Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Scheme & Syllabus for B. Tech Third Year

W.E.F. Academic Session 2020-21

V & VI SEMESTER

Bachelor of Technology (B. Tech.)

[Electrical Engineering]

Uttarakhand Technical University, Dehradun
New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.) III Year
[Electrical Engineering]
W.E.F. Academic Session 2020-21

V Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	EE 501	DC	Electrical Machine-II	100	30	20	30	20	200	3	0	2	4
2.	EE-502	DC	Power Electronics	100	30	20	30	20	200	2	1	2	4
3.	EE-503	DE	Departmental Elective-I	100	30	20	-	-	150	3	1	0	4
4.	EE-504	OE	Open Elective-I	100	30	20	-	-	150	3	1	0	4
5.	EE-505	D Lab	Departmental Lab	-	-	-	30	20	50	0	1	3	2
6.	EE-506	O/E Lab	Open Elective Lab/				30	20	50	0	1	2	2
7	EE-507	IN	Evaluation of Internship-II completed at II year level	-	-	-	-	100	100			4	2
8	EE-508	P	Minor Project – I	-	-	-		100	100	0	0	6	3
9		IN	Internship -III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester.									
Total				400	120	80	120	280	1000	11	5	19	25
NSS/NCC													

Departmental Electives			Open Electives	
EE 503(A)	Electrical Power Generation and Economy		EE-504(A)	Digital Control System
EE 503(B)	Applied Instrumentation		EE-504(B)	Power System Analysis
EE 503(C)	Electrical Engineering Material		EE-504(C)	Industrial electronics
			EE 503 (D)	Innovation and Entrepreneurship

VI Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Team Work / Lab Work & Sessional		L	T	P	
1.	EE 601	DC	Electrical Machine Design	100	30	20	30	20	200	3	1	2	5
2.	EE-602	DC	Power Systems-II	100	30	20	30	20	200	3	1	2	5
	EE-603	DC	Wind and Solar Energy	100	30	20	30	20	200	2	1	2	4
3.	EE-604	DE	Departmental Elective	100	30	20		-	150	3	1	0	4
4.	EE-605	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
5.	EE-606	O/E Lab	Open Elective Lab/ Matlab Programming	-	-	-	30	20	50	0	0	4	2
6.	EE-607	P	Minor Project -II					50	50	0	0	4	2
8		IN	Internship - III	To be completed anytime during Fifth/Sixth semester. Its evaluation/credit to be added in Seventh Semester.									
Total				500	150	100	120	130	1000	14	4	14	26

Note: Meaning of Last Character of Subject Code (T – Theory; P – Practical)

Departmental Electives			**Open Electives**	
EE 604(A)	Power System Protection		EE-605(A)	Microprocessor and Interfacing
EE 604(B)	Energy Conservation and Management		EE-605(B)	Power Plant Engineering
EE 604(C)	Digital Signal Processing		EE-605(C)	Analog and Digital Communication

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Electrical Engineering, V-Semester

EE501 Electrical Machine-II

Unit-I

D.C. Machine-I : Basic construction of DC machines; types of DC machines and method of excitation; lap and wave windings; Emf equation; armature reaction and methods of limiting armature reaction; Commutation process and methods for improving commutation; Basic performance of DC generators and their performance characteristics; Metadyne and Amplidyne; permanent magnet DC motors; Brush less dc motors.

Unit-II

D.C. Machine-II : Basic operation of DC motors; Torque equation; Operating characteristics of DC motors, Starting of DC motors- 2point, 3 point and 4 point starters; speed control of DC motors; losses and efficiency of DC machines; testing of DC machines, direct testing, Swinburne's test and Hopkinson's test. Application of DC machines.

Unit-III

Synchronous Machine-I: Construction; types of prime movers; excitation system including brushless excitation; polyphase distributive winding, integral slot and fractional slot windings; emf equation, generation of harmonics and their elimination; armature reaction; synchronous reactance and impedance, equivalent circuit of alternator, relation between generated voltage and terminal voltage, voltage regulation of alternators using synchronous impedance, mmf, zpf and new A.S.A method.

Unit-IV

Synchronous Machine-II: Salient pole machines; two reaction theory equivalent circuit model and phasor diagram; determination of XdandXqby slip test; SCR and its significance; regulation of salient pole alternator, power angle equation and characteristics; synchronizing of alternator with infinite busbar,; parallel operation and load sharing; synchronizing current, synchronizing power and synchronising torque coefficient; synchro scopes and phase sequence indicator; effect of varying excitation and mechanical torque.

