VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(VJTI)

MATUNGA, MUMBAI 400 019

MINUTES OF

Second Meeting of the

Academic Council

Held on

Wednesday, December 04, 2013 at 2.30 pm

At

DEP I Hall,

VJTI, Matunga, Mumbai 400 019

Veermata Jijabai Technological Institute
Minutes of second Meeting of Academic Council
Wednesday, December 04, 2013 at 2.30 pm

First Meeting of Academic Council was held on Wednesday, December 04, 2013 at 2.30 pm at DEP I Hall. Following members and invitees were present:

1.	Dr. O G Kakde, Director &Chairman
2.	Dr. B Ravi, External Expert member
3.	Dr. D N Badodkar, External Expert member
4.	Dr. A V Topkar, External Expert member
5.	Dr. M S Panse, Head, Electrical Engg. Dept.
6.	Dr. B B Meshram, Head, Computer & IT Dept.
7.	Dr. A N Bambole, Head, Structural Engg. Dept.
8.	Dr. S Y Mhaske, Head, Civil Engg. Dept.
9.	Dr. V M Phalle, Head, Mechanical Engg. Dept.
10.	Dr. V D Gotmare, Head, Textile Manufactures Dept.
11.	Pf. B E Narkhede, Head, Production Engg. Dept.
12.	Pf.L C Nene, Head MCA
13.	Dr. D S Wavhal, Head Physics Dept.
14.	Dr. A D Padhye, Head, Chemistry &I/C Head, Mathematics Dept.
15.	Pf. U. Nair, Head, Humanities Dept.
16.	Dr. H A Mangalvedekar, Professor, Electrical Engineering Dept.
17.	
18.	Prof. P M Chavan, Asso. Professor, Computer Engg.& Information Technology Dept.
19.	Prof. R M Tayde, Asst. Professor, Mechanical Engineering Dept.
20.	Dr. R N Awale, Immediate Past Dean (Academics)
21.	Dr. R D Daruwala, Dean (Academic Programs)& Member Secretary

Item no. 1
The Chairman Academic Council welcomed the members. The minutes of first meeting of Academic Council meeting held on April 30, 2013 were confirmed.

Item no. 2
Proposal for implementation of revised framework for scheme of instruction and evaluation to be implemented from academic year 2014 -15 leading to a revised curriculum implementation for B.Tech. programs at VJTI.

Academic council was informed that the institute proposed to revise the curriculum for the four year B.Tech. programs from academic year 2014-15 onwards. The existing scheme of instruction and evaluation was discussed. The existing scheme has five theory courses and three

to four laboratory courses per semester. A disconnect between theory and laboratory courses was observed during the implementation of the existing curriculum. During the discussion different viewpoints were put forth. Finally it was agreed that where a course curriculum required both theory and laboratory components, there would be a single course code for theory and laboratory components with separate indicators T and L. Further, the two components would have separate heads of evaluation and passing. A brief discussion on the model AICTE curriculum took place. The AICTE model curriculum has introduced noncredit mandatory courses. Members felt that these courses were needed. In light of the AICTE model curriculum, the framework for scheme of instruction and evaluation for four year B.Tech. programs was approved as follows:

SEMESTER I

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code**	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA %**	**IST %**	**ESE %**	**ESE hours**
1.		Applied Physics I	3-0-0=3	3	10	30	60	3
		Applied Physics I laboratory	0-0-2=2	1	100 % CIE			
2.		Applied Chemistry I	3-0-0=3	3	10	30	60	3
		Applied Chemistry I Lab	0-0-2=2	1	100 % CIE			
3.		Mathematics for Engineers I	3-1-0=4	4	10	30	60	3
4.		Basic Electrical Engineering / Engineering Mechanics	3-1-0=4	4	10	30	60	3
		Basic Electrical Engineering Lab / Engineering Mechanics Lab	0-0-2=2	1	100 % CIE			
5.		Computer programming and problem solving / Engineering Graphics	3-1-0=4	4	10	30	60	3
		Computer programming and problem solving Lab / Engineering Graphics Lab	0-0-2=2	1	100 % CIE			
6.		Elements of Civil Engg. / Elements of Mechanical Engg	2-0-0=2	2	10	30	60	3
7.		Workshop Practice	0-0-2	1	100 % CIE			
		Total	30	25				

