June 01, 2015
3	Mid Term Examinations	June 29-30, 2015
4	End Term Examinations	July 27-28, 2015
5	Display of Grades	August 03, 2015
6	Declaration of Results	August 07, 2015

The Senate considered the proposed Academic Calendar and decided to approve the same.

R7/SENATE-IV/14: *The Senate **resolved to approve** the Academic Calendar for the Academic Year 2014-15 as proposed.*

Item No. 8: Revised Fees Structure for Ph. D Programme

As per resolution of the NIT Council, MHRD has directed that the tuition fees for the Ph. D programme in all NITs be enhanced to Rs. 15,000/- per annum from the coming batch vide notification no. F.No.33-4/2014-TS.III dt. 5th May, 2014. Accordingly, a revised fees structure for the Ph. D. programmes as given below was placed before the Senate for its consideration.

The Senate decided to recommend the proposed fees structure to the Board of Governors for approval.

R8/SENATE-IV/14: *The Senate **resolved to recommend** the proposed revised fees structure for the Ph. D. Programme for approval by the Board of Governors.*

Item No. 9: Declaration of Semester Results

As per the Clause 8(iii) of the 1st Statutes of the Institute, the Senate is required to declare the results of the examinations. The Spring Semester End Term Examinations were held from 26th to 31st May. The results were tabled in the meeting of the Senate for its approval for declaration.

The Members of the Senate went through the results as tabled and noted the distribution of the grades in the different years and the various disciplines. Members expressed concern on the weak performance of a good number of students admitted in 2013-14. The Members also noted that the students of the first batch of the B. Tech programme, numbers as tabulated below, have completed the requirements for receiving their degree in respective disciplines:

Discipline	No. of qualifying students
Computer Science and Engineering	23
Electronics and Communication Engineering	30
Electrical and Electronics Engineering	29

It was observed that it is not always possible to hold a meeting of the Senate as per the date of declaration of the results as specified in the Academic Calendar of the Institute. It was therefore decided that the Chairman of the Senate be authorized to declare the semester results as per the Academic Calendar which shall be placed in the next meeting of the Senate for ratification.

R9.1/SENATE-IV/14: *The Senate **resolved to declare** the results of the Spring Semester 2014 results as tabled.*

R9.2/SENATE-IV/14: *The Senate **resolved to authorise** the Chairman of the Senate to declare the semester results as per the date of declaration of results specified in the Academic Calendar and place same in the subsequent meeting of the Senate for ratification.*

Item No. 10 Proposals from Hewlett Packard(HP) India and National Instruments(NI) India to set-up their Centres of Excellence

Proposals have were received from HP India and NI India to establish their centres of excellence in NIT Meghalaya. HP India's proposal is to set-up HP Education Cloud and Finishing Lab Solution while NI India's proposal is to setup a Centre of Excellence for Wireless Communications.

The NIT Council have been of the opinion that the industry should be involved in the laboratory oriented courses so that the graduates of the NITs go out better industry ready. It is suggested that efforts be made to cover up to 25% of the courses with industry participation. It is in this context that the proposals become relevant.

As per the HP India proposal the company will establish the laboratory facility with necessary hardware and software and assist in the laboratory instructions for the set of courses-

- Mobile Application Development
- Software Testing and Application Lifecycle Management
- Designing and Developing Cloud Solutions
- Network & Cloud Security
- Vulnerability and Penetration Testing
- Advance Attacks Simulation & Modelling

The detailed proposal is placed at **Annexure.** The company will bear 40% of the cost of the solution.

The NI India proposal stipulates establishing a Wireless Communications Laboratory with the following:

- Software Defined Radio(SRD) Prototyping Station
- Advanced Prototyping Station
- MIMO Station
- Cognitive Radio Station
- Measurement Station

The company will bear 30% of the cost and shall provide curriculum material for the following M. Tech level courses-

- Digital Communication: Physical Layer Exploration
- Cognitive Radio & Networks
- Intelligent Instrumentation
- MIMO Communication Systems
- Advanced Signal Processing
- Mobile Communication Lab
- Digital Communication Lab

The detailed proposal is placed at **Annexure.**

The Senate was requested to advice on the matter.

The Senate discussed the details of the proposal. All the members were in agreement that the setting-up of the two Centres of Excellence by the two industry leaders in their respective fields will be valuable

to the Institute and be very beneficial to the students. The Senate therefore decided to recommend the two proposals for approval by the Board of Governors.

R10/SENATE-IV/14: *The Senate **resolved to recommend** the proposals for setting-up of the Centres of Excellence by HP India and NI India at NIT Meghalaya to the Board of Governors for Approval.*

Items for Ratification:

Item No. 11: Revised Fees Structure of B. Tech Programme

As per resolution of the NIT Council MHRD has directed that the tuition fees for the B. Tech programme in all NITs be enhanced to Rs. 70,000/- per annum from the coming batch vide notification no. F.No.33-4/2014-TS.III dt. 5th May, 2014. As there was an urgent need to provide the fees structure to CSAB the Director in consultation with the Chairman, BoG has revised the fees structure for the B. Tech programmes as in **Annex.**

The Senate decided to ratify the decision by the Director on revision of the B. Tech fee structure.

R11/SENATE-IV/14: *The Senate **resolved** to **ratify** the decision of the Director on revision of the B. Tech fees structure.*

Item No. 12: Fees Structure of M. Tech Programme

As per resolution of the NIT Council MHRD has directed that the tuition fees for the B. Tech programme in all NITs be fixed as Rs. 70,000/- per annum from the coming batch vide notification no. F.No.33-4/2014-TS.III dt. 5th May, 2014**.** As there was an urgent need to provide the fees structure to CCMT the Director in consultation with the Chairman, BoG has fixed the fees structure for the M. Tech programmes as in **Annex.**

R12/SENATE-IV/14: *The Senate **resolved** to **ratify** the decision of the Director on the fee structure for the M. Tech programme.*

Items Approved by Circulation

Item No. 13: Ordinance-V and Ordinance-VI

Approvals of the members of the Senate for the Ordinance-V: Ordinance on Award of Medals and the Ordinance-VI: Ordinance on Award of Scholarships were obtained by circulation. These were placed in the meeting for ratification by the Senate.

R13/SENATE-IV/14: *The Senate **resolved** to **ratify** Ordinance-V and Ordinance-VI as approved by the members by circulation.*

Item No. 14: Senate Nominee to the Faculty Selection Committees

As per the statutes one member of each faculty selection committee is a *Senate Nominee* who is an expert in a relevant field. Due to urgency approval was taken by circulation from the Senate members for the *Senate Nominees* as-
"A Professor in the relevant field from either of IITs, NITs, IISC, ISI, Central Universities, Jadavpur University, Calcutta University, Gauhati University, IIEST or a Scientist of grade F or above working in a DRDO/ CSIR laboratory".

The matter was placed before the Senate for ratification. The list of nominees based on the above for the forthcoming faculty selections was also placed before the senate.

R14/SENATE-IV/14: *The Senate **resolved** to **ratify** the approval of the members on the Senate Nominees to the faculty selection committees as above.*

Reporting Items:

Item No. 15: Summer Term

To enable the students with academic probation to clear their backlogs a Summer Term is being organized as provided in the Ordinance on Academic Programmes w.e.f. 2nd June as per the following calendar:

Last Date of Course Registration	: 9th May
Start of Summer Term	: 2nd June
Mid Term Examinations	: 30th June and 1st July
End Term Examinations	: 28th and 30th July
Declaration of Results	: 1st August

A student is allowed to register for at most two courses.