Unit-V

Synchronous machine-III

Synchronous motor operation, starting and stopping of synchronous motor, pull in torque, motor under load power and torque, reluctance torque, effect of excitation, effect of armature reaction, power factor adjustment, V curves, inverted V curves, synchronous motors as power factor correcting device, super synchronous and sub synchronous motors, hunting and damper winding efficiency and losses. Analysis of short circuit oscillogram, determination of various transient, sub transient and steady reactances and time constants, expression of transient and sub transient reactances in terms of self and mutual inductances of various winding, short circuit current, equivalent circuit. Single phase synchronous motors- hysteresis motor, reluctance motor. Repulsion motor, stepper motor, switched reluctance

REFERENCE BOOKS

1. M.G. Say, Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rd edition
2. I.J. Nagrath& D.P. Kothari, Electric Machines, Tata McGraw Hill , New Delhi,
3. P.S. Bhimbra, Electrical Machinery, Khanna Pub.
4. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, Delhi,
5. Ashfaq Husain, Electric Machines, Dhanpat Rai, New Delhi
6. Syed A. Nasar, Electric Machines & Power Systems, Volume I , Tata McGraw Hill, New Delhi
7. A.E. Fitzerald, C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill

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New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, V-Semester

EE 502 Power Electronics

UNIT-I

Advantages and application of power electronic devices characteristics, Symbol & application of power diodes, power transistors, GTO, Triac, Diac, Power MOSFET, IGBT, LASCR, Fast recovery diode, schottey diode MCTs. Principle of operation of SCR, Two transistor analogy, brief idea of construction of SCR, Static characteristics of SCR, Condition of turn on & off of SCR Gate characteristics, Method for turning on of SCR, Turnoff methods, different commutation techniques (Class A,B,C,D,E, & F Commutation) firing of SCR, Resistance firing Ckt, Resistance capacitance firing circuit, UJT firing cut, and ramp triggering, firing for 3-Φ circuit. SCR rating & protection of SCR over voltage, Over current, Superior firing, Design of snubber circuit and protection of gate of SCR, heating, cooling & mounting of SCR series and parallel operation of SCR, String efficiency & problem associated with series and parallel operation of SCR.

UNIT-II

Operation and analysis of single phase (Half wave & Full Wave) and multiphase (Three Phase) uncontrolled and controlled rectifier circuit with resistive, resistive & inductive load (continuous & non continuous conduction, FW small & very large inductive loads) and RLE loads. Estimation of average load voltage and load current for above rectifier circuits active and reactive power input. Effect of freewheeling diode and source inductance on performance of these rectifier circuits . Comparison of mid-point & Bridge rectifier circuits.

UNIT-III

Series and parallel inverter, Voltage source & current source inverter, Single phase and three phase bridge inverter, Self-cumulated inverters,, Mc- murray& MC murray bed ford inverters, Voltage control of single phase and three phase bridge inverter, Harmonics & their reduction techniques.

UNIT-IV

Principle of chopper operation, Various control strategies in chopper, Step up & step-up/step down choppers, chopper configuration (Type A,B, C,D, & E), Steady state analysis of chopper circuits, Current & voltage commutation of chopper circuits Jones & Morgens chopper.

UNIT-V

Single phase (midpoint & bridge configuration) and three phase cyclo convertor configuration and operating principles. AC voltage controllers (using SCRs & Traics) single phase full wave controller with R and RL load, Estimation of RMS load voltage, RMS load current and input power factor, three phase AC voltage controller (Without analysis) Dual converter Switched mode voltage regulator buck, Boost, Buch & Boost, Ck regulators.

REFERENCE BOOKS

1- M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson Education, Singapore, 1993.
2- M Ramsmoorthy, An Introduction to transistor and their application, Affiliated East-West Press.
3- P.C. Sen, Power Electonics, TMH.
4- M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi, 2001.
5- Chakravarti A., Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.,
6- Dr. P.S. Bhimbhra, Power Electonics, Khanna Pub.
Vedam Subramanyam, Power Electronics New Age International Revised II ed. 2006.

