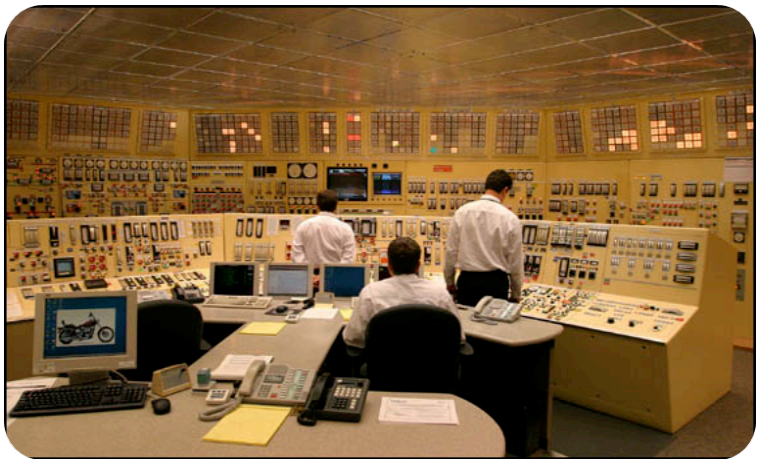
Nuclear Power Stations Engineering

GRADUATION REQUIREMENTS

In the Nuclear power stations Engineering Department, Students must complete a minimum of 187 credits satisfactorily. In addition to the common 14-credit required by the university and the common 34-credit required by the college of engineering, the Department of Nuclear power stations requires the following 139-credits



Nuclear Power Stations Engineering

INTRODUCTION

The department of Nuclear Power Station engineering will cover the necessity of generating electric power by using available solar, wind, and hydraulic energy source. The study will cover many particular problems, requirements, and safety needed in the application of renewable energy engineering field. Environmental requirements made renewable energy sources a best solution for regions where renewable energy is available. Courses are tailored to suit the Middle East zone. Renewable energy engineering department will introduce a modern engineer to the sector of energy generation.

VISION

The Nuclear Power Station Engineering Department aims to be one of the leading higher education institutes on national, regional, and international levels. Modern trends in engineering disciplines are intended to be transferred through cooperation with well-known universities in general and Russian partners in special.

MISSION

The mission of the department of Nuclear Power Station Engineering stems from the mission of the Faculty of Engineering of the Egyptian Russian University (ERU). The particular mission of this department is to educate and graduate engineers wishing to pursue a career in the field of Nuclear Power Station Engineering. The program enables student to develop a thorough understanding of energy generation engineering principles, while at the same time developing expertise that is required for Nuclear Power Station. Nuclear Power Station Engineering provides students with a broad education designed to give them skills necessary to become professional engineers. The program courses include the basic and applied courses of mechanical engineering and the specialized courses that related to the field of the Renewable Energy Engineering, such as technology, performance, dynamics, control, etc.....

EDUCATIONAL OBJECTIVES

1. Good preparing to graduates in both basic and applied knowledge that related to the field of Renewable Energy engineering.
2. Preparing graduates to use the traditional and modern tools and equipment.
3. Preparing graduates to use computer aided design software that can be used in design and analyze behavior the components involved.
4. Enhancing graduates skills through training courses and workshops.
5. Preparing graduates able to self-motivated, self-learning, and critical thinkers to match the continuous technical developments.