R15/SENATE-IV/14: *The Senate **noted** matter appreciated the effort made by the faculty members to help the students.*

Item No. 16: Workshops/ Conferences/ Summer Courses Organized by the Departments

The following workshops/ Summer Courses have been organized by the departments after the last meeting of the Senate:

1. National Workshop on Power and Energy Systems: The Department of Electrical and Electronics Engineering organized a National Workshop on Power and Energy Systems during 24-26 April with sponsorships received from Meghalaya Chapter of Institution of Engineers, North Eastern Electric Power Corporation etc. Lectures and tutorials in the workshop were

delivered by experts from premier institutions as well as from industries. There were participants from academic institutions as well as industries.

2. Summer Course on "Electronic Design Automation and Digital System Realization using FPGA" by ECE department from 9th June to 4th July, 2014.
3. An workshop organized by the Dept. Of Mechanical Engineering and Dept. Of Civil Engineering in collaboration with RUTAG-NE, IIT Guwahati on 25th of Feb, 2014.
4. National Workshop on Teaching/ Learning Language by the HSS department during 18-19 July.

An International Conference on "Electronic Design, Computer Networks and Automated Verification" is being organized in the Institute on 29-30 January, 2015. The conference is expected to receive IEEE sponsorship.

R16/SENATE-IV/14: *The Senate **noted** with appreciation that various workshops, conferences are being organized by the departments.*

Item No. 17: Summer Internships

It was decided to extend the expertise of the faculty members and facilities available in the Institute during the summer to allow UG/ PG students in Institute across the country to undergo summer internships with free lodging and transport. The same was notified in the Institute website. A large number of applications were received from students from Institutions all over the country. 41 students have been shortlisted for undergoing the internships.

R17/SENATE-IV/14: *The Senate was happy to **note** the enthusiasm of the faculty members to extend their expertise and the institute facilities through summer internships beyond the students of the institute.*

Item No. 18: Faculty Development Programmes/ Training

Considering the importance of faculty development a programme on Pedagogy and Curriculum Design has been organized in the Institute during 5-7 June with the following senior faculty members from IIT Kharagpur as resource persons:

1. Professor A. K. Roy
2. Professor K. Pathak
3. Professor S. K.Das Mandal

It was decided to sponsor the young faculty members of the Institute to various short term training programmes/ summer courses organized by various institutions during the summer break. These are:

1. International Summer School held at IIT Kharagpur.
2. Special training courses organized by EQUATE (Effective Quality Upgradation Assistance for Technical Educations), New Delhi.

R18/SENATE-IV/14: *The Senate was happy to **note** the organizing of the faculty development program and the sponsoring of the young faculty to the short term training programmes/ summer courses.*

As there was no other item to discuss the meeting concluded with thanks from and to the Chair.

Annexure-II

NATIONAL INSTITUTE OF TECHNOLOGY MEGHALAYA

Recommended Items of 2nd APC Minutes

The 2nd meeting of the Academic Programmes Committee (APC) of NIT Meghalaya was held on 24th Sep, 2014 at 3.00 PM. in the Conference Room of the Institute at Bijni Complex, Shillong and the following members were present:

1. Dr. A. Dandapat, Assoc. Dean (Acad), NIT Meghalaya - Chairman
2. Dr. G. Panda, Head, EEE, NIT Meghalaya - Member
3. Dr. R. Ray, Head, CSE, NIT Meghalaya - Member
4. Dr. C. Marthong, Head, Civil, NIT Meghalaya - Member
5. Dr. D. K. Sarma, Head, Mechanical, NIT Meghalaya - Member
6. Dr. A. Bhattacharjee, Head, Physics, NIT Meghalaya - Member
7. Dr. P. N. Chatterjee, Head, Chemistry, NIT Meghalaya - Member
8. Dr. S. Mukherjee, Head, Mathematics, NIT Meghalaya - Member
9. Dr. P. S. Mangnang, Head, Humanities, NIT Meghalaya - Member

At the outset the Chairman welcomed the members to the 2nd meeting of the APC. The agenda of the meeting was then taken up.

Following Items are recommended for Approval by the Senate

Sl. No.	Item	Brief Details	Recommendation
1.	**Curriculum Structure of M. Tech (ECE/CSE/EEE)**	The Curriculum Structure of the M. Tech programme was approved by the Senate vide Resolution No. R6/SENATE-III/14 and the Model Semester-wise Distribution of the courses for the M. Tech programme for the individual disciplines vide Resolution Nos. R3.7, R3.8 and R3.9 in the IV-th meeting of the SENATE. However, as per the Ordinance on Academic Programmes of the Institute, it is required to have a general Curriculum for the M. Tech programme in each of the disciplines in which the various courses in the different categories are listed along with the respective credit structures and the prerequisites. The departments have submitted these structure **(Reference: Annex-II-A)** for consideration of the APC. The APC discussed the curriculum structures submitted by the departments of CSE, ECE and EEE. The structures submitted by the departments were found in order.	**R-3/APC-2/14:** **The APC resolved to recommend the Curriculum Structures submitted by the departments for approval by the Senate.**

2.	**Courses & Syllabi of 500 level (CSE)**	The DAC of the Computer Science and Engineering Department has recommended several Elective Courses of 500 levels along with the Syllabi. **(Reference: Annex-II-B).** The APC noted that comments of the experts have been incorporated in the syllabi.	**R-4/APC-2/14:** **The APC resolved to recommend the syllabi of the CSE Courses of 500 level for approval by the Senate.**
3.	**Courses & Syllabi of 500 level (EEE)**	The DAC of the Department of Electrical and Electronics Engineering has recommended Syllabi of several 500 level courses **(Reference: Annex-II-C).** The APC noted that comments of the experts have been incorporated in the syllabi.	**R-5/APC-2/14:** **The APC resolved to recommend the syllabi of the 500 level elective courses proposed by EEE department to the Senate for approval.**

Annex-II-A
M. Tech Curriculum (CSE)

Course Category	Course No.	Course Title	Contact Hours			Credit	Prerequisites
			L	T	P		
Core Courses (12 credits)	CS 501	Mathematical Foundations of Computer Science	3	0	0	3	Basic Mathematics, Discrete Mathematics
	CS 502	Algorithms and Complexity	3	0	0	3	Introduction to Algorithms, Theory of Computation
	CS 503	Advanced Concepts in Operating Systems	3	0	0	3	Operating Systems
	CS 504	Theory of Computation	3	0	0	3	Discrete Mathematics
Lab Courses (6 credits)	CS 505	Advanced Programming, Operating System and Database Laboratory	0	0	6	3	Basic Programming, Database Management Systems
	CS 506	Network Programming Laboratory	0	0	6	3	Computer Networks
Electives (15 Credits)	CS 510	Artificial Intelligence	3	0	0	3	Discrete Mathematics, Principles of Programming Languages
	CS 511	Mobile Computing	3	0	0	3	Computer Networks, Data Communication
	CS 512	Image Processing	3	0	0	3	Engineering Mathematics, Mathematical Foundations of Computer Science

