Gurugram University Scheme of Studies and Examination

Bachelor of Technology Semester 7

S.No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC		Renewable Energy and Distributed Generation	3	0	0	3	30	70	100
2	HSMC		Organizational Behaviour	3	0	0	3	30	70	100
3	PEC		Professional Elective-IV	3	0	0	3	30	70	100
4	OEC		Open Elective-III	3	0	0	3	30	70	100
5	OEC		Open Elective-IV	3	0	0	3	30	70	100
6	PT		Practical Training-II	0	0	2	2	100	-	100
7	PROJ		Project-II	0	0	8	4	100	100	200
8	LC		Renewable Energy and Distributed Generation Lab	0	0	2	1	50	50	100
Total							**22**			**900**

NOTE:

1. Choose any one from Professional Elective Course-IV
2. Choose any one from each of the Open Elective Course-III and IV

PROFESSIONAL ELECTIVE- IV (Semester-VII)

Sr. No	Code	Subject	Credit
1.		High Voltage Engineering	3
2.		Intelligent Instrumentation	3
3.		Solar Technology Appliances and Application	3
4.		Advanced Power Electronics	3
5.		Renewable Energy Converters	3

RENEWABLE ENERGY AND DISTRIBUTED GENERATION

Course Code					
Category	**Professional Core Courses**				
Course title	**Renewable Energy and Distributed Generation**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn various renewable energy sources
2. To gain understanding of integrated operation of renewable energy sources.
3. To understand Power Electronics Interface with the Grid.
4. To understand control and operation of MICROGRID.

Unit-I

Introduction: Introduction of Distributed vs Central Station Generation, Sources of Energy such as Microturbines, Internal Combustion Engines. Introduction to Solar Energy, Wind Energy, Combined Heat and Power, Hydro Energy, Tidal Energy, Wave Energy, Geothermal Energy, Biomass and Fuel Cells.

Unit-II

Power Electronic Interface with the Grid, Impact of Distributed Generation on the Power System, Power Quality Disturbances, Transmission System Operation, Protection of Distributed Generators, Economics of Distributed Generation

Unit-III

IMPACT OF GRID INTEGRATION: Requirements for grid interconnection, limits on operational parameters, voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

BASICS OF A MICROGRID: Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids,

Unit-IV

CONTROL AND OPERATION OF MICROGRID: Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication-based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand about renewable energy.
2. Understand power electronic interface with the grid.
3. Understand the working of distributed generation system in autonomous/grid connected modes.
4. Know the Impact of Distributed Generation on Power System.
5. Understand basics of a microgrid.
6. Analyze control and operation of microgrid.

Text / References

1. Ranjan Rakesh, Kothari D.P, Singal K.C, "Renewable Energy Sources and Emerging Technologies",2nd Ed. Prentice Hall of India ,2011
2. Math H. Bollen, Fainan Hassan, "Integration of Distributed Generation in the Power System", July2011, Wiley–IEEE Press
3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators", October 2007, Wiley-IEEE Press.

4. Roger A. Messenger, Jerry Ventre, “Photovoltaic System Engineering”, 3rd Ed, 2010
5. James F. Manwell, Jon G. McGowan, Anthony L Rogers, “Wind energy explained: Theory Design and Application”, John Wiley and Sons 2nd Ed, 2010

ORGANIZATIONAL BEHAVIOR

Course Code					
Category	**Humanities and Management course**				
Course title	**Organizational Behavior**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. The objective of Organizational Behavior (OB) is to study human behavior within an organizational context.
2. The objective of Organizational Behavior (OB) is to understand human behavior within an organizational context.
3. The course aims to provide students with knowledge and skills to analyze and explain individual and group behavior in organizations.
4. The course aims to provide students with knowledge and skills to influence individual and group behavior in organizations.

Unit-I

Introduction of Management: Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing and Controlling, Interrelationship of managerial functions, scope of management and Importance of management. Difference between management and administration.