6. Preparing capable graduates for diploma, master and PhD degree programs.

NUCLEAR POWER STATIONS ENGINEERING PROGRAM

Code	Course Title	CR	LT	TU	LB	CT	Code	Course Title	CR	LT	TU	LB	CT
Preparatory	**Semester 1**							**Semester 2**					
BS001	Mathematics 1	3	2	2	-	4	BS002	Mathematics 2	3	2	2	-	4
BS003	Physics 1	3	2	1	1	4	BS004	Physics 2	3	2	1	1	4
BS005	Chemistry	3	2	1	1	4	BS008	Engineering Mechanics 2	3	2	2	-	4
BS007	Engineering Mechanics 1	3	2	2	-	4	BS010	Engineering Drawing 2	2	1	2	-	3
BS009	Engineering Drawing 1	2	1	2	-	3	HM002	Russian Language 2	2	1	2	-	3
HM006	Introduction to Engineering	2	2	–	–	2	HM004	English Language 2	2	1	2	-	3
HM001	Russian Language 1	1	-	2	-	2	BS006	Computer Aided Drawing	1	-	-	2	2
HM003	English Language 1	1	–	2	-	2	ME002	Production Technology	2	1	1	1	3
Total		**18**	**11**	**12**	**2**	**25**	**Total**		**18**	**10**	**12**	**4**	26
Freshman	**Semester 3**							**Semester 4**					
BS101	Mathematics 3	3	2	2	-	4	BS102	Mathematics 4	3	2	2	-	4
BS103N	Physics 3 (NE)	3	2	1	2	5	ME102	Fluid Mechanics	3	2	2	1	5
BS105N	Computer Applications in Engineering	2	1	-	2	3	NE308	Nuclear & Neutron Physics	3	2	2	-	4
EE109	Fundamentals of Electrical & Mechanical Engineering	3	2	2	1	5	EE110	Electrical Equipment & Electronics	4	2	2	2	6
HM101	Technical Writing	2	2	-	-	2	EE112	Metrology	2	1	–	3	4
ME105	Mechanical Eng. Drawing	2	1	–	3	4	HM102	Scientific Thinking	2	2	-	-	2
ME107	Engineering Materials	3	2	-	2	4							
Total		**18**	**12**	**5**	**10**	**27**	**Total**		**17**	**11**	**8**	**6**	24
Sophomore	**Semester 5**							**Semester 6**					
BS203	Numerical Analysis	3	2	2	-	4	ME305N	Pollution Control	2	2	–	-	2
EE213	Engineering Measurements	3	2	2	1	5	CE307	Engineering Hydrology	3	2	2	1	5
HM202	Engineering Economics and Managements	2	2	1	-	3	BS104N	Discrete Mathematics	3	3	2	-	5
ME101	Thermodynamics	3	2	2	1	5	BS108N	Numerical Modeling of Physical Processes	4	2	4	–	6
ME111	Mechanics & Strength of Material	3	2	2	1	5	NE202	Information & Technology Network In NPS	2	2	1	-	3
BS108	Probability and Statistics in Engineering	2	2	1	-	4	RE204	Physical Basics of Using Renewable Sources of Energy Sources	3	1	2	2	5
Total		**16**	**12**	**10**	**3**	**26**	**Total**		**17**	**12**	**11**	**3**	26
Junior	**Semester 7**							**Semester 8**					
BS301	Mechanics 3	3	2	2	-	4	BS302	Methods of Solving Engineering Problems	2	1	2	-	3
BS303	Physics of Nuclear Reactors	3	2	-	3	5	BS304	Physical Chemical Processes in NPS	3	2	-	2	4
ME313	Technical Thermodynamics	3	2	2	-	4	NE302	Nuclear power stations NPS II	4	2	2	2	6
ME315	Materials Technology	3	2	2	-	4	NE304	Principles of Providing Safety of NPS	3	2	2	-	4
NE	Elective	3	2	2	-	4	NE306	Automated Control Systems for NPS	3	2	2	-	4
NE301	Nuclear power stations NPS I	4	2	2	2	6	BS401	Physics of Neutron Reactor	2	2	1	-	3
Total		**19**	**12**	**10**	**5**	**27**	**Total**		**17**	**11**	**9**	**4**	24
Senior	**Semester 9**							**Semester 10**					
NE204	Kinematic Nuclear Reactor	3	2	2	-	4	HM	Elective	2	2	-	-	2
NE	Elective	3	2	2	-	4	NE402	Nuclear Energy Reactors	3	2	2	-	4
NE401	Water Preparation for NPS	1	1	-	1	2	NE404	Turbo-Machineries of Nuclear Power Stations	3	2	2	-	4
NE403	Theory of Neutron Activity	3	2	2	-	4	NE406	Integrated Applied systems	3	2	2	-	4
NE405	Steam Generators of NPS	3	2	2	-	4	NE408	Protection against Atomic	2	1	-	1	2

								Radiation					
NE407	Heat Transfer in Energy Equipment of Nuclear Power stations	4	2	2	2	6	NE410	Economics of Nuclear Energy	3	2	2	-	4
Total		**17**	**11**	**10**	**3**	**24**	**Total**		**16**	**11**	**8**	**1**	20
Senior	**Semester 11**												
HM	Elective	2	2	-	-	2							
NE	Elective	3	2	2	-	4							
NE490	Senior Seminar	2	1	2	-	3							
NE499	Graduation Project	6	4	2	4	10							
Total		13	9	6	4	19							

NUCLEAR POWER STATIONSENGINEERING DEPARTMENT COURSE

1. COMPULSORY COURSES (130 CREDITS):

Course Code	Course Title	Credit Hours	Prerequisite
BS101	Mathematics 3	3	BS001
BS102	Mathematics 4	3	BS101
BS103N	Physics 3 (NE)	3	Cr. Hr. 20
BS203	Numerical Analysis (NE)	3	BS002
BS105N	Computer Applications in Engineering	2	BS006
BS108N	Numerical modeling of the physical Processes	4	BS203
BS104N	Discrete Mathematics	3	BS101
BS301	Mechanics 3	3	BS008
BS302	Methods of Solving Engineering Problems	2	BS101
BS303	Physics of Nuclear Reactors	3	NE308
BS304	Physical Chemical Processes in NPS	3	BS104N, BS303
BS401	Physics of Neutron Reactors	2	BS303
CE307	Engineering Hydrology	3	ME102
EE112	Metrology	2	Cr. Hr. 20
EE109	Fundamentals of Electrical & Mechanical Engineering	3	BS004
EE110	Electrical Equipment & Electronics	4	EE109
EE213	Engineering Measurements	3	EE110
ME101	Thermodynamics	3	BS003
ME102	Fluid Mechanics	3	BS003
ME107	Engineering Materials	2	Cr. Hr. 20
ME105	Mechanical Engineering Drawing	2	BS006,BS010
ME111	Mechanics & Strength of Materials	3	-
ME305N	Pollution Control	2	-
ME313	Technical Thermodynamics	3	ME101
ME315	Materials Technology	3	ME107
NE202	Information & Technology Network of NPS	2	Cr. Hr. 75
NE204	Kinematic Nuclear Reactor	3	BS303
NE301	Nuclear power stations NPS I	4	80 Cr. Hr.
NE302	Nuclear power stations NPS II	4	120CR.HR, NE301
NE304	Principles of Providing Safety of NPS	3	NE301
NE306	Automated control Systems for NPS	3	NE301
NE308	Nuclear & Neutron Physics	3	BS103N
NE401	Water Preparation for NPS	1	ME102