	CS 513	Software Defined Networking	3	0	0	3	Computer Networks
	CS 514	Foundations of Automatic Verification	3	0	0	3	Mathematical Foundations of Computer Science, Theory of Computation.
	CS 515	Distributed Computing	3	0	0	3	Introduction to Algorithms, Operating Systems, Computer Networks
	CS 516	Data Warehousing and Data Mining	3	0	0	3	Discrete Mathematics
	CS 517	Database Engineering	3	0	0	3	Database Management Systems
	CS 518	Information Security	3	0	0	3	Computer Networks, Data Communication
	CS 519	Cloud Computing	3	0	0	3	Computer Networks, Data Communication
	CS 520	Design and Analysis of Parallel Algorithms	3	0	0	3	Introduction to Algorithms
	CS 521	Principles of Program Analysis	3	0	0	3	Discrete Mathematics, Basic Programming
Electives shall include any other course of appropriate level offered in the Institute and recommended by the DAC							
Seminar & Term paper (5 Credits)	CS 507	Seminar-I	0	0	2	1	None
	CS 602	Seminar-II	0	0	4	2	None
	CS 601	Term Paper	0	0	4	2	None
Project Works (22 credits)	CS 5xx	Mini Project (Project Preli.)	0	0	4	2	None
	CS 603	Project I	0	0	16	8	None
	CS 604	Project II	0	0	24	12	None

M. Tech Curriculum (EEE)

Course Category	Course No.	Course Title	Contact Hours			Credit	Prerequisites
			L	T	P		
Core Courses (12 credits)	EE 501	Power System Interconnection & Control	3	0	0	3	Fundamentals of Power Systems
	EE 502	Advanced Power Converters	3	0	0	3	Fundamentals of Power Electronics
	EE 503	Renewable and Distributed Energy Systems	3	0	0	3	Basic Electrical Engg, Engg. Phy, Engg. Chem
	EE 504	Computer Aided Power System Analysis	3	0	0	3	Fundamentals of Power Systems
Lab Courses (6 credits)	EE 551	Power & Energy Systems Lab	0	0	6	3	Fundamentals of Power Systems / Power Electronics/ Instrumentation & Control Systems
	EE 552	Power & Energy Systems Simulation Lab	0	0	6	3	Fundamentals of Power Systems / Power Electronics/ Instrumentation & Control Systems
Electives (15 credits)	EE 511	Power System Dynamics	3	0	0	3	Fundamentals of Power Systems
	EE 512	Optimization Techniques	3	0	0	3	Engineering Mathematics
	EE 513	Soft Computing	3	0	0	3	Engineering Mathematics
	EE 514	Applied Linear Algebra	3	0	0	3	Engineering Mathematics
	EE 515	Instrumentation & Control in Energy Systems	3	0	0	3	Measurement & Instrumentation, Control Systems
	EE 516	SCADA Systems & Applications	3	0	0	3	Fundamentals of Power Systems
	EE 517	Programmable & Embedded Systems	3	0	0	3	Microprocessors & Interface
	EE 518	Modeling & Analysis of Electrical Machinery	3	0	0	3	Electrical Machines
	EE 519	Advanced Control Systems	3	0	0	3	Control Systems
	EE 520	Advanced Process Control	3	0	0	3	Control Systems
	EE 521	FACTS Controllers	3	0	0	3	Fundamentals of Power Systems, Fundamentals of Power Electronics
	EE 522	Advanced DSP	3	0	0	3	DSP

	EE 523	Restructured Power System	3	0	0	3	Fundamentals of Power Systems
	EE 524	Power Quality Assessment & Remedial Measures	3	0	0	3	Fundamentals of Power Systems
	EE 525	Power System Reliability	3	0	0	3	Fundamentals of Power Systems
	EE 526	Advanced Relaying and Protection	3	0	0	3	Fundamentals of Power Systems
	EE 527	Energy Assessment & Management	3	0	0	3	Energy Systems
	EE 528	Smart Grid Technology	3	0	0	3	Fundamentals of Power Systems
	EE 529	Special Electric Machines	3	0	0	3	Electrical Machines
	EE 530	Electric Drives and Control	3	0	0	3	Fundamentals of Power Electronics, Electrical Machines
	EE 531	Power System Transients	3	0	0	3	Fundamentals of Power Systems
Electives shall include any other course of appropriate level offered in the Institute and recommended by the DAC.							
Seminar & Term paper (5 Credits)	EE S01	Seminar-I	0	0	2	1	None
	EE S02	Seminar-II	0	0	4	2	None
	EE 0TP	Term Paper	0	0	4	2	None
Project Works (22 credits)	EE P01	Minor Project	0	0	4	2	None
	EE P02	Project-I	0	0	16	8	None
	EE P03	Project-II	0	0	24	12	None

M. Tech Curriculum (ECE)							
Course Category	**Course No**	**Course Title.**	**Contact Hours**			**Credit**	**Prerequisites**
			L	**T**	**P**		
Core Courses (12 credits) (2 credits for Practical)	EC 501	Physics of Semiconductor	3	0	0	**3**	Basic Semiconductor Devices & Circuits
	EC 502	Electronic System Design	3	0	2	**4**	Digital Logic Design
	EC 503	Advanced Digital Signal Processing	3	0	2	**4**	DSP
	MA 551	Advanced Engineering Mathematics	3	0	0	**3**	Basic Engineering Mathematics
Electives (15 credits) (4 credits for Practical)	EC 510	Data & Computer Communication Networks	3	0	2	**4**	Communication
	EC 511	Wireless & Mobile Communication	3	0	2	**4**	Communication
	EC 512	VLSI Circuits & Systems	3	0	2	**4**	VLSI Design
	EC 513	Advanced Microprocessor & Microcontrollers	3	0	2	**4**	Microprocessor
	EC 514	Advanced Digital Communication	3	0	2	**4**	Communication
	EC 515	Fabrication Technology	3	0	2	**4**	Communication
	EC 516	VLSI Physical Design	3	0	2	**4**	Basic Electronics
	EC 517	Optical Communication Systems	3	0	2	**4**	Electronic Devices & Basic Communication
	EC 518	Digital System Design	3	0	2	**4**	Digital Electronics
	EC 519	RF & Microwave Engineering	3	0	2	**4**	EM Theory
	EC 520	Mixed Signal Design	3	0	2	**4**	VLSI Design
	EC 521	Low Power VLSI Design	3	0	2	**4**	VLSI Design
	EC 522	RF-IC Design	3	0	2	**4**	Microelectronics & EM Theory
	EC523	Digital IC Design	3	0	2	**4**	Digital Electronics VLSI Design
	EC524	Semiconductor IC Technology	3	0	0	**3**	VLSI Circuits & Systems
	EC 526	Security in Communication network	3	0	0	**3**	Data Communication networks, MA551
	EC 527	Computer Arithmetic	3	0	0	**3**	Electronic System Design, VLSI Circuits & Systems
Electives shall include any other course of appropriate level offered in the Institute and recommended by the DAC							
Seminar & Term paper	EC 550	Seminar-I	0	0	2	**1**	None
	EC 650	Seminar-II	0	0	4	**2**	None

(5 Credits)	EC 601	Term Paper	0	0	4	**2**	None
Project Works (22 credits)	EC 551	Minor Project	0	0	4	**2**	None
	EC 651	Major Project-I	0	0	16	**8**	None
	EC 652	Major Project-II	0	0	24	**12**	None

Annex-II-B

500 level Elective Courses & Syllabi (CSE)

CS512: IMAGE PROCESSING (3-0-0: 3)

Introduction and Fundamentals of Digital Image Processing
Origins, Fundamental steps, Components and Applications of Digital Image Processing; Visual Perception, Image Sensing and Acquisition , Image Sampling and Quantization, Basic Relationships Between Pixels, Image File Format.