Unit-II

Introduction of organization: Meaning and process of Organization, Management v/s organization; Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. Individual Processes and Behavior, Personality, Concept, determinants and applications; Perception, Concept, process and applications, Learning, Concept (Brief Introduction); Motivation, Concept, techniques and importance

Unit-III

Interpersonal Processes, Teams and Groups, Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, Conflict, Concept, sources, types, management of conflict; Leadership: Concept, function, styles and qualities of leadership. Communication – Meaning, process, channels of communication, importance and barriers of communication.

Unit-IV

Organizational Processes: Organizational structure, Meaning and types of organizational structure and their effect on human behavior; Organizational culture, Elements, types and factors affecting organizational culture. Organizational change: Concept, types and factors affecting organizational change, Resistance to Change.

Course Outcomes:

At the end of this course,

1. Students will be able to apply the managerial concepts in practical life.
2. Students will be able to understand the functions of management.
3. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
4. Students will be able to understand the behavioural dynamics in organizations.
5. Students will be able to understand the leadership.
6. Students will be able to understand the organizational culture and change

Text / References

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.

5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications, New Delhi

HIGH VOLTAGE ENGINEERING

Course Code					
Category	**Professional Elective Courses**				
Course title	**High Voltage Engineering**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn Physics behind conduction and breakdown
2. To gain understanding of High voltage generation and measurement.
3. To understand Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems.
4. To understand testing of high voltage equipment.

Unit-I

Conduction and Breakdown in Gases:
Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.
Conduction and Breakdown in Liquid Dielectrics:
Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.
Breakdown in Solid Dielectrics:
Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Unit-II

Generation of High Voltages and Currents:
Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.
Measurement of High Voltages and Currents:
Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.

Unit-III

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:
National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.
Non-Destructive Testing of Materials and Electrical Apparatus:
Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

Unit-IV

HV Testing of Electrical Apparatus:
Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Explain conduction and breakdown phenomenon in gases, liquid dielectrics.
2. Analyze breakdown phenomenon in solid dielectrics.
3. Explain generation of high voltages and currents

4. Analyze measurement techniques for high voltages and currents.
5. Discuss overvoltage phenomenon and insulation coordination in electric power systems.
6. Perform non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus.

Text / References

1. High Voltage Engineering M.S. Naidu, V. Kamaraju McGraw Hill 5 th Edition, 2013.
2. High Voltage Engineering Fundamentals E. Kuffel, W.S. Zaengl, J. Kuffel Newnes 2nd Edition, 2000
3. High Voltage Engineering Wadhwa C.L. New Age International 3rd Edition, 2012
4. High-Voltage Test and Measuring Techniques Wolfgang Hauschild • Eberhard Lemke Springer 1st Edition 2014
5. High Voltage Engineering Farouk A.M. Rizk CRC Press 1st Edition2014

INTELLIGENT INSTRUMENTATION

Course Code					
Category	**Professional Elective Courses**				
Course title	**Intelligent Instrumentation**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn various Intelligent instrumentation.
2. To gain understanding of Data acquisition system and signal processing.
3. To understand Intelligence sensor device for measurement and instrumentation.
4. To understand Interfacing instruments and computers.

Unit-I

Intelligence, features characterizing intelligence, intelligent instrumentation system: features of intelligent instrumentation, components of intelligent instrumentation, block diagram of intelligent instrumentation.

Unit-II

Signal amplification and attenuation (OP-AMP based), instrumentation amplifier (circuit diagram, high CMRR & other features), signal linearization (different types such as diode resistor combination, OPAMP based etc.), bias removal signal filtering (output from ideal filters, output from constant – k filters, matching of filter sections, active analog filters).

Unit-III

OP-AMP based voltage to current converter, current to voltage conversion, signal integration, voltage follower (pre amplifier), voltage comparator, phase locked loop, signal addition, signal multiplication, signal transmission, description of spike filter.
Smart sensors: Primary sensors, excitation, compensation, information coding/processing, data compensation, standard for smart sensor interface.