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New Scheme of Examination as per AICTE Flexible Curricula
Electrical Engineering, V-Semester, Departmental Elective
EE- 503 (A) Electrical Power Generation & Economy

Unit-I

Introduction: Energy sources and their availability, Principle types of power plants, their special features and applications, Present status and future trends. Hydro Electric Power Plants: Essentials, Classifications, Hydroelectric survey, Rainfall run-off, Hydrograph, Flow duration curve, Mass curve, Storage capacity, Site selection, Plant layout, various components, Types of turbines, Governor and speed regulation, Pumped storage, Small scale Hydro electric plants (mini and micro).

Unit-II

Thermal Power Plant: General developing trends, Essentials, Plant layout, Coal its storage, Preparation, Handling, Feeding and burning, Cooling towers, Ash handling, Water treatment plant, High pressure boilers and steam turbines, Components of thermal power plant.

Unit-III

Non-Conventional Power Generation: Geothermal power plants, Electricity from biomass, Direct energy conversion systems (Solar and Wind), Thermo-electric conversion system, Fuel cells, Magneto-Hydro dynamic system..

Unit-IV

Gas Turbine Power Plants: Field of use, Components, Plant layout, Comparison with steam power plants, combined steam and gas power plants. Nuclear Power Plant: Nuclear fuels, Nuclear energy, Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radioactive and waste disposal safety aspect..

Unit-V

Power Plant Economics: Cost of electrical energy, Selection of type of generation and generation equipment, Performance and operating characteristics of power plants, Economic scheduling principle, Load curves, Effect of load on power plant design, Load forecasting, electric tariffs, Peak load pricing.

REFERENCE BOOKS

1. Deshpande, M.V., Power Plant Engineering, Tata McGraw Hill (2004).
2. Gupta, B.R., Generation of Electrical Energy, S. Chand (1998).
3. Deshpande, M.V., Electrical Power System Design, McGraw Hill (2004).
Wood, A.J. and Wollenberg, B.F., Power Generation and Control, John Wiley (2004).

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New Scheme of Examination as per AICTE Flexible Curricula
Electrical Engineering, V-Semester Departmental Elective
EE- 503 (B) Applied Instrumentation

Unit-I

Introduction to measurement: Definition, application and types of measurement
System Introduction to CRO, Different parts of CRO, Its Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Screen for CRTs, Graticule, Vertical & Horizontal deflection system, Time base circuit, Oscilloscope probes and transducers, Attenuators, Application of CROs, Lissajous patterns, Special purpose CROsMulti input, Dual trace, Dual beam, Sampling, Storage (Analog & Digital) Oscilloscopes.

Unit-II

R, L, C Measurement: Bridges: Measurement of resistance using Measurement of inductance and capacitance by A.C. bridges: Maxwell's bridge, Anderson bridge, Schering bridge, Hay'sbridge, Wein's bridge, Shielding and grounding, Q meter.

Unit-III

NonElectrical Quantities (Transducer): Classification of Transducers, Strain gauge, Displacement Transducer Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezoelectric transducer, Photo emissive, Photo conductive, Photo voltaic, Photodiode, Photo Transistor, Nuclear Radiation Detector.

Unit-IV

Digital instruments: Advantages of digital instruments, Over analog instruments, DA, AD conversion, Digital voltmeter, Ramp type DVM, Integrating DVM, successive approximation DVM,frequency meter. Display devices: Digital display system and indicators like CRT, LED, LCD, Nixies, Electro luminescent, Incandescent, Electrophoretic image display, Liquid vapour display dotmatrix display, Analog recorders, XY recorders. Instruments used in computer controlled instrumentation RS 232C and IEEE 488, GPIB electric interface.

Unit-V

Signal generator: Function generator, sweep frequency generator, Pulse and square wave generator, Wave Analysers, Harmonic Distortion Analyser, Spectrum Analyser, frequency counter.

References Books:

1. John P. Bentley : Principles of measurement systems, Longman 1983
2. Johnson C.D: Process control instrumentation technology, 4/e, PHI, 1995
3. D.Patranabis : Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd. New Delhi, 1999
4. Sheingold D. H.: Transducer interfacing hand book – a guide to analog signal conditioning, analog devices Inc masschusetts, 1980.
5. Anderson N A : Instrumentation for process measurement and control :Chilton book company 1980.
6. H. S. Kalsi: Electronics Instrumentation, TMH.
7. K. Sawhney: Instrumentation and Measurements, Dhanpat Rai and Co.
8. Helfric and Cooper: Modern Electronic Instrumentation and Measurement Techniques; Pearson.