Image Enhancement in Spatial Domain and Frequency Domain
Some Basic Gray Level Transformations, Histogram Processing, Enhancement using Arithmetic/ Logic Operations, Smoothing and Sharpening Spatial Filters, Fourier Transform and Frequency Domain, Smoothing and Sharpening Frequency-Domain Filters; Homomorphic Filtering.

Image Restoration
Model of the Image Degradation and Restoration Process; Noise Models; Restoration In the Presence of Noise only-Spatial Filtering; Linear Position-Invariant Degradations; Estimating the Degradation Function; Inverse Filtering; Weiner Filtering; Geometric Transformations.

Morphological Image Processing
Preliminaries; Basic Morphological Operations – Opening and Closing, Dilation and Erosion; Morphological Algorithms; Extension Of Morphological Operations to Gray-Scale Images.

Colour Image Processing
Colour Models; Pseudocolour Image Processing; Colour Transformations; Smoothing and Sharpening, Colour Segmentation.

Image Segmentation
Detection of Discontinuities; Edge Linking and Boundary; Thresholding; Region-Based Segmentation; Use of Motion in Segmentation.

Image Representation and Description
Boundary Representation; Boundary Descriptors, Regional Descriptors

Image Compression
Fundamentals; Image Compression Models; Error-Free Compression; Lossless compression; Image Compression Standards.

Text Books and References

1. R. C. Gonzalez and R. E Woods, "Digital Image Processing", Pearson Prentice Hall.
2. A. K. Jain, "Fundamentals of Digital Image Processing", PHI.
3. B. Chandra and D.D. Majumder “Digital Image Processing and Analysis”, PHI.
4. S. Jayaraman, S. Esakkirajan and T. Veerakumar, “Digital Image Processing”, Tata McGraw Hill.
5. E. Gose, R. Johnsonbaugh and S. Jost, “Pattern Recognition and Image Analysis”, PHI.

CS515: DISTRIBUTED COMPUTING (3-0-0: 3)

Introduction, Distributed Programming Model, Theoretical Foundations of Distributed Systems, Wave and Traversal Algorithms, Minimal Spanning Tree Algorithms.

Balanced Sliding Window Protocol, Routing Algorithms, Deadlock free packet switching, Logical Clocks and Causal Ordering, Communication Protocols, Agreement Protocols, Commit Protocols, Leader Election Algorithms.

Distributed Mutual Exclusion, Distributed Deadlock Detection Algorithms, Termination Detection Algorithms, Self-Stabilization Algorithms, Failure Recovery and Fault tolerance in distributed systems.

Distributed File System (DFS), Distributed Shared Memory.

Text Books and References

1. G. Tel, "Introduction to Distributed Algorithms", Cambridge University Press.
2. M. Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw-Hill Publishing Company Limited.
3. H. Attiya and J. Welch, "Distributed Computing: Fundamentals, Simulations, and Advanced Topics", John Wiley and Sons, Inc.
4. N. Lynch, "Distributed Algorithms", Elsevier.
5. S. Ghosh, "Distributed Algorithms, An Algorithmic Approach", Chapman and Hall.
6. A.S. Tanenbaum, "Distributed Operating Systems", Prentice Hall.
7. P. K. Sinha, "Distributed Operating Systems – Concepts and Design", IEEE CS Press, PHI.

CS516: DATA WAREHOUSING AND DATA MINING (3-0-0: 3)

Introduction to Data Warehousing, Establishing Dimensional Modelling, Modelling the business process, Building fact tables Creating dimensions.

Building the Data Warehouse, Architecting the physical database, Ensuring data quality.
Extracting data from multiple sources.

Leveraging BI for Data Analysis, Deploying a Complete Data Warehouse Solution, Materialization techniques including full, partial and no materialization.

Basic concepts in data mining, Data measurement, exploratory data analysis, data visualization.

Predictive modelling: classification and regression, model fitting as optimization, evaluation of predictive performance, over-fitting, regularization, other data mining tasks: clustering and pattern detection, Lasso method for regularized regression. Information retrieval and search, Text classification, Unsupervised learning.

Recommender System: Recommender data, Netflix prize data, nearest neighbor algorithms, matrix decomposition algorithms, efficient algorithms for large data sets, modeling systematic effects.

Web Data Analysis: Web data: collection and interpretation, analyzing user browsing behavior, learning from click through data, predictive modeling and online advertising, link analysis and the Page-Rank algorithm. Approaches to Market Basket and quantitative data analysis using ARM (single and multi objective). Dynamic and distributed association mining.

Social Network Analysis: descriptive analysis of social networks, network embedding and latent space models, network data over time: dynamics and event-based networks, link prediction.

Text Books and References

1. D. J. Hand, H. Mannila, P. Smyth, "Principles of Data Mining", MIT Press.
2. C.D. Manning, P. Raghavan, and H. Schutze, "Introduction to Information Retrieval", Cambridge University Press.
3. R. Kimbal, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", Wiley.

CS521: PRINCIPLES OF PROGRAM ANALYSIS (3-0-0: 3)

Introduction

Program analysis, data flow analysis, constraint based analysis, abstract interpretation, type and effect systems, algorithms.

Preliminaries

Partially ordered sets, complete lattices, construction of complete lattices, chains, fixed points.

Data flow analysis

Intraprocedural Analysis, monotone frameworks, equation solving – the MFP and MOP solution, interprocedural analysis, intraprocedural versus interprocedural analysis.

Abstract Interpretation

Correctness relations, approximation of fixed points, widening operators, narrowing operators, Galois connections.

Text Books and References

1. F. Nielson, H. R. Nielson, C. Hankin, "Principles of Program Analysis", Springer.
2. M. Sharir and A. Pnueli, "Two Approaches to Inter-Procedural Data-Flow Analysis", New York: Courant Institute of Mathematical Sciences, New York University.
3. N. Jones and S. Muchnik, "Program Flow Analysis: Theory and Applications", Prentice-Hall.

Annex-II-C

500 level Elective Courses & Syllabi (EEE)

EE 520 ADVANCED PROCESS CONTROL (3-0-0: 3)

Review of Systems
First and higher order systems, closed and open loop response. Control valve types linear, equal percentage and quick opening valve. ON/OFF control, proportional integral and derivative control, Anti-reset windup, concept of bumpless transfer and PID controller, effect of process characteristics on PID control, selection and application of control action.

Stability Analysis
Frequency response, design of control system, controller tuning and process identification. Zigler-Nichols and Cohen-Coon tuning methods, Bode-Nyquist plots - process modeling.
Advanced control techniques, stability analysis of nonlinear process ,cascade, ratio, feed forward, adaptive control, selective controls, computing relays, simple alarms, Smith predictor, internal model control, theoretical analysis of complex processes.