Abbreviations: **L**: Lectures, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment, **IST**: In Semester Tests (comprises of one mid semester test (MST) and two class tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

SEMESTER II

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code***	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA %**	**IST %**	**ESE %**	**ESE hours**
1.		Applied Physics II	3-0-0=3	3	10	30	60	3
		Applied Physics II laboratory	0-0-2=2	1	100 % CIE			
2.		Applied Chemistry II	3-0-0=3	3	10	30	60	3
		Applied Chemistry II Lab	0-0-2=2	1	100 % CIE			
3.		Mathematics for Engineers II	3-1-0=4	4	10	30	60	3
4.		Engineering Mechanics / Basic Electrical Engineering	3-1-0=4	4	10	30	60	3
		Engineering Mechanics Lab / Basic Electrical Engineering Lab	0-0-2=2	1	100 % CIE			
5.		Engineering Graphics / Computer programming and problem solving	3-1-0=4	4	10	30	60	3
		Engineering Graphics Lab / Computer programming and problem solving Lab	0-0-2=2	1	100 % CIE			
6.		Elements of Mechanical Engg / Elements of Civil Engg.	2-0-0=2	2	10	30	60	3
7.		Workshop Practice	0-0-2	0/1	100 % CIE			
		Total	30	24/25				

*course codes would be decided later

Names of courses for semester I & II is suggestive and is likely to change.

SEMESTER III

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Mathematics for Electrical Engineers (Math - separate for each program)	3-1-0=4	4	20	30	50	3
2.		Program Core course 1	3-1-0=4	4	10	30	60	3
3.		Program Core course 2	3-1-0=4	4	10	30	60	3
4.		Program Core course 3	3-0-0=3	3	10	30	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Core course 4	3-0-0=3	3	10	30	60	3
		Program Core course 4 Lab	0-0-2=2	1	100 % CIE			
6.		Program Core course 5	3-0-0=3	3	10	30	60	3
		Program Core course 5 Lab	0-0-2=2	1	100 % CIE			
7.		Noncredit mandatory course	3	3 units	100 % CIE			
		Total	30	24				

SEMESTER IV

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Mathematics for Electrical Engineers (Math - separate for each program)	3-1-0=4	4	20	30	50	3
2.		Program Core course 1	3-1-0=4	4	10	30	60	3
3.		Program Core course 2	3-1-0=4	4	10	30	60	3
4.		Program Core course 3	3-0-0=3	3	10	30	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Core course 4	3-0-0=3	3	10	30	60	3
		Program Core course 4 Lab	0-0-2=2	1	100 % CIE			
6.		Program Core course 5	3-0-0=3	3	10	30	60	3
		Program Core course 5 Lab	0-0-2=2	1	100 % CIE			
7.		Noncredit mandatory course	3	3 units	100 % CIE			
		Total	30	24				

SEMESTER V

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Mathematics for Electrical Engineers (Math - separate for each program)	3-1-0=4	4	20	30	50	3
2.		Program Core course 1	3-1-0=4	4	10	30	60	3
3.		Program Core course 2	3-1-0=4	4	10	30	60	3
4.		Program Core course 3	3-0-0=3	3	10	30	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Core course 4	3-0-0=3	3	10	30	60	3
		Program Core course 4 Lab	0-0-2=2	1	100 % CIE			
6.		Program Core course 5	3-0-0=3	3	10	30	60	3
		Program Core course 5 Lab	0-0-2=2	1	100 % CIE			
7.		Program Core Lab course 6	1-0-2=3	2	100 % CIE			
		Total	30	26				

SEMESTER VI

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Program Core course 1	3-1-0=4	4	10	30	60	3
2.		Program Core course 2	3-1-0=4	4	10	30	60	3
3.		Program Core course 3	3-1-0-4	4	10	30	60	3
4.		Program Core course 4	3-0-0=3	3	10	30	60	3
		Program Core course 4 Lab	0-0-2=2	1	100 % CIE			
5.		Program Core course 5	3-0-0=3	3	10	30	60	3
		Program Core course 5 Lab	0-0-2=2	1	100 % CIE			
6.		Program Elective course 1	3-0-0=3	3	10	30	60	3
		Program Elective course 1 Lab	0-0-2=2	1	100 % CIE			
7.		Noncredit mandatory course	3	3 units	100 % CIE			
		Total	30	24				