Nuclear Power Stations Engineering

NE402	Nuclear Energy Reactors	3	120 CR. HR
NE403	Theory of Neutron Activity	3	BS401
NE404	Turbo Machineries of Nuclear power stations	3	NE302
NE405	Steam Generators of NPS	3	ME313
NE406	Integrated Applied Systems	3	120 CR. HR
NE407	Heat Transfer in Energy Equipment of Nuclear power stations	4	ME313
NE408	Protection against Atomic Radiation	2	NE308
NE410	Economics of Nuclear Energy	3	100 CR. HR.
NE490	Senior Seminar	2	120 CR. HR
NE499	Graduation Project	6	130 CR. HR
RE204	Physical Basics of using renewable sources of Energy Sources	3	-

2. Elective Courses (9 Credits)

Prerequisite: senior standing

Students at the senior standing must complete 9 credits from the following electives:

Course Code	Course Title	Credit Hours	Prerequisite
NE440	Nuclear Power Stations	3	NE302
NE441	Safety Provision Principles at Nuclear Power Stations	3	NE304
NE442	Selected Topics in Electro-Power Stations	3	EE110
NE443	Maintenance of Nuclear Power Stations	3	NE302

NUCLEAR POWER STATIONS ENGINEERING PROGRAM
FRESHMAN

- **Semester 3**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS101	Mathematics 3	3	2	2	-	4
BS103N	Physics 3 (NE)	3	2	1	2	5
BS105N	Computer Applications in Engineering	2	1	-	2	3
EE109	Fundamentals of Electrical & Mechanical Engineering	3	2	2	1	5
HM101	Technical Writing	2	2	-	-	2
ME105	Mechanical Eng. Drawing	2	1	-	3	4
ME104	Engineering Materials	2	2	–	2	4
Total		**18**	**12**	**5**	**10**	**27**

Nuclear Power Stations Engineering

- **Semester 4**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours

BS102	Mathematics 4	3	2	2	-	4
ME102	Fluid Mechanics	3	2	2	1	5
NE308	Nuclear & Neutron Physics	3	2	2	-	4
EE110	Electrical Equipment & Electronics	4	2	2	2	6
EE112	Metrology	2	1	-	3	4
HM102	Scientific Thinking	2	2	-	-	2
Total		**17**	**11**	**6**	**6**	**25**

NUCLEAR POWER STATIONS ENGINEERING PROGRAM
SOPHOMORE

- **Semester 5**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS203	Numerical Analysis	3	2	2	-	4
EE213	Engineering Measurements	3	2	2	1	5
HM202	Engineering Economics and Managements	2	2	1	-	3
ME101	Thermodynamics	3	2	2	1	5
ME111	Mechanics & Strength of Material	3	2	2	1	5
BS108	Probability & Statistics in Engineering	2	2	1	-	3
Total		**16**	**12**	**10**	**3**	**25**

- **Semester 6**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
ME305N	Pollution Control	2	2	-	-	2
CE307	Engineering Hydrology	3	2	2	1	5
BS104N	Discrete Mathematics	3	3	2	-	5
BS108N	Numerical Modeling of Physical Processes	4	2	4	-	6
NE202	Information & Technology Network In NPS	2	2	1	-	3
RE204	Physical Basics of Using Renewable Sources of Energy Sources	3	1	2	2	5
Total		**17**	**12**	**11**	**3**	**26**

NUCLEAR POWER STATIONS ENGINEERING PROGRAM
JUNIOR

- **Semester 7**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS301	Mechanics 3	3	2	2	-	4
BS303	Physics of Nuclear Reactors	3	2	-	3	5
ME313	Technical Thermodynamics	3	2	2	-	4
ME315	Materials Technology	3	2	2	-	4
NE	Elective	3	2	2	-	4
NE301	Nuclear power stations NPS I	4	2	2	2	6
Total		**19**	**12**	**10**	**5**	**27**

- **Semester 8**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS302	Methods of Solving Engineering Problems	2	1	2	-	3
BS304	Physical Chemical Processes in NPS	3	2	-	2	4
NE302	Nuclear power stations NPS II	4	2	2	2	6
NE304	Principles of Providing Safety of NPS	3	2	2	-	4
NE306	Automated Control Systems for NPS	3	2	2	-	4
BS401	Physics of Neutron Reactors	2	2	1	-	3
Total		**17**	**11**	**9**	**4**	**24**