Multivariable and Interactive Process Control
Introduction to multivariable systems, importance of multivariable systems, interaction, dynamics and its role on control system design, multivariable control, classical approaches, tuning single loop controllers tuning of multivariable controllers for MIMO systems,

Process Signal Conditioning for Measurement and Control
Need of transmitter (concept of field area & control room area), need for standardization of signals, current, voltage, and pneumatic signal standards, concept of live & dead zero.two and four wire transmitters, electronic and pneumatic transmitters electronic differential pressure transmitter: types, mounting, calibration setup, application of DPT for level measurement, suppression, square root extractor. Signal conditioning (analog & digital) for Wireless transmitters.

Text Books and References

1. C.D.Johnson, “Process control and Instrument technology”, TMH .
2. N.A. Anderson, “Instrumentation for Process measurement and control”, CRC Press
3. C.D.Johnson, “Process control and Instrument technology”, TMH
4. K. Kant, “Computer-Based Industrial Control”, PHI Learning Pvt. Ltd
5. B. G Liptak, “Instrumentation Engineers Hand Book – Process Control” (Set Of 2 Vols) CBS Publishers & Distributors-New Delhi
6. D. M. Considine, “Process Instruments and Controls Handbook”, McGraw-Hill.

EE 521: FACTS CONTROLLER (3-0-0: 3)

Introduction to Flexible Alternating Current Transmission System (FACTS)
Fundamentals of ac power transmission, transmission problems and needs, Emergence and advantages of FACTS technology in transmission system, Types of FACTS controller, Application of FACTS controllers in Distribution System

Power Flow Control Concepts
Theory and implementation of Power Flow Control Concepts, Analysis of uncompensated AC Transmission line, Passive reactive power compensation: Effect of series and shunt compensation at the mid-point of the line on power transfer

Voltage-Sourced Converters
Basic concept of voltage-sourced converters, single and three phase bridge converters, Introduction to power factor control, Transformer connections for 12- pulse, 24 pulse and 48 pulse operations, VSC based FACTS controllers

Static VAR Compensation
Analysis of SVC, Configuration of SVC, SVC Controller, Voltage Regulator Design, Harmonics and Filtering, Protection Aspects, Modelling of SVC, Application of SVC

Shunt Compensation
Principles of shunt compensation, Variable Impedance type & switching converter type-Static Synchronous Compensator (STATCOM) configuration, characteristics and control

Series Compensation
Basic concepts of controlled series compensation, Principles and operation of static series compensation using GCSC, TCSC and TSSC, applications, Static Synchronous Series Compensator (SSSC)

Static Voltage and Phase Angle Regulators
Principles of operation-Steady state model and characteristics of a static voltage regulators and phase shifters-power circuit configurations, Power-flow control and improvement of stability by phase angle regulator, Introduction to Thyristor Controlled Voltage and Phase Angle Regulators (TCVR and TCPAR)

UPFC& IPFC
Principles of operation and characteristics, independent active and reactive power flow control, comparison of UPFC with the controlled series compensators and phase shifters, Applications of UPFC. Interline Power Flow Controller (IPFC), basic operating principles and characteristics, Applications of IPFC

Text Books and References

1. K.R.Padiyar, “FACTS controllers for transmission and Distribution systems”, New Age international Publishers.
2. Y.H. Song and A. T. Johns, “Flexible ac transmission systems (FACTS)”, Institution of Electrical Engineers Press, London.
3. R. M. Mathur and R. K.Varma,“Thyristor - based FACTS controllers for Electrical transmission systems”, IEEE press, Wiley Inter science.

EE522: ADVANCED DIGITAL SIGNAL PROCESSING (3-0-0: 3)

Parametric Methods for Power Spectrum Estimation

Discrete random signals, power spectral density and properties, spectral estimation methods.

Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

Filter Design

Digital filter design techniques, Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform, design of linear phase FIR filters, transformation of digital filters, FIR filter design using windows, MATLAB based examples.

Adaptive Signal Processing

FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

Digital Signal Processor

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language.

FPGA

Architecture, different sub-systems, design flow for DSP system design, mapping of DSP alrorithms onto FPGA.

Multirate DSP

Introduction to multirate DSP, decimation and interpolation, polyphase decomposition, uniform DFT filter banks, quadrature mirror filters and perfectreconstruction, introduction to

Speech Signal Processing

Digital models for speech signal : Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

Wavelet Transforms

Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition – Haar Wavelet – Daubechies Wavelet.

Text Books and References

1. S. K. Mitra, “Digital Signal Processing :A computer Based Approach”, TMH.
2. J. G. Proakis, D. G. Manobakis, “Digital Signal Processing, Principles, Algorithms and Applications”, PHI.

3. M. H.Hayes, “Statistical Digital Signal Processing and Modeling”, Wiley.
4. L.R.Rabiner and R.W.Schafer, “Digital Processing of Speech Signals”, Pearson Education.
5. R. Crist, “Modern Digital Signal Processing”, Thomson Brooks/Cole.
6. R. M. Rao, A. S.Bopardikar, “Wavelet Transforms, “Introduction to Theory and applications”, Pearson Education, Asia.
7. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Pearson.

EE523: RESTRUCTURED POWER SYSTEM (3-0-0: 3)

Introduction

Basic concept and definitions, Privatization, Restructuring, Transmission open access, Wheeling, Deregulation, Components of deregulated system, Advantages of competitive system.

Power System Restructuring

An overview of the restructured power system, Difference between integrated power system and restructured power system, Explanation with suitable practical examples.

Deregulation of Power Sector

Separation of ownership and operation, Deregulated models-pool model, pool and bilateral trade’s model, Multi-lateral trade model, Competitive electricity market: Independent System Operator activities in pool market, Wholesale electricity market characteristics, Central auction, Single auction power pool, Double auction power pool, Market clearing and pricing, Market Power and its mitigation techniques, Bilateral trading, Ancillary services, Transmission pricing.

Open Access Same Time Information System

Introduction, Structure, Functionality, Implementation, Posting of information, Uses.

Congestion Management

Congestion management in normal operation, Explanation with suitable example, Total transfer capability (TTC), Available transfer capability (ATC), Transmission reliability margin (TRM), Capacity benefit margin (CBM), Existing transmission commitments (ETC).

Case Studies in Deregulation in India as well as other countries.

Text Books and References

1. K. Bhattacharya, M. H. J. Bollen and J. E. Daalder, “Operation of Restructured Power Systems”, Springer.
2. M. Ilic and F. Galiana, “Power System Restructuring Engineering & Economics”, Academic.
3. L. L. Lai, “Power System Restructuring and Deregulation”, John Wiley.
4. L. Philipson and H L. Willis, “Understanding Electric Utilities and Deregulation”, CRC Press.
5. M. Shahidehpour, H. Yamin and Z. Li, “Market Operations in Electric Power Systems”, John Wiley.

6. N. S. Rau, "Optimization Principles: Practical Applications to the Operation and Markets of the Electric Power Industry", John Wiley.
7. S. Hunt and G. Shuttleworth, "Competition and Choice in Electricity", John Wiley.
8. S. Stoft, "Power System Economics: Designing Markets for Electricity", John Wiley.