SEMESTER VII

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Program Core course 1	3-1-0=4	4	10	30	60	3
2.		Program Core course 2	3-1-0=4	4	10	30	60	3
3.		Program Core course 3	3-0-0=3	3	10	30	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
4.		Program Elective course 2	4-0-0=4	4	10	30	60	3
		Program Elective course 2 Lab	0-0-2=2	1				
5.		Open Elective	4-0-0=4	4	10	30	60	3
6.		Project I	0-0-4=4	2	100 % CIE			
7.		Noncredit mandatory course	3	3 units	100 % CIE			
		Total	30	23				

SEMESTER VIII

Scheme of Instruction				Scheme of Evaluation				
S. No		**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Program Core course 1	3-1-0=4	4	10	30	60	3
2.		Program Core course 2	3-1-0=4	4	10	30	60	3
3.		Program Core course 3	3-0-0=3	3	10	30	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
4.		Program Elective course 3	3-0-0=3	3	10	30	60	3
		Program Elective course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Elective course 4	4-0-0=4	4	10	30	60	3
6.		Project II	0-0-8=8	4	*			
		Total	30	24				

* Evaluation pattern would be decided later.

Members agreed to have flexibility available to the individual Board of Studies (BOS) to have one or none noncredit mandatory course per semester for third to eight semester. On the whole there should be a minimum of 3 such courses during the whole program. The individual BOS were permitted to have minor deviations from the suggested framework for semesters III to VIII.

It was decided that although AICTE model curriculum recommends a minimum CPI of 5.0 for award of degree VJTI will continue to have a minimum CPI of 4.0 for award of degree. Currently VJTI follows a nine grade scale for relative grading of performance which has grades AA, AB, BB, BC, CC, CD and DD as pass grades and EE and FF as fail grades. It was felt that two fail grades were confusing to students and not necessary. It was agreed the new framework will have Grades AA, AB, BB, BC, CC, CD, DD and FF, FF being the fail grade. The current fail grade EE would be dropped. A suggestion to merge the EE grade into FF grade and have only one fail grade i.e. FF grade for students admitted in academic year 2013-14 was accepted.

Item no. 3

Proposal for implementation of revised framework for scheme of instruction and evaluation to be implemented from academic year 2014 -15 leading to a revised curriculum implementation for M.Tech. programs at VJTI

Academic council was informed that the institute also proposed to revise the curriculum for the two year M.Tech. programs from academic year 2014-15 onwards. The existing scheme of instruction and evaluation was discussed. The existing scheme has five theory courses and three to four laboratory courses per semester. A disconnect between theory and laboratory courses was observed during the implementation of the existing curriculum. During the discussion different viewpoints were put forth. Finally it was agreed that where a course curriculum required both theory and laboratory components, there would be a single course code for theory and laboratory components with separate indicators T and L. Further, the two components would have separate heads of evaluation and passing. The Chairman and Member Secretary brought to the notice of members of Academic Council that major institutes of higher learning had twelve courses for an M.Tech. program. The Member Secretary informed that as member of AICTE's All India Board of Post Graduate Education and Research in Engineering and Technology he was privy to deliberations on model curriculum for M.Tech. programs. It was proposed to introduce two generic core courses across all M.Tech. programs – Computations methods and Research Methodologies. Finally, the framework for scheme of instruction and evaluation for two year M.Tech. programs was approved as follows:

SEMESTER I

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code+**	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Generic Core - **Computational Methods**	3-1-0=4	4	20	20	60	3
2.		Program Core course 1	3-1-0=4	4	20	20	60	3
3.		Program Core course 2	3-0-0=3	3	20	20	60	3
		Program Core course 2 Lab	0-0-2=2	1	100 % CIE			
4.		Program Core course 3	3-0-0=3	3	20	20	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Elective course 1	3-0-0=3	3	20	20	60	3
6.		Program Elective course 2	3-0-0=3	3	20	20	60	3
		Program Elective course 2 Lab	0-0-2=2	1	100 % CIE			