NUCLEAR POWER STATIONS ENGINEERING PROGRAM
SENIOR

- **Semester 9**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
NE204	Kinematic Nuclear Reactor	3	2	2	-	4
NE	Elective	3	2	2	-	4
NE401	Water Preparation for NPS	1	1	-	1	2
NE403	Theory of Neutron Activity	3	2	2	-	4
NE405	Steam Generators of NPS	3	2	2	-	4
NE407	Heat Transfer in Energy Equipment of Nuclear Power stations	4	2	2	2	6

Total		17	11	10	3	24

- **Semester 10**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
HM	Elective	2	2	-	-	2
NE402	Nuclear Energy Reactors	3	2	2	-	4
NE404	Turbo-Machineries of Nuclear Power Stations	3	2	2	-	4
NE406	Integrated Applied systems	3	2	2	-	4
NE408	Protection against Atomic Radiation	2	1	-	1	2
NE410	Economics of Nuclear Energy	3	2	2	-	4
Total		**16**	**11**	**8**	**1**	**20**

- **Semester 11**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
HM	Elective	2	2	-	-	2
NE	Elective	3	2	2	-	4
NE490	Senior Seminar	2	1	2	-	3
NE499	Graduation Project	6	4	2	4	10
Total		**13**	**9**	**6**	**4**	**19**

NUCLEAR POWER STATIONS ENGINEERING COURSE DESCRIPTION

1. MATHEMATICS 3

Code	Credit Hours	LT	TU	LB	Prerequisites
BS101	3	2	2	-	BS001

Ordinary different equations of the first order separable homogenous, exact and linear – Bernoulli - higher order linear equations - operator D - Initial value problem - vibrations: Transient and steady state solutions - Resonance - Laplace transform - Basic properties - Shift theorems - Dirac delta - Sign-functions - Solving differential equations by using Laplace Fourier series - Expansion for a general period - Sine and cosine half range expansions - Fourier complex exponential series - Fourier Integral - Fourier Transformations.

2. MATHEMATICS 4

Code	Credit Hours	LT	TU	LB	Prerequisites
BS102	3	2	2	-	BS101

Vector functions - Velocity and acceleration - The directional derivative and the gradient - Vector and scalar fields - Work and line integral - Flux of vector and the divergence theorem - Curl of a vector and Stokes' theorem – Polar, Cylindrical and spherical coordinates function of a complex variable – Exponential, Logarithmic, Trigonometric and hyperbolic - Analyticity: Cauchy-Riemann equations, harmonic functions - Contour integrals – Cauchy – Goursat theorem - Independence of path - Zero and poles - Residue theorem - conformal mapping - Joukovsky transformation.

3. PHYSICS (3) (NE)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS103	3	2	1	2	-

Elements of solid physics - types of conjunction of structural fractions - crystal state - wave function of electrons in solids - electron zonal theory of solids - doping states - electrons and holes in zones - thermal capacity - contact of heterogeneous materials - quantum-dimension structures - kinematic appearances in solids - proper and doping conductivity - temperature dependence of conductivity - superconductivity - nonlinear appearances - thermo-electric and thermo-magnetic effects.

4. NUMERICAL ANALYSIS(NE)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS104	3	2	2	-	BS102

Numerical solution of linear systems - numerical solution of nonlinear equations – interpolation - numerical integration and differentiation - curve fitting-optimization -numerical solution of ordinary and partial differential equations - Probability and statistics - discrete and continuous random variables - frequency tables - deviation measures - data analysis - optimization techniques.

5. COMPUTER APPLICATIONS IN ENGINEERING

Code	Credit Hours	LT	TU	LB	Prerequisites
BS105	2	1	-	2	-

Introduction to software programming: the concept of programming, difference between application programs and programming languages. Types of programming languages: Machine language, Assembly language, High level language. Principles of MATLAB programming language: Starting with MATLAB. Creating arrays. Mathematical operations with arrays. Using script and managing Data. Two-Dimensional plots. User-defined functions and function files. Programming in MATLAB. Polynomials, Curve fitting and interpolation. Application in numerical analysis.

6. Numerical Modeling of Physical Processes

Code	Credit Hours	LT	TU	LB	Prerequisites
BS110	4	2	4	-	-

Errors, their sources and classification; methods for solving the systems of algebraic equations; direct methods, iteration methods, variational methods, methods of function minimization; solution of non-linear equations and systems; function approximation; processing of experimental data; numerical integration; optimal quadratures; linear integral equations; Cauchy problem and methods for solving it; boundary problems for ordinary differential equations; variation-differential methods for ordinary differential equations of second order; stationary boundary problems for equations in partial derivatives; starting-boundary problems.