EE524: POWER QUALITY ASSESSMENT & REMEDIAL MEASURES (3-0-0: 3)

Power Quality- An Overview

Power quality definition, PQ characterization: Transients, Short duration and long duration voltage variations, Voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation-power acceptability curves: CBEMA, ITIC -- sources of Electric Power Quality problem in power system: poor load power factor , Non- linear and unbalanced loads, DC offset in loads , Notching in load voltage, Disturbance in supply voltage-power acceptability curves-IEEE guides, EMC standards and recommended practices.

Voltage Variations

Voltage sags- Magnitude & Duration – types- Sources of sags-Estimation of Voltage sag performance: Transmission and Utility distribution system, Effect of Sag on AC Motor Drives, Single- Phase Domestic and Office Loads, Monitoring and mitigation of Voltage sag. Origin of Long and Short interruption-influence on various equipments-Basic reliability indices related interruption-monitoring and mitigation of interruption.

Power Quality Analysis

Measurements of Voltage, Current, Power, Energy, Power Factor- Time Domain methods and Frequency Domain methods: Laplace's Fourier and Hartley transform-The Walsh Transform- Wavelet Transform. Harmonics and Distortion, Voltage versus Current Distortion, Harmonics versus Transients, Harmonics Indexes, Harmonics Sources from Commercial Loads, Harmonics Sources from Industrial Loads.

Power Quality Monitoring

Introduction, transducers, CT, PT, power quality instrumentation, Harmonic monitoring, event recording, flicker monitoring, assessment of voltage and current unbalance, Symmetrical components of phasor quantities , Instantaneous symmetrical components, Instantaneous real and reactive powers, analysis of distortion: On-line extraction of fundamental sequence components from measured samples.

Power Quality Enhancement

Utility –**Customer** interface-Harmonics filters: passive , Active and hybrid filters- Customer power device: Network configuration Devices, Load compensation using DSTATCOM ,Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P-Q theory , Synchronous detection method-Customer power park- Status of application of customer power devices.

Text Books and References

1. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publishers.
2. M. H. Bollen, "Understanding Power Quality Problems", Wiley-IEEE Press.
3. J. Arrillaga, "Power System Quality Assessment", John Wiley.

4. J. Arrillaga, B. C. Smith, N. R. Watson & A. R. Wood, "Power System Harmonic Analysis", John Wiley.
5. S. Santoso, H. W. Beaty, R. C. Dugan, M. F. McGranaghan, "Electrical Power System Quality", McGraw Hills.
6. M. H.J. Bollen, "Understanding Power Quality Problems- Voltage sag & Interruptions", IEEE Press.
7. A. Ghosh, " Power Quality Enhancement using Costum Power Devices", Kluwer Academic publishers.

EE525: POWER SYSTEM RELIABILITY (3-0-0: 3)

Generating System Reliability Analysis
Generation system model, Capacity outage probability tables, Recursive relation for capacitive model building, Sequential addition method, Unit removal, Evaluation of loss of load and energy indices

Frequency and Duration methods
Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units, Merging generation and load models

Operating Reserve Evaluation
Basic concepts, Risk indices, PJM methods, Security function approach, Rapid start and hot reserve units, Modeling using STPM approach

Bulk power System Reliability Evaluation
Basic configuration, Conditional probability approach, System and load point reliability indices, Weather effects on transmission lines, Weighted average rate and Markov model, Common mode failures.

Interconnected System Reliability Analysis
Probability array method, Two inter connected systems with independent loads, Effects of limited and unlimited tie capacity, Imperfect tie – Two connected Systems with correlated loads, Expression for cumulative probability and cumulative frequency

Distribution System Reliability Analysis
Radial networks: Introduction, Evaluation of Basic reliability indices, Performance indices – load point and system reliability indices – Customer oriented, loss and energy oriented indices

Parallel and Meshed Networks
Introduction, Basic evaluation techniques, Bus bar failures, Scheduled maintenance, Temporary and transient failures, Weather effects and Breaker failures.

Text Books and References

1. B. Roy and A.N. Ronald, "Reliability Evaluation of Power Systems", Springer Publications
2. J. Endrenyi, "Reliability Modeling in Electric Power Systems", John Wiley and Sons.

EE526: ADVANCED RELAYING AND PROTECTION (3-0-0: 3)

Introduction
Basic construction of static relays, Classification of protective schemes, Comparison of Static relays with electromagnetic relays, Amplitude comparator, Phase comparator, Principle of Duality.

Amplitude and Phase Comparators
Rectifier bridge circulating and opposed voltage type-Averaging-Phase splitting type-Sampling type of amplitude comparison, Block spike type-Phase splitting type-Transistor integrating type-Rectifier bridge type-Vector product type phase comparison.

Static over Current Relays
Instantaneous-Definite time-Inverse time-Directional-IDMT-Very inverse Time-Extremely inverse time over current relays, Time current characteristics of over current relays-Applications.

Distance Protection
Impedance Relay: Operating principle-Relay characteristic-Protective Schemes-Static Impedance Relay-Static Reactance relay-Static MHO relay-Effect of arc resistance, Effect of power surges, Effect of line length and source impedance on performance of distance relays-Quadrilateral relay-Elliptical relay-Selection of distance relays.

Pilot Relaying Schemes
Wire pilot protection: Circulating current scheme-Balanced voltage scheme - Translay scheme-Half wave comparison scheme-Carrier current protection: Phase comparison type-Carrier aided distance protection-Operational comparison of transfer trip and blocking schemes-Optical fiber channels.

AC Machines and Bus Zone Protection
Protection of Alternators: Stator protection-Rotor protection-Over voltage protection-Over speed protection-Transformer protection: Earth faults in transformers-Percentage differential protection-Protection against magnetic inrush current-Generator and transformer unit protection-Bus zone protection: Differential current protection-High impedance relay scheme-Frame leakage protection.

Microprocessor Based Protective Relays
Introduction-Over current relays-Impedance relay-Directional relay-Reactance relay.

Protection Against Over Voltages
Protection of transmission lines, stations, and substations against direct lightning strokes-Protection against travelling waves-Insulation coordination.

Text Books and References

1. A. R. Warrington, “Protective Relaying”, Chapman and Hall.
2. A. T. John and A. K. Salman, “Digital Protection for Power Systems”, IEEE Power Series.
3. P. M. Anderson, “Power System Protection”, John and Wiley.
4. T. S. Madhav Rao, “Power System Protection: Static Relays with Microprocessor Applications”, TMH.
5. B. Ram and D. N. Vishwakarma, “Power System Protection and Switchgear”, TMH.

6. C. R. Mason, “The Art and Science of Protective Relaying”, John Wiley.
7. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis-CRC Press.
8. G. Ziegler, “Numerical Distance Protection”, Siemens.
9. M. V. Deshpande, “Switchgear and Protection”, TMH.
10. S. H. Horowitz and A. G. Phadke, “Power System Relaying”, John Wiley.
11. S. S. Rao, “Switchgear Protection and Power systems”, Khanna.

EE527: ENERGY ASSESSMENT & MANAGEMENT (3-0-0: 3)

Energy resources & Consumption

Direct use of primary energy sources, conversion of primary into secondary energy sources. Prospecting, extraction and resource assessment and their peculiar characteristics. Energy consumption in various sectors and its changing pattern, exponential increase in energy consumption and projected future demands. Energy performance assessment for equipment and utility systems.