Unit-IV

Interfacing instruments and computers: basic issues of interfacing, address decoding, data transfer control, A/D convertor, D/A convertors, sample and hold circuit, other interface considerations.

Course Outcomes:

At the end of this course, students will be able to

1. Understand the basic characteristic of intelligent instrumentation system Knowledge of new sensor technology
2. Understand the data acquisition system in intelligent instrumentation system
3. Understand the Signal amplification and attenuation.
4. Develop the design methodologies for measurement and instrumentation of real-world problems.
5. Study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.
6. Understand Interfacing instruments and computers.

Text / References

1. Principles of measurements and instrumentation by Alan S Morris, PHI
2. Intelligent instrumentation by Bamay, G.C.Prentice Hall
3. Sensors and transducers by Parranabis, PHI
4. Introduction to digital signal processing: MGH

SOLAR TECHNOLOGY APPLIANCES AND APPLICATION

Course Code					
Category	**Professional Elective Courses**				
Course title	**Solar Technology Appliances and Application**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn the fundamental concepts about solar energy systems and devices
2. To study the performance of each system in detail along with practical case studies
3. To learn the fundamental concepts about solar energy systems and devices
4. To study the performance of each system in detail along with practical case studies

Unit-I

Solar Radiation: Solar Radiation Outside the Earth's Atmosphere, Solar Radiation at the Earth's Surface, Instruments for Measuring Solar Radiation and Sunshine, Solar Radiation Data, Solar Radiation Geometry, Empirical Equations for Predicting the Availability of Solar Radiation, Solar Radiation on Tilted Surfaces. Heat transfer concept.

Solar Energy Collectors: Liquid Flat-Plate Collectors, Concentrating Collectors, Flat-plate Collectors with Plane Reflectors, Cylindrical Parabolic Collector, Compound Parabolic Collector (CPC), Paraboloid Dish Collector, Central Receiver Collector,

Unit-II

Thermal Energy Storage: Introduction, Sensible Heat Storage, Latent Heat Storage, Thermochemical Storage

Solar Air Heaters and greenhouse drying system: Introduction, Performance Analysis of a Conventional Air Heater, Other Types of Air Heaters, Greenhouse effect, solar drying, types of dryers, drying mechanics.

Unit-III

SOLAR LIGHTING: Solar cell – Working principle of a solar cell – Solar home lighting systems – Solar Street lighting systems - Solar lanterns – Applications - Rural electrification process – Case studies.

SOLAR COOKING: Introduction – Types of solar cookers – Advantages and disadvantages - Box type – Parabolic dish cooker - Performance evaluation of solar cookers – Testing of a solar cooker – Applications of solar cooking - Case studies

Unit-IV

SOLAR DRYING Introduction – Need for solar drying - Basics of solar drying – Types of solar dryers – Direct type solar dryer – Mixed mode type solar dryer – Forced circulation type dryers – Hybrid dryer – Bin type dryer – Solar timber drying – Applications - Case studies.

SOLAR DESALINATION: Introduction – Necessity for desalination – Study on various desalination techniques – Comparison between conventional and solar desalination – Basics of solar still - Simple solar still – Material problems in solar still – Solar disinfection and its methods – Case studies on various desalination techniques.

Course Outcomes:

At the end of this course, students will demonstrate the ability to understand

1. The fundamental concepts about solar energy systems and devices are incorporated.
2. The performance of the systems along with practical case studies were done.
3. The fundamental concepts about thermal energy systems and devices are incorporated.
4. The performance of the systems along with practical case studies were done.
5. The fundamental concepts about solar drying and desalination systems and devices are incorporated.
6. The performance of the systems along with practical case studies were done.