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Electrical Engineering, V-Semester Departmental Elective
EE- 503 (C) Electrical Engg. Material

Unit-I

Conducting Material: Classification and main properties, High resistivity alloy: Constant Mangann, Nichrome, Electrochemical, properties of copper, Aluminum, steel tungsten, Molybdenum,Platinum, Tantalum, Niobium, Mercurry, Nickel, Titanum, Carbon, Lead, thermal, Bitmetals,thermocouple,materials, specific resistance, conductance, variation of resistance with temperature, super conductors.

Unit-II

Semi-Conductor Materials: General conception, variation of electrical conductivity, Elements having semiconductor properties, general application, hall effect, energy levels, conduction insemiconductors, Intrinsic conduction, impurity conduction, P and N type impurities, electrical change,Neutrality, Drift, Mobility current flow in semiconductors P-N junction formation by alloying, Elasing(forward and reverse) of P-n junction, Reverse separation current, Zener effect, Junction,capacitance, hall defects and hall coefficient.

Unit-III

Magnetic Materials: Details of magnetic materials, reduction between B.H. and, soft and hard magnetic materials. Di-magnetic, Para magnetic and Ferromagnetic materials, electrical sheet steel, cast iron. Permanent magnetic materials. Dynamic and static hysteresis loop. Hysteresis loss, eddycurrent loss, Magnetisation, magnetic susceptibility, coercive force, core temperature, rectangularhysteresis loop, Magnet rest square loop core materials, iron silicon, Iron alloys

Unit-IV

Insulating Materials: General electrical mechanical and chemical properties of insulating material, Electrical characteristics volume and surface resistivity complex permitivity loss, anddielectric loss, equivalent circuits of an imperfect dielectric polarization and polarizability classification of dielectric.

Unit-V

Mechanical Properties: Classification insulating materials on the basis of temperature rise. General properties of transformer oil, commonly used varnishes, solidifying insulating materials, resins,bituminous waxes, drying oils, Fibrous insulating materials, wood, paper and cardboard, insulatingtextiles, varnished adhesive tapes, inorganic fibrous material and other insulating materials, such asmica, ceramic, bakelite, ebonite, glass, PVC, rubber, other plastic molded materials.

REFERENCE BOOKS

1. TTTI Madras; Electrical Engineering Materials; TMH.
2. Electrical Engineering Material s & Devices; John Allison ;TMH
3. Materials for Electrical Engineering: B.M. Tareev
4. Anderson; Di-Electrics :
5. Kortisky; Electrical Engineering Materials:
6. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand
7. Dekkor AK; Electrical Engineering Materials; PHI

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New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, V-Semester Open Elective

EE- 504 (A) Digital Control System

UNIT I

Introduction to Discrete Time Control System Basic building blocks of Discrete time Control system, Sampling Theorem, Z transform and Inverse Z transform for applications for solving differential equations, Mapping between the S-plane and the Z plane, Impulse sampling and Data Hold.

UNIT II

Pulse Transfer Function and Digital PID Controllers The pulse transfer function, pulse transfer function of Closed Loop systems, Pulse transfer function of Digital PID controller, Velocity & Position forms of Digital PID Controller, Realization of Digital Controllers, Deadbeat response and ringing of poles

UNIT III

Design of Discrete Time Control System by conventional methods Stability analysis in Zplane, Jury stability criterion, bilinear transformations, Design based on the root locus method, Digital Controller Design using Analytical Design Method.

UNIT IV

State Space Analysis of Discrete Time Control System State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Eigen Values, Eigen Vectors and Matrix Diagonalization, Discretization of continuous time state space equations, Similarity transformations.

UNIT V

Pole Placement and Observer Design Concept of Controllability and Observability, Useful transformations in state space analysis and design, Stability improvement by state feedback, Design via pole placement, State observers. Optimal Control Quadratic Optimal Control and Quadratic performance index, Optimal state regulator through the matrix riccati equations, Steady State Quadratic Optimal Control.