Energy efficiency

Cost benefit risk analysis, energy efficient technologies in electrical system, environmental repercussions and the economic structure. Econometric in the context of multiple objectives, conflicting goals and decisions under uncertainty.

Environmental aspects of energy and pollution control, energy for sustainable development. Energy management approach, energy monitoring and targeting.

Energy Security, Energy Vision:

Chemical and nuclear**:** non proliferation, energy Consumption and its impact on environmental climatic change. Energy Conservation Act and its features - Energy Conservation - Energy Audit - Energy Bench Marking - Maximizing System Efficiencies.

Text Books and References

1. J. J. Winebrake, “**Alternate** Energy: Assessment & Implementation”, The Fairmont Press INC, Georgia.
2. P. W. O'Callaghan, “Energy Management – A comprehensive guide to reducing costs by efficient energy use”, McGraw Hill.
3. Energy Performance Assessment for Equipment & Utility Systems, Bureau of Energy Efficiency, **www.beeindia.in**
4. IEEE Std. 739-1995, “IEEE recommended practice for energy management in industrial and commercial facilities”.
5. A. K. Tyagi, “Handbook on Energy Audits and Management”, TERI.
6. W.R. Murphy and G. McKay, “Energy management”, Butterworth & Co Publishers, Oxford, UK.
7. “BEE Study Material, Energy Management & Energy Audit”, www.bee-india.com

EE528: SMART GRID TECHNOLOGY (3-0-0: 3)

Introduction to Smart Grid

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Smart Grid Technologies: Part 1

Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Smart Grid Technologies: Part 2

Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

Microgrids and Distributed Energy Resources

Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

Power Quality Management in Smart Grid

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Information and Communication Technology for Smart Grid

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

Text Books and References

1. J. Ekanayake, N. Jenkins, K. Liyanage, J. Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley.
2. S. Chowdhury, S. P. Chowdhury, P. Crossley, “Microgrids and Active Distribution Networks”, Institution of Engineering and Technology.
3. S. Borlase, “Smart Grids (Power Engineering)”, CRC Press.
4. A. Keyhani, M. N. Marwali, M. Dai, “Integration of Green and Renewable Energy in Electric Power Systems”, Wiley
5. C. W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press
6. A. Carvallo, J. Cooper, “The Advanced Smart Grid: Edge Power Driving Sustainability: 1”, Artech House Publishers.
7. M. Kezunovic, M. G. Adamiak, A. P. Apostolov, J. G. Gilbert, “Substation Automation (Power Electronics and Power Systems)”, Springer

8. R. C. Dugan, M. F. McGranghan, S. Santoso, H. W. Beaty, “Electrical Power System Quality”, McGraw Hill Publication
9. Y. Xiao, “Communication and Networking in Smart Grids”, CRC Press.
10. J. C. Sabonnadière, N. Hadjsaïd, “Smart Grids”, Wiley Blackwell.

EE529: SPECIAL ELECTRICAL MACHINES (3-0-0: 3)

Stepper Motor

Introduction, Types, Hybrid stepper motor- construction, principle of operation, two phases energized at a time, conditions for operation, different configurations, VR Stepper motor- single stack and multi stack, Drive systems and circuit for open loop and Closed loop control of stepping motor, Dynamic characteristics, Single phase stepper Motor, Expression of voltage, current and torque for stepper motor and criteria for synchronization.

Switched Reluctance Motor

Constructional features, principle of operation, Design Aspects and profile of the SRM, Torque equation, Power converters and rotor sensing mechanism, expression of torque and torque-speed characteristics.

Brushless DC Motor

Construction, operation, sensing and switching logic scheme, Drive and power circuit, Theoretical analysis and performance prediction, transient Analysis.

Servo motors

Types of servomotors, construction, operating principle and application.

Linear Induction Motor

Construction and principle of operation of Linear Induction Motor, Approximate calculation of the force on rotor.

Text Books and References

1. K. Venkataratnam, “Special Electrical Machines”, University Press.
2. A. E. Fitzgerald, Charles Kingsley, Stephen D. Umans,” Electrical Machinery”, McGraw Hill.
3. T. J. E Miller, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford.
4. T. Kenjo and S. Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, Oxford.
5. T. Kenjo, “Stepping Motors and their Microprocessor Control”, Clarendon Press, Oxford.
6. R. Krishnan, “Switched Reluctance Motor Drives, Modelling, Simulation, Analysis, Design and applications”, CRC press.

EE 530: ELECTRIC DRIVES & CONTROL (3-0-0: 3)

Review of Conventional Drives

Speed –torque relation, Steady state stability, methods of speed control & braking for DC motor – Multi quadrant operation, Speed torque relation of AC motors, Methods of speed control and braking for Induction motor, Synchronous motor; Criteria for selection of motor for drives.

Converter Control of DC Drives

Analysis of series and separately excited DC motor with single phase and three phase controlled rectifiers operating in different modes and configurations.

Analysis of series and separately excited DC motors fed from different choppers for both time ratio control and current limit control, four quadrant control. Single quadrant variable speed chopper fed DC drives. Four quadrant variable speed chopper fed DC Drives.

Single phase/ three phase - dual converter fed DC Drive, current loop control, Armature current reversal, Field current control, Different controllers and firing circuits.

Inverter fed AC Drives

Analysis of different AC motor with single phase and three phase inverters Operations in different modes and configurations.

Cyclo-Converter fed AC Drives

Analysis of different AC motor with single phase and three phase cyclo-converters Operations in different modes and configurations. Vector Control and Rotor side Control.

AC Voltage Controller fed AC Drives

Speed Control and braking, Analysis of different AC motor with single phase and three phase ac voltage controllers. Operations in different modes and configurations.

Control and Estimation of AC drives

Induction motor: Small signal models, scalar control, FOC control, sensor less control, DTC, adaptive control. Synchronous motor: sin SPM, synchronous reluctance machines, sin IPM machines, trapezoidal SPM, wound fitted SM, sensor-less operation, switched reluctance machines, Dynamics and Modeling of AC Drives.

Text Books and References

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", P.H.I Private Ltd. New Delhi.
2. B. K Bose, " Modern Power Electronics and AC Drives" PHI
3. G.K. Dubey "Power Semiconductor controlled drives", Prentice Hall inc, A division of Simon and Schester England cliffs, New Jersey.
4. Sheperal, L.N. Wand Hully, "Power Electronic and Motor control" Cambridge University Press Cambridge.
5. S. Dewan, B. Slemon, A.G.R Straughen, "Power Semiconductor drives", John Wiley and Sons, NewYork.
6. P.C. Sen, "Thyristor DC Drives", John Wiley and sons, NewYork.
7. V. Subramanyam, "Electric Drives – Concepts and applications", Tata McGraw Hill Publishing Co., Ltd., New Delhi.

8. B.K. Bose, “Power Electronics and Variable frequency drives”, Standard Publishers Distributors, New Delhi.
9. J.M.D. Murphy and F.G. Turnbull, “Thyristor control of AC motor”, Pergamon press,Oxford.
10. N. Mohan et.al. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd.
11. R. Krishnan, “Electric motor drives: modeling, analysis and control”, Pearson.