		Technical Seminar *	0-0-4=4	2				
		Total	30	25				

* will also look into aspects of language proficiency

SEMESTER II

Scheme of Instruction				Scheme of Evaluation				
S. No	**Course code**	**Course Title**	**L-T-P (Hours / week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.		Generic Core – **Research Methodologies**	3-1-0=4	4	20	20	60	3
2.		Program Core course 1	3-1-0=4	4	20	20	60	3
3.		Program Core course 2	3-0-0=3	3	20	20	60	3
		Program Core course 2 Lab	0-0-2=2	1	100 % CIE			
4.		Program Core course 3	3-0-0=3	3	20	20	60	3
		Program Core course 3 Lab	0-0-2=2	1	100 % CIE			
5.		Program Elective course 2	3-0-0=3	3	20	20	60	3
6.		Program Elective course 3	3-0-0=3	3	20	20	60	3
		Program Elective course 3 Lab	0-0-2=2	1	100 % CIE			
		Design Course	0-0-4=4	2				
		Total	30	25				

*course codes would be decided later

SEMESTER III and SEMESTER IV – Project work

S. No	**Course Category**	**Course Title**	**Credits**	**Evaluation pattern**	**Semester**
1.	Project	Stage –I Presentation	4	*	III (end August)
2.	Project	Stage –II Presentation	4	*	III (end November)
3	Project	Stage –III Presentation	4	*	IV (end March)
4.	Project	Presentation and Final Viva Voce	12	*	IV (end June)

* Evaluation pattern shall be decided later

Flexibility is available to the individual BOS to have 6 courses per semester for first and second semesters or to have 5 courses per semester for first and second semesters and two Program Elective courses in third semester. The proposal to have an open elective for M.Tech. programs was dropped and replaced by Program Elective.

Item No. 4
Proposal for recognizing Dr. D S Wavhal, Professor and Head of Physics Department, VJTI, as PhD supervisor at VJTI.

During discussions it evolved that VJTI is an engineering college mandated to impart instruction and evaluation in engineering programs, the degrees of which are awarded by University of Mumbai. All it UG and PG programs are in the field of technical education and approved by AICTE for AY 2013-14. While applying for extension of approval for AY 2013-14, the institute has solemnly declared that institute does not conduct any activities other than AICTE approved programs. Thus, VJTI cannot start programs other than in field of technical education, including PhD in sciences. It was suggested that Dr. Wavhal could work as co-supervisor to research scholars in engineering and / or obtain recognition as a PhD teacher from University of Mumbai and guide research scholars at one of the research centers in Sciences of the University of Mumbai.

Item No. 5
Proposal from Production Engineering Department for introducing an elective course titled Elements of Automobile Engineering at Third Year, semester VI of B.Tech. program.

The proposal of The Board of Studies in Production Engineering for a new elective to be introduced at semester VI of B.Tech. program in Production Engineering was discussed. Members were of opinion that the course contents vast to fit into a semester and suggestions were provided to trim the course contents. The final approved course contents are put up as Annexure I. Academic Council accorded approval to offer this course from semester starting from January 2014 onwards.

Item No. 6
Proposal from Electrical Engineering Department for introducing elective courses at semester II of M.Tech. programs in Electrical Engineering.

The proposal of The Board of Studies in Electrical Engineering for the following two new electives to be introduced at semester II of M.Tech. programs in Electrical Engineering was discussed.

S. No.	Programme Name & Semester	Course Title
1	M. Tech. (Electrical Engineering) with specialization in Control Systems Semester II M. Tech. (Electrical Engineering) with specialization in Power Systems Semester II	Decentralized Control of Complex Systems.
2	M. Tech. (Electrical Engineering) with specialization in Power Systems Semester II	Renewable Energy Systems

During discussions a suggestion to include topic of stability of complex systems in the course Decentralized Control of Complex Systems was made. Also, suggestion to include mini and micro hydropower systems in course Renewable Energy Systems was made. The final approved course contents are put up as Annexure II. Academic Council accorded approval to offer these elective courses from semester starting from January 2014 onwards.