7. Discrete Mathematics

Code	Credit Hours	LT	TU	LB	Prerequisites
BS112	3	3	2	-	-

Sets and operations - Accordance and mapping - Definition of functions on finite sets - N-point relations - Binary relations and their characteristics - Functions of logic algebra. Characteristics of elementary functions - Duality principle - Dissipation of boolean functions by variables - Absolute disjunction normal form - Completeness and restraint - Logics of predicates - Turing machines - Graphs, apexes, heels, arches - Matrix of graph - Routes, chains, cycles - Eyler

graphs - Base of independent cycles - Cyclematic figure of graph - Trees - Optimal trees, minimal ties - Dicotyledonous graphs - Task about maximal couplecombination - Finite automations - Isomorpgism and equivalence of finite automations - Basic problems of abstract theory of automations - Recognition of sets by automations - Synthesis of automations - Conjunction of finite automations with theory of algorithms.

8. Mechanics 3

Code	Credit Hours	LT	TU	LB	Prerequisites
BS301	3	2	2	-	BS008

Displacement and deflections. Statically indeterminate structures, energy methods applied to bar problems. Buckling of columns, curved beams, stresses in composites, analysis of bars of thin walled sections in shear, transverse shear, torsion, shear center. Analysis of axisymmetric shells: thin walled cylinders, spheres, cones, discontinuity stresses. Introduction to structural analysis by matrix methods. Stresses in elastic structures with applications.

9. Methods of Solving Engineering Problems

Code	Credit Hours	LT	TU	LB	Prerequisites
BS302	2	1	2	-	BS108,BS102

Research organization; types of tests; experiment planning; experimental data statistical treatment; automated data-measuring systems.

10. Physics of Nuclear Reactors

Code	Credit Hours	LT	TU	LB	Prerequisites
BS303	3	2	-	3	NE204

Physical classification of reactors; coefficient of neutron cloning; lattice theory; theory of critical dimensions; neutron-physical features and computation of power reactors; neutron-physical computations on computer; classification of experiments; interconnection of computational and experimental investigations; neutron-physical features characteristics defined experimentally on reactors.

11. Physical Chemical Processes in NPS

Code	Credit Hours	LT	TU	LB	Prerequisites
BS304	3	2	-	2	BS104,BS303

Physical chemical fundamentals of properties of water and water solutions - at normal and increased state parameters; principles of the theory of natural water treatment for the purpose of

obtaining process contour make-up water; general characteristics of physical chemical processes and modes at heat-and power equipment maintenance of NPS with reactors.

12. Physics of Neutron Reactors

Code	Credit Hours	LT	TU	LB	Prerequisites
BS401	2	2	1	-	BS303

Experiments on reactor operation, flux measurement, measurements of reactor parameters, using pool type reactor.

13. Engineering Hydrology

Code	Credit Hours	LT	TU	LB	Prerequisites
CE307	3	2	2	1	ME102

Hydrological cycle and the atmosphere – Effect of temperature, moisture, wind, solar radiation and earth rotation on the hydrological cycle – Rain Studies: Types, intensity, repetition, measurement methods and equipment. Soil infiltration studies: measurement methods, Evaporation and Evapotranspiration - measurement and calculation methods – Hydrographic measurements: properties and analysis of hydrographs – types of storms – relationship between rain and storms – water balance equation – storage.

14. Fundamentals of Electrical and Mechanical Engineering

Code	Credit Hours	LT	TU	LB	Prerequisites
EE113	3	2	2	1	BS004

Electric field – Magnetic field – Electric circuits – Elements of electric circuits – Source of electric voltage – Electric current sources – Element of resistances – Capacitors and Induction coils – Methods of analysis for continuous current circuits – Node analysis – Method of superposition – Circuits theories – Sine concept – Applications on theory of oscillating. Current electric circuits.

Fundamentals of conduction, convection and radiation. Energy transfer with engineering applications in building. Thermal comfort cooling and heating loads. Industrial ventilation inn buildings. Air conditioning types. Suitability of conditioning systems in architectural conditions.

15. Electrical Equipment & Electronics

Code	Credit Hours	LT	TU	LB	Prerequisites
EE114	4	2	2	2	EE113

Network theorems; circuit laws; resistance, capacitance, inductance, response of RC, RL and RLC circuits to initial conditions and constant forcing functions. AC steady-state analysis and AC power. Integration of computer applications using SPICE. Rectifier diodes and applications: Zener diodes and applications; biasing BJT and FET amplifiers; small signal analysis of BJT and FET amplifiers; power amplifiers; amplifier frequency response.

16. METROLOGY

Code	Credit Hours	LT	TU	LB	Prerequisites
EE112	2	1	-	3	-

This course covers the principals of metrology and the relationship of precise measurement to design practice and production processes. It also covers the use of various measuring devices. Laboratory exercises focus on applications of various measuring devices.

17. ENGINEERING MEASUREMENTS

Code	Credit Hours	LT	TU	LB	Prerequisites
EE209	3	2	2	1	-

What is measurement, Units and dimensions, Measuring system components, DC Bridge as signal conditioning circuit.

- Transducers, advantages of using transducers, characteristics of transducers (Sensitivity, Accuracy, Precession, Resolution, Response time, Linearity, Declivity…).

Measurement of temperature (Thermocouples, RTD, Thermistors, Diode Temperature Detector…), strain gauges (one, two, four element bridge), sound transducers (Different types of microphones), lux meter. Flow transducers, liquid level transducers, humidity, transducers, speed transducers, Pressure Transducers.