Reference Books:

1. Discrete Time Control systems by K. Ogata, Prentice Hall, Second Edition.
2. Digital Control and State Variable Methods by M. Gopal, Tata McGraw Hill.
3. B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition
4. Digital control of Dynamic Systems by G.F.Franklin, J.David Powell, Michael Workman 3rd Edition, Addison Wesley .
5. Digital Control Engineering by M. Gopal, Wiley Eastern Ltd.
6. Digital Control by Kannan Moudgalya, John Wiley and Sons.
7. Digital Control Systems by Contantine H. Houpis and Gary B. Lamont, Second Edition, McGraw-Hill International.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula
Electrical Engineering, V-Semester Open Elective
EE- 504 (B) Power System Analysis

Unit I:

Representation of power system components:

Synchronous machines, Transformers, Transmission lines, One line diagram, mpedance and reactance diagram, per unit system.

Symmetrical Components:

Symmetrical components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machines, internal voltage of loaded machines under transient conditions.

Unit II:

Analysis of single line to ground fault, line to line fault and double line to ground fault on an unloaded generator and power system network with and without fault impedance.

Formation of Zbus using singular transformation and algorithm, computer method for short circuit calculations.

Unit III:

Load flows:

Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphon method, approximation to N-R method, line flow equation and fast decoupled method.

Unit IV:

Power system Stability: Stability and stability limit, steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step by step method.

Factors affecting steady sate and transient stability and methods of improvement.

Unit V:

Wave equation for uniform transmission lines, velocity propagation, surge impedance, reflection and transmission of traveling waves under different line loadings, Bewlay's Lattice diagram, protection of equipment and line against traveling waves.

Reference Books:

1. Kothari & Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill.
2. P S R Murthy." Power System Analaysis, BSP, Hyderabad
3. A.R. Bergen and V. Vittal, "Power System Analysis", Pearson Publication.
4. Stevenson." Elements of Power System Analysis. McGraw Hill Pub Co..

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New Scheme of Examination as per AICTE Flexible Curricula
Electrical Engineering, V-Semester Open Elective
EE- 504 (C) Industrial Electronics

Unit-I

Power supply, rectifiers (half wave, full wave), performance parameters of power supplies, filters (capacitor,inductor, inductor-capacitor, pi filter), bleeder resistor, voltage multipliers .Regulated power supplies (series and shunt voltage regulators, fixed and adjustable voltage regulators, current regulator), switched regulator (SMPS), comparison of linear and switched power supply, switch mode converter (flyback, buck, boost, buk-boost, cuk converters).

Unit-II

Silicon controlled rectifies (SCR), constructional features, principle of operation, SCR terminology, turn-onmethods, turn-off methods, triggering methods of SCR circuits, types of commutation, comparison ofthyristors and transistors, thermal characteristics of SCR, causes of damage to SCR, SCR overvoltageprotection circuit, Line commutated converters (half wave rectifier withinductive and resistive load, single phase and three phase full wave rectifiers).

Unit-III

Other members of SCR family Triacs, Diacs, Quadracs, recovery characteristics, fast recovery diodes, power diodes, power transistor, power MOSFET, Insulated gate bipolar transistor (IGBT), loss of power in semiconductor devices, comparison between power MOSFET, power transistor and power IGBT.

Unit-IV

Applications of OP-AMP Basics of OP-AMP, relaxation oscillator, window comparator, Opcomp as rectangular to triangular pulse converter and vice- versa, Wien bridge oscillator, function generator, frequency response of OP-AMP, simplified circuit diagram of OP-AMP, power supplies using OP-AMP, filters (low-pass, high pass) using OP-AMP

Unit-V

Programmable Logic Controller (PLC)Functions, applications, advantages and disadvantages of PLC over conventional relay controllers, comparison of PLC with process control computer system, factors to be considered in selecting PLC, functional block diagram of PLC, microprocessor in PLC, memory, input and output modules (interface cards), sequence of operations in a PLC, status of PLC, event driven device, ladder logic language, simple process control applications of PLC, Programming examples..

REFERENCE BOOKS

1. Bishwanath Paul: Industrial Electronics and control, PHI Learning.
2. Rashid: Power Electronics- Circuits, devices and applications, Pearson Education.
3. Singh and Khanchandani: Power Electronics, TMH
4. Bhimbra: Power Electronics, Khanna Publishers.
5. Moorthi: Power Electronics, Oxford University Press.
6. Webb: Programmable Logic Controllers- Principles and Applications, PHI Learning.