Item No. 7

Appointment of nominee of Academic Council on Board of Studies in Electrical Engineering:

The Academic Council had nominated Dr. Madhu Belur, Asso. Professor, Electrical Engineering Department, IIT Bombay as its nominee on BOS in Electrical Engineering. Electrical Engineering Department has informed Dr. Madhu Belur has declined the nomination by an email to Secretary BOS in Electrical Engineering. The department proposed to nominate Dr. S V Kulkarni, Professor, Electrical Engineering Department, IIT Bombay as nominee of Academic Council on BOS in Electrical Engineering. During discussion it was observed that Electrical Engineering Department had not obtained concurrence of Dr. S V Kulkarni hence the item was postponed.

Item no. 8

Any other matter with permission of Chair

A reference was made to the Manual of Rules for Doctoral Programs leading to Doctor of Philosophy (Technology) degree implemented from AY 2013-14 onwards. It was mentioned that VJTI offered admission to PhD program under two categories i) Full-time research scholar ii) Part-time research scholar. There is currently no provision for change over from one category to the other after the admission process is over. It was proposed that on case to case basis, Director in his Capacity as Chairman Academic Council, be authorized to permit conversion from one category to the other. After discussion Academic council agreed to authorize Director to permit / approve changeover of candidature from one category to other category through the following process:

1. The research scholar requesting conversion should apply for category conversion giving valid reasons.
2. The Supervisor of research scholar should forward the case with specific recommendations
3. The DAC of the department of the research scholar and Institute PhD affairs committee shall recommend the case to Director.

This may be suitably added to the Manual of Rules for Doctoral Programs leading to Doctor of Philosophy (Technology) degree implemented from AY 2013-14 onwards as an amendment.

The meeting ended with a vote of thanks.

Annexure I

Programme Name & Semester	**:**	**T.Y. B. Tech. (Production Engineering) Semester VI**
Course Code	**:**	**PE0812**
Course Title	**:**	**Elements of Automobile Engineering (Elective)**

Course Content

A) Anatomy of Automobiles : History of Automobiles, Classifications of automobiles, Understanding Vehicle specifications (in terms of vehicle dimensions, weight and parameters), Current knowledge about Domestic and Global Automobile Industry (various companies, their products, their strengths, their area of operations etc).

B) Overview of Power Generation System : Engine, Fuels, Intake systems, Exhaust Systems, Cooling Systems

C) Overview of Power Transmission System : Clutch, Gear Box, Transfer Case, Propeller Shaft, Differential, Wheels & Tyres.

D) Overview of Running Systems : Suspension system, Steering, Braking system

E) Overview of Comfort System : Battery, Charging System, Alternator.

F) Body Engineering : Importance of Body design, Materials for body construction-Styling forms-Coach and bus body style, layouts of passenger cars, Bus and truck bodies.
Aerodynamic drag, Basic dimensions, Overall Criteria for vehicle comparison, Chassis types and structure types, Frames

G) Recent Trends in Automobiles:
Electronic Control module (ECM), operating modes of ECM (closed loop and open loop) Inputs required and output signals from ECM, Electronic Spark control, Air Management system, Idle speed control. Multipoint fuel injection system and single point fuel injection. Electronic fuel injectors. Principle of operation, Construction, working & application of temperature sensors, inductive sensors, Position sensors (rotary, linear), Pressure sensors, Knock sensors, Hot wire and thin film air flow sensors, vortex flow/turbine fluid sensors, Optical sensor, Oxygen sensors, Light sensors, methanol sensors, Rain sensor, New developments in the sensor technology, Vehicle Telematics.

References Books :

1. Automotive Mechanics, Donald L Anglin, William H Crouse, TMH,2006
2. Automotive Mechanics: Principles & Practices : Principles and Practices, Joseph Heitner, CBS Publisher,2004
3. Automobile Engineering, T.R. Banga & Nathu Singh, Khanna Publications, 1993
4. The Automobile,Harbans Singh Reyat,S. Chand Limited,2004
5. Automobile Engineering (Volume -1 & 2),Kirpal Singh,Standard Publishers Distributors,2011
6. Automobile Electrical and Electronic Systems,Tom Denton,Taylor & Francis,2004
7. Vehicle Body Engineering, J. Pawlowski, Janusz Pawłowski,Business Books, 1969

Annexure II

Programme Name & Semester	**:**	**M. Tech. (Electrical Engineering) with specialization in Power Systems SEMESTER –II**
Course Code	**:**	
Course Title	**:**	**Renewable Energy Systems (Elective)**

Course Contents

1 **Solar Radiation:** Solar Spectrum, Extraterrestrial radiation , Radiation on the earth surface, Global, diffuse solar radiation, Solar radiation at a given location , Daily radiation pattern, Annual variation in solar radiation , Optimal tilt for solar equipment, Monthly averaged global radiation at optimal tilt

2 **Design of Solar cells:** Upper limits of cell parameters, Losses in solar cell, solar cell design, design for high short circuit current, design for high open circuit voltage.

3 **Solar cell technology:**
Si Wafer based solar cell technology: Development of commercial Si solar cells, high efficiency Si solar cells.
Thin Film Solar Cell Technologies: advantages, materials, deposition techniques, common features, types of thin film cell technologies.

4 **Concentrator PV cells and systems:** Light Concentration, Series Resistance Optimization of Concentrator Cells, Optics for Concentrator PV

5 **Emerging Solar Cell Technologies and concepts:** Organic Solar Cells, Dye-sensitized Solar Cell, GaAs solar cells, Thermo-Photovoltaic's.

6 **Wind Energy:** Wind flow, Motion of wind, Vertical wind speed variation, Distribution of wind speeds, Power in the wind , Conversion of wind power, Wind turbines.

7 **Components of Wind Power Plants:** Rotor, Nacelle, Towers, Electric Substation

8 **Working of Wind Power Plants**: Physical Principle of Modern wind Turbine, Wind Turbine Rotor Blade Characteristics, Hub and main shaft functions, working of Geared, Direct-drive and hybrid WPP

9 **Types of Generators**: WPP with Squirrel cage Induction Generator, Wound rotor Induction Generator, Doubly fed Induction Generator, Wound Rotor Synchronous Generator and Permanent Magnet Synchronous Generator.

10 **Grid Integration of Wind Power Plants:** Direct, Indirect and mesh Grids, Integration and operational issues.

11 **Hydro Power:** Small and Micro Hydro Power Plants.

Text Books:

1 Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI publication, Second edition.
2 Joshua Earnest and Tore Wizelius, Wind Power Plants and Project Development, PHI

publication

Reference Books:

1 Solar Energy International, Photovoltaics: Design and Installation Manual, New Society Publishers

2 Brendan Fox, Wind Power Integration: Connection and System Operational Aspects, The Institution Of Engineering and Technology

Programme Name & Semester II	**M. Tech. (Electrical Engineering) with specialization in Control Systems Semester II** **M. Tech. (Electrical Engineering) with specialization in Power Systems Semester II**
Course Title	**Decentralized Control of Complex Systems (elective)**

Course Content

Theory: Graphs and Matrices, properties of the Laplacian matrix and relation with graph connectivity. Non-negative matrices. Graphs and Dynamic Systems, Input and Output Reachability, Structural Controllability and Observability, Distributed Feedback Structures, Connective Stability and Stabilization, Vector Lyapunov Functions, Distributed Suboptimal and Optimal Control, Decentralized Observers and Feedback, Output Feedback

Applications:

a) Control of Smart Grids: Frequency Regulation with variable resources, Charging Control for Plug-in electric Vehicle, Wide Area Damping Control.

b) Cooperative Control of Multi-agent systems: Connectivity, Coordination and Consensus algorithms: Formation Control, Flocking, rendezvous Adversarial interactions, Task assignment and routing.

Texts/References

1. R. B. Bapat, Graphs and Matrices, TRIM Series, Hindustan Book Agency, 2011
2. C. Godsil and G. Royle, Algebraic Graph Theory, Springer, New York, 2001
3. Dragoslav D. Siljak, Decentralized Control of Complex Systems, Mathematics in Science and Engineering vol 184, Academic Press, London, 1991
4. Aranya Chakraborty and Marija D. Ilic Editors, Control and Optimization Methods for Electric Smart Grids, Springer New York, 2012.
5. Jeff S. Shamma Editor, Cooperative Control of Distributed Multi-Agent Systems, John Wiley and Sons, West Sussex, England, 2007.