EE531: POWER SYSTEM TRANSIENTS (3-0-0: 3)

Introduction to Transients
Introduction to simple transients in R-L, R-C, RLC Circuit, Origin and nature of power system transient and surges, Equivalent circuit representations, Lumped and distributed circuit parameters, Switching and Lightning overvoltage.

Switching Transients in Power Systems
Resistance switching, Capacitance switching, current chopping in circuit breakers, load switching, Transformer magnetising Inrush Currents, Short line fault condition

Travelling Waves
Wave equation, Reflection and Refraction of Travelling Waves, Attenuation and Distortion of Electromagnetic Waves, Behaviour of travelling waves at line termination, switching operations involving transmission lines, Lattice diagram

Lightening Transients
The Mechanism of Lightning, Wave-shape of the Lightning Current, Direct and Indirect Lightning Stroke, Interaction between lightning and power system.

Insulation Coordination
Basic concept of insulation coordination and insulation level, Statistical approach to insulation coordination, Correlation between insulation and protection levels

Protection of Equipment against Transient Overvoltage
Protection of transmission lines against lightning, Surge suppressors and lightning arrestors, Surge capacitor and reactor, Surge protection of rotating machines, Transient voltages and grounding practice

Modeling and Behavior of Power Equipment under Transient Condition
Modeling of transformer, overhead transmission lines, cables, generators, motors**,** Numerical techniques for transient analysis

Text Books and References

1. A. Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York.
2. E. Kuffel, W.S.Zangeal & J. Kuffel, “High Voltage Engineering: Fundamentals”, Newnes.
3. L. V. Sluis, “Transients in power systems”, John Wiley & Sons Ltd.
4. R.D. Begamudre, “Extra High Voltage AC Transmission Engineering”, NewAge International.

Annex-III

National Institute of Technology Meghalaya

Bijni Complex, Laitumkhrah, Shillong – 793003, India

Evaluation of Candidates for the President's Gold Medal Award 2014-15

The following candidates have applied for the President's Gold Medal:

Roll No.	Name	Department
MU10C009	Ankita Brahmachari	CSE
MU10EC11	Arpit Shekhar	ECE
MU10EC27	Yogesh Pal Singh	ECE
MU10EC27	Shashi Kant	ECE
MU10CO14	Kallol Ghose	CSE
MU10EC23	Gurinder Singh	ECE
MU10EE21	Dileep Kumar Sahu	ECE

The candidates NOT ELIGIBLE for the President's Gold Medal:

Roll No.	Name	Department	Reason
MU10EC27	Shashi Kant	ECE	Disciplinary action taken during the programme.

Applications from the eligible candidates have been evaluated. The score of the candidates are as follows:

Roll No.	Name	Department	Score
MU10C009	Ankita Brahmachari	CSE	51.6
MU10EC11	Arpit Shekhar	ECE	51.15
MU10EC27	Yogesh Pal Singh	ECE	49.45
MU10CO14	Kallol Ghose	CSE	48.1
MU10EC23	Gurinder Singh	ECE	47.75
MU10EE21	Dileep Kumar Sahu	ECE	44.6

Based on the score, it is recommended that **Miss Ankita Brahmachari** be awarded the President's Gold Medal for the year 2014-15.

Dr. R Ray, HOD, CSE Dept. Rajarshi Ray (11/8/14)

Dr. S. Maity, Asst. Professor, ME Dept. 11/8/14 Date: 11 August 2014.

Recommendation Accepted for placing before the Senate/BoG.

27-8-2014

Registrar i/c

DR (Acad.) for meeting. 27/8

Annex-IV

700 Level Courses & Syllabi

CS 707: SELECTED TOPICS IN WIRELESS SENSOR NETWORKS (3-0-0: 3)

Course Description

This course focuses on selected research topics in Wireless Sensor Networks (WSNs) and is intended for master or doctoral students. Through this course, students can learn the state of the art and open problems in WSNs, thus enhancing their potential to do research or pursue a career in this exciting area. This course is structured as a research seminar where research papers from leading conferences & journals will be presented by a student or the instructor. One selected topic will be taken each week, on which three to four papers will be studied and discussed in the class. The list of topics will be updated throughout the semester, depending on the availability of high-quality papers published or to appear in most recent top conferences & journals. Tentative topics may include (but not limited to):

- WSN Power
- Energy Harvesting
- Coverage, Connectivity, longevity, scheduling, synchronization in WSNs
- WSN security
- QoS
- WSN Hardware
- Middleware for WSNs
- WSN Applications
- Internet of Things
- WSN Deployment
- Routing Protocols for WSNs
- Fault Tolerance and Diaganostics
- Networks Resource Management, network protocols, lightweight protocols
- Data Storage, query processing, operating systems in WSNs

References:

1. K. Sohrabi, D. Minoli, and T. Znati, “Wireless Sensor Networks: Technology, Protocols and Applications” , Wiley-Interscience.
2. I. F. Akyildiz and M. C. Vuran, “Wireless Sensor Networks”, Wiley.
3. J. Wu, “Handbook on Theoretical and Algorithmic Aspects of Sensor, Ad-Hoc Wireless and Peer to Peer Network”, CRC Press.
4. Y. Li, M. T. Thai, “Wireless Sensor Networks and Applications”, Springer.
5. Papers published in leading conferences and journals.

EE 709: BIO-MEMS (3-0-0:3)

Introduction to Bio-MEMS and Microsystems

Biochips / Biosensors and device fabrication, Introduction to Cell biology, DNA & Protein sensor, Micro fluidics, Potential of Micro-fluidics, Microarrays and Lab-on-chip devices, Introduction to MEMS Design, Biochip Sensors & detection methods.

Micro-Fluidics

Basics of micro-fluidics, Low Reynolds's no. flows, Gas Flows, Liquid flows, surface tension, Electro-kinetic techniques like electrophoresis, Electro-osmosis and dielectrophoresi, Micro-fluidics for internal flow control (micro- pumps and micro-valves, device building and characterization), Micro mixer design and characterization, Micro-fluidic for Bio-sciences.

Microsystems-Fabrication Processes

Review of basic fabrication processes for silicon: Introduction to microelectronic fabrication, Optical lithography, Photo-resists, Non optical lithography techniques, LIGA processes. Design Considerations: Vacuum science and plasmas, Etching techniques, Physical vapor deposition (evaporation and sputtering), Chemical vapor deposition, Bulk and surface micromachining techniques.

Overview of Lab-On-Chip Technology: Biomedical & Chemical Sensors

Integrated gene analysis systems, Single cell and single molecule analysis using lab-on-chip techniques, Pharmaceutical analysis using lab-on-chip technology, Biomedical and chemical sensors: Electrochemical, Optical (labeled and unlabeled), Piezoelectric sensors, Chemo resistor, Chemo capacitor.

MEMS Packaging, Assembly & Test

Packaging: Encapsulation, Hermetic Encapsulation, Power, Data & RF Safety of Bio-MEMS, Assembly, Testing & calibration.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan, K. N. Bhat, V. K. Aatre, "Micro and Smart System", Wiley India.
2. N. Mahalik, "MEMS". Tata McGrawHill Education.
3. M. Gad-el-Hak, "Mems Application", CRC Press.
4. A. Liu, "RF-MEMS Switching and Integrated Switching Circuits Microsystems", Springer.