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Electrical Engineering, V-Semester Open Elective

EE- 504 (D) Innovation and Entrepreneurship

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Electrical Engineering, V-Semester

EE506 MATLAB

MATLAB

Basic simulation Mechanism and Simulation Tools, Starting and Ending MATLAB, MATLAB Desktop, Help Browser, Types of Files, Command Input Assistance, Operators and Special Characters, Variables and Arrays, Handling Arrays, Useful Built-in Functions, Control Structures, Input/Output Commands, File Handling

Introduction to Plotting

The plot command, Formatting and Labeling a Plot, Multiple Plots, Adding Legend, Sub Plots, Plotting Complex Data, 2-D and 3-D Plots, Plotting a Function, Plot Editor, Interactive Plotting using Plotting Tool

Programming in MATLAB

MATLAB Editor, MATLAB Programming, Debugging MATLAB Programs, MATLAB Debugger, Functions and Function Files, Differential Equation Solver, Symbolic Mathematics, Programming Examples

Basic Electrical and Networks Applications

Analysis of Electrical Networks – Experiments based on Solution of Series-Parallel Circuits, Solution of system with linear equations - Experiments based on mesh and nodal analysis, Experiments for Validation of Network Theorems, Solution of Network Problems.

REFERENCE BOOKS

1. “Modelling And Simulation Using Matlab- Simulink”,2011Dr Shailendra Jain, Willey India.

2. “MatlabProgramming”,Rudra prasad.

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Electrical Engineering, VI-Semester
EE-601 Electrical Machine Design

Unit-I Fundamental Aspects of Electrical Machine Design

Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration.

Unit-II Design of DC Machines

Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings.

Unit-III Design of Transformers

Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes.

Unit-IV Design of Three Phase Induction Motors

Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance.

Unit-V Design of Three Phase Synchronous Machines and Computer aided Design (CAD):

Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding.

OUTCOMES:

Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.

M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

References:-

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

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Electrical Engineering, VI-Semester

EE-602 Power System-II

Unit-I Power Flow Analysis

Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton- Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems

Unit-II Stability Constraints in synchronous grids

Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three-- phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge- Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

Unit-III Control of Frequency and Voltage

Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters.

Unit-IV Monitoring and Control

Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control.

Unit-V Power System Economics and Management

Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Electrical Power Systems, Subir Ray, PHI
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. A text book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S. Bhatnagar & A. Chakrabarti, Dhanpat Rai & CO.

Reference Books:

1. Protection & Switchgear, B. Bhalja, R.P. Maheshwari, N.G.Chothani, Oxford.
2. Power system protection & switchgear, B.Ram & D.N. Vishwakarma, Tata McGraw Hill.
3. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press
4. Electric Power Transmission and Distribution, S. Sivanagaraju, S.Satyanarayana, Pearson Education.
5. Power Systems Stability, Vol. I,II & II, E.W. Kimbark, Wiley.
6. Power Engineering, D.P Kothari & I.J. Nagrath, Tata McGraw Hill.
7. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education. 8. Computer Aided Power systems
analysis, Dr. G. Kusic, CEC press.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester

EE-603: Wind and Solar Energy

Unit 1: Physics of Wind Power:

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit 2: Wind generator topologies:

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Unit 3: The Solar Resource

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Unit 4: Solar photovoltaic:

Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit 5: Network Integration Issues and Solar thermal power generation:

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems. Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Text / References:

1. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005.
2. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.
3. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.
4. H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” John Wiley and
Sons Ltd., 2006.
5. G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester Departmental Elective

EE-604(A) Power System Protection

Unit-I: Introduction and Components of a Protection System

Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers

Unit-II: Faults and Over-Current Protection

Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay coordination.

Unit-III: Equipment Protection Scheme

Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.

Unit-IV: Digital Protection

Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

Unit-V: Modeling and Simulation of Protection Schemes and System Protection

CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing. Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area
Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text/References:-

1. J. L. Blackburn, “Protective Relaying: Principles and Applications”, Marcel Dekker, New York, 1987.
2. Y. G.Paithankar and S. R. Bhide, “Fundamentals of power system protection”, Prentice Hall, India, 2010.
3. A. G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, John Wiley & Sons, 1988.
4. A. G. Phadke and J. S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer, 2008.
5. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis, 2006.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester

Open Elective EE-604(B) Energy Conservation and Management

Course Outcomes: Upon completion of this course, the students will be able:-

 To perform of energy auditing for the energy consumption of industries.

Unit-I

Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing.

Unit-II

Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.

Unit-III

Thermal systems, Boilers, Furnaces and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories.