-Operational amplifier as signal conditioning circuit. Application on displacement transducers.

-Oscilloscope parts, modes of operation, probes, applications, digital oscilloscope.

-Digital counters parts (oscillator frequency, divider, gates, DCU).Applications (time, measurements, frequency, two frequency comparison, and clock mode).

-Experimental Part: Measuring electrical and mechanical values, calibrating some measuring devices. Measuring using Oscilloscope and digital counters.

18. THERMODYNAMICS

Code	Credit Hours	LT	TU	LB	Prerequisites
ME101	3	2	2	1	BS004

Introduction and basic concepts of Thermodynamics. Energy, Energy transfer and general energy analysis. Properties of pure substances. Energy analysis of closed systems. Mass and energy analysis of control volumes. The second law of thermodynamics. Entropy. Air standard cycles, properties gas-vapor mixture.

-Experimental Part: Application of the first law of thermodynamics on air conditioner, heat pump, refrigeration unit, internal combustion engine and pump, dry and met bulb temperature, Relative humidity.

-Mini projects: Parametric study on air standard power cycle using computer.

19. Fluid Mechanics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME102	3	2	2	1	BS004

kinematics – Bernoulli's equation – Principal equations for mass continuity, energy conservation and momentum – Applications – Dimensional analysis and similarity – Laminar and turbulent flows – Reynolds number – Laminar flow cases – Steady flow in pipelines – Friction coefficient and losses – Minor losses – Methods of nets connection.

-Experiments cover hydrostatic, energy equipment, impact of a jet and minor and major losses.

20. Engineering Materials

Code	Credit Hours	LT	TU	LB	Prerequisites
ME104	2	2	2	-	-

Elements of atomic structure and bonding – Crystal structure – Solidification –Phase diagrams – Alloy Properties – Classification use and selection of common alloys – TTT diagrams – Heat treatment – Polymeric materials – Materials testing, tension, bending, shear, hardness.

21. Mechanical Engineering Drawing

Code	Credit Hours	LT	TU	LB	Prerequisites
ME105	2	1	-	4	BS006,BS010

Working drawing, Surface finish symbols, Fits and tolerances, Standard tables. Material codes, Threads (types, specs), Joints, Bolts and Nuts. Springs (types, specs), Keys, Rivets, Welds, Gears. Mechanical drawing with computer graphic.

22. Mechanics and Strength of Materials I

Code	Credit Hours	LT	TU	LB	Prerequisites
ME111	3	2	2	1	-

Mechanics of Rigid bodies –translation and rotation- motion on curves- rotation without sliding- motion on a plan- center of mass- moment of inertia -free and forced vibrations – work, energy and low of conservation- impulsive motion.

Stresses and Strains. Testing machines and strain gages. Engineering material behavior under tension, compression and cold bending. Direct and transverse shear. Torsion. Fatigue. Hardness. Toughness and impact stresses.

Experimental part: Mechanical tests. Static tests: Tension, compression, shear, bending, torsion, hardness. Dynamic tests: Fatigue, impact.

23. Pollution Control

Code	Credit Hours	LT	TU	LB	Prerequisites
ME203	2	2	-	-	-

Introduction to pollution and its effect on human health – Sources of pollution - Clean air requirements – Pollution formation (NOx, CO, CO2, HC, and particulates….etc) – Exhaust gas treatment – Acoustic pollutions – Vibration – New fuels and pollution – Legislation- industrial plants, rivers, channels and soil.

24. Technical Thermodynamics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME313	3	2	2	-	ME101

Basic equations and thermodynamics laws. Thermodynamic equilibrium, liquid-steam systems, properties of real gases, stream thermodynamics. Cycles of steam-power and gas turbine units, coefficient of efficiency.

25. Materials Technology

Code	Credit Hours	LT	TU	LB	Prerequisites
ME315	3	2	2	-	ME107

An introduction to Materials Engineering Technology emphasizing relationships between structure and properties of engineering materials.

26. Information & Technology Network of NPS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE202	2	2	1	-	-

Description: Symbolic and object-oriented modeling, product and process modeling for design and manufacturing, information models for computer integrated and collaborative engineering, information modeling for life-cycle engineering.

27. Kinematics Nuclear Reactor

Code	Credit Hours	LT	TU	LB	Prerequisites
NE204	3	2	2	-	BS103

Introduction - Principles pf nuclear engineering - Generation, transport and transfer of energy in the nuclear reactor core - Nuclear power plants - Pressurized water reactors (PWR), Boiling water reactors (BWR) and Gas-cooled reactors (GCR) - Fast breeder reactors (FBR) - The future of nuclear fusion - Reactors safety - Power plant site selection.

28. Nuclear power Stations NPS I

Code	Credit Hours	LT	TU	LB	Prerequisites
NE301	4	2	2	1	-

Situation and development of nuclear engineering; types of NPS and their main machinery; selection of parameters, heat economy of NPS; regeneration on NPS; units of conductive contour; technical water supply; steam generator units; turbine units; internal and intermediate separation; evaporation units and schemes of their inclusion into NPS heating scheme.

29. Nuclear power Stations NPSII

Code	Credit Hours	LT	TU	LB	Prerequisites
NE302	4	2	2	2	120CR.HR,NE301

Reactor units; main reactor contour and its supplementary systems; issues of reliability and safety of NPS; pipelines and reinforcement for NPS; water-chemical modes; activation and deactivation at NPS; radioactive wastes at NPS and their entombment; ventilation units at NPS; general plan and components of NPS; operation of NPS in power system; organization of performance and maintenance.

30. Principles of Providing Safety of NPS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE304	3	2	2	-	-

Main components of safety problem; provision of safety quality and culture; normative documents of the RF for using nuclear power; principle of deeply echeloning protection; deterministic approach to safety provision; accident control; handling and storing of used fuel and radioactive wastes; norms and rules of radioactive safety; safety probability analysis; analysis of greatest accidents at NPS.

31. Automated Control Systems for Nuclear Power Stations

Code	Credit Hours	LT	TU	LB	Prerequisites
NE306	3	2	2	-	-

Main principles for regulation and mathematical description of object and system dynamics; initial concepts of control and regulation theory; mathematical description of technological control object (TCO); general principles of structural analysis of complex systems; stability of automated regulation systems (ARS); basics of ARS synthesis; technical-economical aims of ARS designing; selection of regulation schemes, typical regulation algorithms and their dynamic characteristics; functional and technical structure of NPS automated control system (ACS); aims of control; their decomposition and hierarchical principle for NPS control system arrangement; ACS hierarchical levels; automated regulation in ACS for NPS.

32. Nuclear & Neutron Physics

Code	Credit Hours	LT	TU	LB	Prerequisites
NE308	3	2	2	-	BS303

Photons, nuclear atom model, wave properties of micro-particles, elements of quantum mechanics, lasers, energy bands in crystals, elements of atomic nucleus physics, elements of physics of elementary particles - types of interactions and their integration. Charged particles passing through the matter, ionization and radiation losses. Thermo-nuclear reactions.

33. Water Preparation for NPS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE401	1	1	-	1	ME102

Requirements of the water and vapor quality depending on parameters' level and purposes; ways and methods of feed and delivery water preparation; construction of equipment for water purification, principles of their operation and maintenance conditions; methods and ways of quality maintenance of feed water and steam of boiler units and steam generators at the process of operation; water-chemical mode of operation maintenance.

34. Nuclear Energy Reactors

Code	Credit Hours	LT	TU	LB	Prerequisites
NE402	3	2	2	-	120 CR.HR

Operational principle and composition of nuclear reactor; reactor materials and requirements to them; component and heat-physical characteristics of nuclear power reactions of different types; heat-isolation in nuclear reactor and heat removal organization; heat-hydraulic computation of reactors; reactor operation control; requirements to reliability and safety of reactor operation.

35. Theory of Neutron Transfer

Code	Credit Hours	LT	TU	LB	Prerequisites
NE403	3	2	2	-	-

Concept of neutron diffusion; parameters defining neutron diffusion in space; Fick law for neutrons; diffusion equation; retardation of neurons in continuous media; dissipation of neutrons on stable nucleus; dissipation law; power distribution of neutrons being retarded in continuous homogeneous media; possibility to avoid absorption during retardation; effective resonance integral; neutron thermalization; neutron gas temperature; spatial distribution of retarding neutrons; model of continuous retardation; age equation; retardation equation in age approximation; multi-group approximation.

36. TURBO MACHINERIES FOR NUCLEAR POWER STATIONS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE404	3	2	2	-	-

Place of a turbine and turbo-installation in power block of NPS; turbine types for NPS; turbine stage, multi-stage turbines; effectiveness and reliability of a turbine, seismic stability; structures of turbines for NPS and their features; elements of steam-turbine installation: condense devices, pumps, separators-reheaters; concept of variable and transition modes for turbines and turbo-installations; basics of operating steam-turbine installations, diagnostics.

37. STEAM GENERATORS & NUCLEAR POWER STATIONS (NPS)

Code	Credit Hours	LT	TU	LB	Prerequisites
NE405	3	2	2	-	ME313

Place of steam generator in the heating system of NPS; requirements to steam generator; principle for selecting structural schemes and structures of steam generators; heat-carriers of NPS; general characteristics of processes in steam generators; operational temperature mode of heat-transferring surfaces of steam generators. hydro-dynamic processes in single- and double-phase media; natural circulation; steam separation processes; admixtures of feeding and steam generator water, their influence upon the reliability and economy of steam generator performance and steam quality; water mode of steam generators; computation of steam generators, features of main types of computations for steam generators of various types; operational reliability of steam generators; issues of economics in steam generator manufacturing.

38. INTEGRATED APPLIED SYSTEMS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE406	3	2	2	-	120 CR.HR

Modern information systems; data banks and bases; systems for database management (SDBM); basic concepts of relational data model; general notions of SDBM of dBASE family; database (DB) programming; batch files; concept of links between DB; menu programming; modern integral packets (IP): main functions and components; IP management; menu, windows, functions; creation of personal DB in IP; search, sorting, binding of data, archiving and printing out; graphic notion of tabular data.

39. HEAT TRANSFER IN POWER EQUIPMENT OF NUCLEAR POWER STATIONS

Code	Credit Hours	LT	TU	LB	Prerequisites
NE407	4	2	2	2	ME313

Techniques of heat transfer; laws of Fourier and Newton-Rihman; coefficient of heat-transfer through flat, cylindrical and spherical walls; basic concepts of heat calculation in heat-exchange apparatuses; differential equation of temperature field with heat sources; non-stationary heat-conductivity; system of differential equations of convective heat-exchange; theory of dimensionalities and theory of similarity in the problems of convective heat-exchange; heat-exchange in pipes with laminar and turbulent flow; heat-exchange and resistance of flows in annular channels and longitudinal streamline of rod bunches; heat-exchange during condensation and boiling; boiling crisis in large volume; heat-exchange during film boiling; parameters of two-phase mixture in pipes; heat-exchange in steam-generators; laws of heat radiation; concept of complex heat-exchange; basics for calculating heat and mass-exchange in power machinery.

40. Protection against Atomic Radiation

Code	Credit Hours	LT	TU	LB	Prerequisites
NE408	2	1	-	1	120CR.HR

Types of ionizing radiations; process of their transfer to the substance; exposition, absorbed and equivalent doses; biological effect of radiation; law of radiation intensity decrease; decrease coefficients; main types of interaction between neutrons and nuclei atoms; computation of nuclear reactor biological protection; main criteria of biological danger from radionuclides in case of internal radiation; radiation registration techniques.

41. Economics for Nuclear Energetic

Code	Credit Hours	LT	TU	LB	Prerequisites
NE410	3	2	2	-	100 CR.HR

Structure of power consumption in industry and ways for improving it; capital investments, investment sources; fixed assets and working capital, dynamics, structure, indexes and ways for increasing their utilization; pricing, profit, taxes, profitability; discounted costs; technical-economical basics of optimization of heat-power supply systems; financing and crediting, securities; book-keeping and analysis of enterprise industrial and economic activity; NPS management, planning, maintenance organization and work measurement.

42. Nuclear Power Stations

Code	Credit Hours	LT	TU	LB	Prerequisites

NE440	3	2	2	-	-

Situation and development of nuclear engineering; types of NPS and their main machinery; selection of parameters, heat economy of NPS; regeneration on NPS; units of conductive contour; technical water supply; steam generator units; turbine units; internal and intermediate separation; evaporation units and schemes of their inclusion into NPS heating scheme; reactor units; main reactor contour and its supplementary systems; issues of reliability and safety of NPS; pipelines and reinforcement for NPS; water-chemical modes; activation and deactivation at NPS; radioactive wastes at NPS and their entombment; ventilation units at NPS; general plan and components of NPS; operation of NPS in power system; organization of performance and maintenance.

43. Safety Provision Principles at Nuclear Power Stations

Code	Credit Hours	LT	TU	LB	Prerequisites
NE441	3	2	2	-	-

Main components of safety problem; provision of safety quality and culture; normative documents of the RF for using nuclear power; principle of deeply echeloning protection; deterministic approach to safety provision; accident control; handling and storing of used fuel and radioactive wastes; norms and rules of radioactive safety; safety probability analysis; analysis of greatest accidents at NPS.

44. Selected Topics in Electro-Power Stations

Code	Credit Hours	LT	TU	LB	Prerequisites
NE442	3	2	2	-	-

Power stations classification - Steam power plants; cycles and components - Gas power stations (gas turbines) and Diesel power plants - Combined power cycles - Co-generation concepts and systems - Hydroelectric power stations - Nuclear power stations - Load analysis, storage and power plant economics - Power plant efficiency - Power generation and environmental impact.

45. Senior Seminar

Code	Credit Hours	LT	TU	LB	Prerequisites
NE490	2	1	2	-	120 CR.HR

Selected topics of interest to the faculty will be used to introduce students to engineering science

46. Graduation Project

Code	Credit Hours	LT	TU	LB	Prerequisites
NE499	6	4	2	4	130 CR.HR

The student introduces a complete study and constructs a project determined through his department applying the basics of sciences that he studied – The student presents a report containing the rules and calculations that he made in his project.

47. Physical Basics for Using Renewable Energy Sources

Code	Credit Hours	LT	TU	LB	Prerequisites
RE204	3	1	2	2	-

Hydro-meteorological service: tasks and organization; measurement of precipitations, air, water and soil temperature, wind speed and direction, evaporation, solar radiation; methods for organizing and conducting basic calculations in hydrometeorology; Earth water resources; basic notions of hydro-graph; water circulation; drainage factor; water balance and its components; evaporations, precipitations, surface and underground drainage, filtration into the soil; hydrology: basic notions and definitions; hydrologic and hydrometric computations in hydro-power engineering for large and small water basins; application of methods of probability theory and mathematical statistics in hydrometeorology.