Text / References

1. Solar Energy by S.P. Sukhatme

2. Solar Thermal Engineering by P.J. Lunde
3. Solar Energy by J.S. Hsieh
4. Solar Thermal Engineering Systems by G.N. Tiwari and S. Suneja
5. Solar energy by G.N. Tiwari, Alpha Science, 2002
6. Suhatme and Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2008.
7. HP Garg and J Prakash: Solar Energy: Fundamentals and Applications, Tata McGraw Hill, 2010.
8. Rai, G.D., Solar Energy Utilization, KhannaPublishers,Delhi, 2010.
9. Michael Grupp, Time to Shine: Applications of Solar Energy Technology, John Wiley & Sons, 2012.
10. SM Sze, Kwok K Ng: Physics of semiconductor devices, third edition, John Wiley & Sons, 2007. 6. Daniel J. O'Connor, 101 patented solar energy uses,VanNostrand Reinhold Co., 2007.
11. Martin A. Green, Solar Cells Operating Principles, Technology, and System Applications Prentice- Hall, 2008

ADVANCED POWER ELECTRONICS

Course Code						
Category	**Professional Elective Courses**					
Course title	**Advanced Power Electronics**					
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**	
	3	**0**	**0**	**3**		
Class Work	30 Marks					
Exam	70 Marks					
Total	100 Marks					
Duration of Exam	3Hrs					

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To review basic concepts of power electronics in the field of power control and drives.
2. To address the underlying concepts and methods behind Advanced Power Electronics.
3. To impart knowledge of power semiconductor technologies.
4. To impart knowledge of power electronics advancement in the field of power conversion.

Unit-I

Advanced solid-state devices such as MOSFETs, IGBT, GTO, IGCT etc, their power modules, intelligent power modules, thermal design, protection, gating circuits, digital signal processors used in their control. Non isolated and isolated dc- dc converters such as buck, boost, buck-boost, flyback, forward, Cuk, SEPIC, Zeta, half bridge, push-pull and bridge in DCM and CCM, single-phase, single-stage converters (SSSSC), power factor correction at ac mains in these converters, their application in SMPS, UPS, welding and lighting systems.

Unit-II

Improved power quality ac-dc converters such as single-phase buck, boost, buck-boost ac- dc converters, PWM (Pulse width modulated) based single phase, three-phase VSC (Voltage source converters), multilevel VSCs, multipulse VSCs, PWM CSC (Current voltage source converters), multipulse ac-dc converters. power quality mitigation devices such as passive filters, active filters, hybrid filters, DTSTCOM (Distribution static compensator), DVR (Dynamic voltage restorers) and UPQC (Universal power quality conditioners).

Unit-III

FACTS devices such TCR (thyristor-controlled reactor), TSC (thyristor switched capacitors), STATCOM (Static synchronous compensator), SSSC (Static series synchronous compensator), UPFC (Unified power flow controller), IPFC (Interline power flow controller). HVDC (High voltage direct current) system such as 12-pulse converter based HVDC systems, HVDC light, HVDC PLUS (Power universal link), multipulse and multilevel VSC based flexible HVDC systems.

Unit-IV

Solid state controllers for motor drives such as vector control and direct torque control of induction motor, synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless dc (PMLDC) motor, LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in these drives.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Theoretical and practical knowledge on modern day semiconductor devices, their characteristics and control.
2. Understand improved power quality by converters.
3. Understanding operation and analysis of switched mode DCDC converters and their designing.
4. Understand FACTS devices.
5. Knowledge of power conditioners and their application.
6. Working knowledge of static applications of advanced power electronics like UPS, HVDC, Automotive etc.

Text / References

1. R. S. Ramshaw, “Power Electronics Semiconductor Switches”, Champman & Hall, 1993.
2. N. Mohan, T. M. Undeland and W. P. Robbins, “Power Electronics, Converter, Application and Design”, Third Edition, John

Willey & Sons, 2004.
3. M. H. Rashid, “Power Electronics, circuits, Devices and Applications”, Pearson, 2002, India.
4. K. Billings, “Switch Mode Power Supply Handbook”, McGraw-Hill, 1999, Boston.
5. A. I. Pressman, “Switch Mode Power Supply Design”, McGraw-Hill, 1999, New York.
6. N. G. Hingorani and L. Gyugyi, “Understanding FACTS”, IEEE Press, Delhi, 2001.
7. B. K. Bose, “Power Electronics and Variable Frequency Drive”, Standard Publishers Distributors, 2000.
8. Bin Wu, “High-Power Converters and AC Drives”, IEEE Press, A John Wiley & Sons, Inc Publication, New York,2006.
9. G. T. Heydt, “Electric Power Quality”, Stars in a Circle Publications, second edition, 1994, Avarua, Rarotonga, Cook Islands.
10. R. C. Duagan, M. F. Mcgranaghan and H. W. Beaty, “Electric Power System Quality”, McGraw-Hill, 2001, 1221 Avenue of the Americas, New York.
11. Vijay K. Sood, “HVDC and FACTS Controllers -Applications of Static Converters in Power Systems”, Kluwer Academic Publishers, Massachusetts, 2004.

RENEWABLE ENERGY CONVERTERS

Course Code					
Category	**Professional Elective Courses**				
Course title	**Renewable Energy Converters**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	3	**0**	**0**	**3**	
Class Work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To understand about various advanced power converters.
2. To analyze and design different power converter circuits used in renewable energy systems.
3. To analyze power converters for buck boost operation.
4. To analyze power converters for grid converter operation.

Unit-I

Introduction Review of 2-pulse and 6-pulse converters and their performance with inductive and capacitive loads. Harmonic analysis of single-phase and three-phase converters.

Unit-II

Power Converters for Solar PV Systems, Multi-level converters, topologies and control techniques, PWM techniques.

Unit-III

Power Converters for Fuel Cells Buck converter, Boost converter, Interleaved buck/boost converter, advanced modulation techniques

Unit-IV

Power Converters in WECS Multi-channel interleaved boost converters, voltage source converters, control of grid-tied converters, matrix converter, and modular multi-level inverters.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand advanced concepts in power electronics.
2. Understand about various advanced power converters
3. Adaptability to analyze power converter based renewable energy systems.
4. Analyze power converters for buck boost operation.
5. Analyze power converters for grid converter operation.
6. To troubleshoot gird compatibility issues with power electronics circuits.

Text / References

1. V. Yaramasu and B.Wu, "Model Predictive Control of Wind Energy Conversion Systems," Wiley- IEEE Press, 2016.
2. Rashid M. H., “Power Electronics Circuits Devices and Applications”, 3rd Ed., Pearson Education, 2008.
3. Lander Cyril W., “Power Electronics”, Prentice Hall of India Private Limited, 2004.
4. Mohan N., Undeland T.M. and Robbins W.P., “Power Electronics-Converters, Applications and Design”, 3rd Ed.,Wiley India, 2008.
5. Paice D. A., “Power Electronic Converter Harmonics – Multipulse Methods for Clean Power”, IEEE press, 1995.

PRACTICAL TRAINING-II

Course Code					
Category	**PT**				
Course title	**Practical Training-II**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	0	**0**	**2**	**2**	
Class Work	100 Marks				
Exam					
Total	100 Marks				
Duration of Exam					

The students are required to undergo practical training of duration not less than 1.5 months in a reputed organization or concerned institute. The students who wish to undergo practical training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the practical training will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training will be based on seminar, viva-voice, report and certificate of practical training or institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students who have undergone industrial training consist of 100 marks internally.

PROJECT-II

Course Code					
Category	**Project**				
Course title	**Project-II**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	0	**0**	**8**	**4**	
Class Work	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	3Hrs				

Course objectives:

1. To allow students to demonstrate a wide range of the skills by working on PROJECT-I that has passed through the design, analysis, testing and evaluation
2. To encourage problem solving skills.
3. To allow students to develop problem solving, synthesis and evaluation skills.
4. To encourage teamwork and leadership.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation.

The students are required to undertake institutional project work.

The final Viva voice of the institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of institutional project work will be based on seminar, viva-voice and report of institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students consists of 100 marks internally and 100 marks by an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project solution.
2. Undertake problem solution.

3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct the remaining engineering project.
5. Communicate with team members at large in written an oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

RENEWABLE ENERGY AND DISTRIBUTED GENERATION LAB

Course Code					
Category	**Laboratory Courses**				
Course title	**Renewable Energy and Distributed Generation Lab**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VII**
	0	**0**	**2**	**1**	
Class Work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

Notes:

(iii) At least 10 experiments are to be performed by students in the semester.

(iv) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS

1. Introduction to MATLAB or any other software.
2. Modelling of PV cell
3. Effect Of Temperature Variation on Photovoltaic Array
4. Effect of irradiation on a photovoltaic array
5. Design of solar PV boost converter using PandO MPPT technique.
6. Open circuit voltage of PV cells and short circuit current of PV cells
7. Explore Wind Turbines
8. Effect of Load on Wind Turbine Output
9. Draw Power Curves and energy
10. Build a Wind Farm
11. Designing and planning of a stand-alone system

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Lab Outcomes:

At the end of this lab, students will demonstrate the ability to

1. Understand about renewable energy.
2. Understand power electronic interface with the grid.
3. Understand the working of distributed generation system in autonomous/grid connected modes.
4. Know the Impact of Distributed Generation on Power System.
5. Understand basics of a microgrid.
6. Analyze control and operation of microgrid.

Gurugram University Scheme of Studies and Examination

Bachelor of Technology Semester 8

S.No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	ESC		MOOC-1 (Essential)	3	0	0	3	25	75	100
2	ESC		MOOC-2 (Essential)	3	0	0	3	25	75	100
3	PROJ		Industrial Project / Project-III	0	0	16	8	150	150	300
Total							**14**			**500**

MOOC-1 (ESSENTIAL)

Course Code					
Category	**Engineering Science Course**				
Course title	**MOOC-1 (Essential)**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	3	**0**	**0**	**3**	
Class Work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

A student has to complete NPTEL/SWAYAM Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL/SWAYAM Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL/SWAYAM directly as per the course offering in Odd/Even Semesters at NPTEL/SWAYAM. These NPTEL/SWAYAM courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL/SWAYAM status/certificates to the University (COE) through their college of study only.

MOOC-2 (ESSENTIAL)

Course Code					
Category	**Engineering Science Course**				
Course title	**MOOC-2 (Essential)**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	3	**0**	**0**	**3**	
Class Work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3Hrs				

A student has to complete NPTEL/SWAYAM Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL/SWAYAM Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL/SWAYAM directly as per the course offering in Odd/Even Semesters at NPTEL/SWAYAM. These NPTEL/SWAYAM courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL/SWAYAM status/certificates to the University (COE) through their college of study only.

INDUSTRIAL PROJECT/PROJECT-III

Course Code					
Category	**Project**				
Course title	**Industrial Project/Project-III**				
Scheme	**L**	**T**	**P**	**Credits**	**Semester: VIII**
	0	**0**	**16**	**8**	
Class Work	150 Marks				
Exam	150 Marks				
Total	300 Marks				
Duration of Exam	3Hrs				

Course objectives:

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

The students are required to undergo industrial training or institutional project work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the industrial training or institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training or institutional project work will be based on seminar, yiva-voice, report and certificate of industrial training or institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students who have undergone industrial training consist of 150 marks internally and 150 marks buy an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct an engineering project.
5. Communicate with engineers and the community at large in written an oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.