Unit-IV

Energy conservation in major utilities; pumps, fans, blowers, compressed air systems, Refrigeration& Air
Conditioning systems, Cooling Towers, DG sets.

Unit-V

Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.

Text Books:

1. Witte L.C. , Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington, 1988.
2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.
3. Murphy W.R. and McKay G., Energy Management, Butterworths, London, 1987.
4. Energy Manager Training Manual , Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004 (available at www.energymanager training.com).

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering VI-Semester

EE- 603 (C) Digital signal Processing

Unit – I: Discrete-Time Signals and Systems

Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

UNIT –II: z-Transform

The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z transform, analysis of linear time-invariant systems in the z- domain, block diagrams and signal flow graph representation of digital network, matrix representation.

Unit – III: Frequency Analysis of Discrete Time Signals

Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

Unit – IV: Efficient Computation of the DFT

FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for 'N'composite number.

Unit – V: Digital filters Design Techniques

Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques rectangular and other windows, examples of FIR filters, design using windowing.

References:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.
2. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI Learning.
3. Proakis: Digital Signal Processing, Pearson Education.
4. Rabiner and Gold: Theory and Application of Digital Signal Processing, PHI Learning.
5. Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.

List of Experiments:

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
7. Computation and plots of linear/circular convolution of two sequences.
8. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of **v**arious window design techniques (Rectangular, Bartlett, Hann, Hamming etc).

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electronics & Communication Engineering V-Semester Departmental Elective
EC501 MICROPROCESSOR AND INTERFACING

UNIT I Salient features of advanced microprocessors. RISC & CISC processors. Review and evolution of advanced microprocessors: 8086, 8088, 80186 introduction to 8086 processor: Register organization of 8086, Architecture, signal description of 8086, minimum mode 8086 systems and timings and maximum mode 8086 systems and timings , Knowledge on iCore processors.

UNIT II Intel 8086 microprocessor programming: 8086 Instruction Set, Addressing modes, Assembly Language Programming with Intel 8086 microprocessor

UNIT III Introduction to the various interfacings chips like, 8255, Interfacings key boards, LEDs , ADC, DAC and memory Interfacing.

UNIT IV General purposes programmable peripheral devices: Timer (8253/8254), 8259A programmable interrupt controller & 8257 DMA controller, USART, serial I/O & data Communication. Interfacing Programs for chips

UNIT V Introduction to 8bit and 16 bit microcontrollers and embedded systems, 8051 architecture, pin description , I/O configuration , interrupts, addressing modes instruction set, use of microcontrollers in automation.

Reference Books:

1. Advance microprocessor and peripheral –A.K. Ray and K. M. Bhurchandi, Tata Mcgraw Hill
2. Microprocessor and Interfacing – D.V.Hall, McGraw Hill.
3. The Intel microprocessor - Barry B. Brey, Pearson
4. The 8086 & 8088 Microprocessor- LIU and Gibson, Tata McGraw Hill
5. The 8051 microcontroller and embedded systems-M.A. Mazidi, Janice GillispieMazidi, Pearson Prentice Hall

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester Open Elective

EE-605(B) Power Plant Engineering

Unit-I

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

Unit-II

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Unit-III

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Unit-IV

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

Unit-V

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester

Departmental Elective EE-603(C) Digital Signal Processing

Course Outcomes: At the end of this course, students will demonstrate the ability to:-

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Analyse discrete-time systems using z-transform.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Module 1: Discrete-time signals and systems

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; epresentation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Module 2: Z-transform

z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of ztransform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Module 2: Discrete Fourier Transform

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

Module 3:Designof Digital filters

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

Module 4: Applications of Digital Signal Processing

Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Text/Reference Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications",
Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester

Open Elective EE-605(C) Analog and Digital Communication

Course Outcomes:- Upon successful completion of this course the students will have developed following skills/abilities:

- Interpret, represent and process discrete/digital signals and systems.
- Thorough understanding of frequency domain analysis of discrete time signals.
- Ability to design & analyze DSP systems like FIR and IIR Filter etc.
- Practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
- Understanding of spectral analysis of the signals

Unit-I

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Unit-II

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation.

Unit-III

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Unit-IV

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

Unit-V

Digital Modulation trade-offs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Text/Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers,
2004.

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New Scheme of Examination as per AICTE Flexible Curricula

Electrical Engineering, VI-Semester

EE-608 Minor Project-II

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Project-I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under Project-I;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee