

Course Description

I. General Education 30 credits

Humanities & Social 9 credits

MUGE 100 General Education for Human Development 3 (3-0-6)

Well-rounded graduates, key issues affecting society and the environment with respect to one' particular context; holistically integrated knowledge to identify the key factors; speaking and writing to target audiences with respect to objectives; being accountable, respecting different opinions, a leader or a member of a team and work as a team to come up with a systematic basic research-based solution or guidelines to manage the key issues; mindful and intellectual assessment of both positive and negative impacts of the key issues in order to happily live with society and nature

SHHU 161 Group Dynamics and Teamwork 2 (2-0-4)

Meaning of group dynamics; nature, types of groups and group behavior; team development; teamwork; group leadership; group communication; management of group conflict; group ethics and manners

SHHU 166 Human and Society in the Digital World 2 (2-0-4)

Meaning of technology; history of technology; philosophy of technology and information; the relationship between human and digital technology; self, identity and risks in the digital world; ethics of technology and artificial intelligence; impacts of digital technology on culture and religion

SHHU 155 Medical Ethics 2 (2-0-4)

Meanings and scope of medical ethics, medical morality and code of ethics; methods of ethical analysis; medical ethical theories; religious ethics; ethical issues in medicine

Language 12 credits

LATH 100 Art of Using Thai Language in Communication 3 (2-2-5)

Art of using Thai language and of speaking, listening, reading, writing, and thinking skills for accurate and appropriate communication

LAEN 103 English Level 1 3 (2-2-5)

English structure, grammar and vocabulary in the context of daily language use, dealing with integration in four basic skills (listening, speaking, reading, and writing); reading strategies, sentence writing, listening for the gist, pronunciation and classroom communication

LAEN 105 English Level 3 3 (2-2-5)
Reading passages and writing at sentence and paragraph levels about proportion, frequency and probability, shape, measurement, comparison and contrast, definition and classification; coherence, unity and transition; listening comprehension; listening for the main idea; listening for specific details; and making inferences

LAEN 106 English Level 4 3 (2-2-5)
Reading passages and writing at sentence and paragraph levels about sequence of events and process, function, purpose, method and means, cause and effect, and conditional reasoning; academic English paragraph writing and introduction to essay writing; listening comprehension; listening for the main idea; listening for specific details; and making inferences

LAEN 266	English for Health Science	3 (3-0-6)
Study of English terms, sentence structures and expressions used in health science-related professionals; communicative practice in speaking, listening, reading and writing skills		

7 credits

SCGE 132	Decision Making Using Principles of Statistics	2 (2-0-4)
<p>Concepts of data collections; types of data; presentation of quantitative data; the use of appropriate methods and tools for the data analysis; conclusions and discussions in order to make decision using principles of statistics</p>		

SCGE 133	Data Science for All	2 (2-0-4)
Data science concepts; current applications of data science; complicated and big data management; data analysis and decision making by machine learning; searching data for planning collaboration; data presentation techniques		

2

Elective General Education Courses**2 credits****EGID 102 New Product Development****3 (3-0-6)**

Fundamentals of design and product development; Process management concepts; Service development; Innovation management structure; Customer need identification; Conceptual design and selection; Concept testing; Industrial design; Design for production; Project management; Case studies for product development; Ethics and design for environment

SHHU 168 Human Relations and Self Development**2 (2-0-4)**

Meaning and scope of human relations; self-esteem and self-confidence; positive thinking and coping with stress; understanding of individual differences; interpersonal communication; provision of guidance for others; teamwork; cross-cultural relationship; ethics in interpersonal and group relationship

SHHU 171 Cultures and Medicine**2 (2-0-4)**

Meanings of culture; influences of cultures on human beliefs, behavior and medicine; relationship between culture and treatment; different tradition medical customs

SHSS 186 The approach of Administration and Management for New Generation**2 (2-0-4)**

Learning an approach of basically working management as a group participation for efficiency, effectiveness and learning of philosophy and administrative theoretical development general characteristics of administration to comparison between public administration and business administration organization management by using management principles and management processes and concepts for forms to adopt modern management to apply the new generation

SHED 133 Marketeer for a Small Business**2 (2-0-4)**

Basic knowledge and principles of marketing and small business founders; concepts of business plan and self-learning with innovations; information retrieval and analysis for the social media; techniques for innovation design of products and services; Techniques for marketing and advertising; development of small business prototype; elements of being ownership; value of leadership; Emotional Intelligence; positive thinking behaviors and wellness; forms of Guerrilla Marketing

II. Special Education 112 credits***Basic Sciences 33 credits*****SCCH 102 General Chemistry 3 (3-0-6)**

Atomic structure, chemical bonding, gases, liquids, solids, solutions, colloids, chemical thermodynamics, chemical kinetics, chemical equilibria, ionic equilibria, electrochemistry, the periodic table

SCCH 119 Chemistry Laboratory 1 (0-3-1)

Experiments of general chemistry and basic organic chemistry, e.g., errors, significant numbers, precision and accuracy, preparation of solution, acid-base titration, use of models for stereochemistry of organic substances, chemical equilibria, rate of reaction, redox reaction, solubility classification and reactions of hydrocarbons, reactions of alcohols and phenols, reactions of aldehydes and ketones, reactions of carboxylic Acids and derivatives, reactions of amine

SCCH 125 Basic Organic Chemistry 3 (3-0-6)

Molecular structure and classification of organic compounds, reactions of organic compounds, nomenclature and stereochemistry, syntheses and reactions of alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, halides, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives, amines, carbohydrate, amino acid and lipids

SCBI 124 General Biology I 2 (2-0-4)

Basic concepts in biology; carbon and the molecular diversity of life; cell structure and function; energy and metabolism, cellular respiration and photosynthesis; principles of heredity, genetics, and molecular biology of gene; evolution; population genetics; ecology and conservative biology

SCPY 110 General Physics Laboratory 1 (0-3-1)

Basic Physics experiments relating to Physics curriculums taught to the first-year students in each faculty

SCPY 155 Basic Physics for Health Science 2 (2-0-4)

Mechanics, temperature and heat, fluid, waves, sound and hearing, optics and vision, basic electromagnetism, atomic physics, nuclear physics and radioactivity

SCPY 156 Physics for Health Science

3 (3-0-6)

Mechanics: Oscillation motion, system of many particles, motion of rigid bodies,

Thermodynamics: Laws of thermodynamics, directions of thermodynamic processes, entropy

Physical Optics: Diffraction, interference, polarization

Electromagnetism: Gauss's law, Biot-Savart's law, Ampere's law, Faraday-Henry's induction, electrical circuits containing capacitors and inductors

Quantum mechanics: Black body radiation, photoelectric effect, Compton effect, De Broglie's hypothesis (wave-particle duality), Davisson-Germer's experiment, wave function and probability of finding particles, Schrodinger's equation, application of Schrodinger's equation to simple systems

Atomic physics: Schrodinger's equation for single-electrons atom, possible wave function and energy level of electrons, quantum numbers, angular momentum, electron spins, electron configurations in atoms, periodic table

Nuclear physics: structures and properties of nucleus, binding energy, nuclear model, stability of nucleus and decay, nuclear fission, principles of nuclear reactor control, nuclear fusion

Particle physics: Elementary particles, standard model of elementary particles

SCPY 107 Electronics

2(2-0-4)

Introduction to electronics, inductance and transformers, capacitance, AC circuits, network analysis, semiconductors, operational amplifiers, digital electronics

SCMA 111 Calculus

2(2-0-4)

Functions, limits, continuity, derivatives of algebraic functions, logarithmic functions, exponential functions, and trigonometric functions, implicit differentiation, higher-order derivatives, differentials, applications of differentiation, indeterminate forms and l' Hospital's rule, functions of several variables and partial derivatives, total differentials and total derivatives, antiderivatives and integration, techniques of integration, applications of integration

SCMA 177 Introduction to Fourier Methods for Differential Equations 3 (3-0-6)

Introduction to ordinary differential equations; first-order differential equations; second-order linear differential equations with constant coefficients; introduction to power series and convergence; power series solutions of differential equations; Fourier series; Fourier transform; convolution; discrete-time Fourier transform; elementary partial differential equations

SCMA 182 Statistics for Health Science

2 (2-0-4)

Concepts and applications of probability and probability distributions to various events; interpretation of statistical values; descriptive statistics; sampling for good representatives of populations and its use in estimation and hypothesis testing

SCAN 211 General Human Anatomy 3 (2-3-5)
Human body; structures and functions of tissue; organ relationships and functions; systemic anatomy

SCBC 206 General Biochemistry 3 (3-0-6)
Structures and functions of all 4 types of biomolecules, namely carbohydrate, lipid, protein and nucleic acid, basic metabolic processes of these 4 types of biomolecules, basic mechanisms of DNA replication, regulation of gene expression and DNA technology, basic roles of biomolecules involving their functions in various biological systems in normal human body and their applications

SCPS 202 Basic Physiology 3 (2-3-5)
Basic concepts and principles of the cell function, mechanism, and functions of different organ systems such as the nervous, muscular, cardiovascular, respiratory, renal, gastrointestinal tract, endocrine and reproductive systems. The combined mechanisms of the organ system integration and adaptations in order to keep the body in a homeostatic state

Professional Education 79 credits

MTRD 171 Introduction to Radiological Technology 1 (1-0-2)
Introduction to radiological technology including diagnostic radiology, nuclear medicine and radiation therapy, role of radiological technologist, interdisciplinary collaboration

MTRD 271 Radiation Physics 2 (2-0-4)
Mechanism of the radiation emission, physical properties and factors affecting radiation beam quality, interactions of various radiations with matters associated with medicine, applying the physical properties of radiation to radiodiagnosis, including physical and statistical principles of the resultant quality analysis.

MTRD 272 Instrumentation in Diagnostic Radiology 1 (1-0-2)
Equipment in the diagnostic radiology, installation standards and safety, electronic components, features of diagnostic radiology equipment such as x-rays, mammography, fluoroscopy, ultrasound, computed tomography and magnetic resonance imaging and preventive maintenance of radiology equipment

MTRD 273 Radiation Protection 2 (2-0-4)
Radiation sources, biological consequences of human radiation exposure, radiation damage in the human body, principles of radiation protection, radiation units and quantities, limitation of radiation dose for the radiation workers and the public, instruments and detection devices in the radiation protection, personal radiation monitoring

- MTRD 372 General Radiography 3 (1-6-4)**
Standard radiographic positioning, radiographic anatomy, radiographic image evaluation criteria of upper and lower extremities, chest and heart, bony thorax, skull, vertebral column, abdomen, kidney, ureter, and bladder (KUB) systems, pelvis, orthopedics, portable and pediatrics imaging, dental radiography, practice in radiographic positioning, patient care, and team-working
- MTRD 373 Radiopathology and Image Interpretation 2 (2-0-4)**
Radiopathology and principle of image interpretation of musculoskeletal system, chest and cardiac radiography, skull, vertebral column, abdominal, kidney, ureter, and bladder (KUB) radiography
- MTRD 374 Patient Care and Radiological Service Management 2 (1-3-3)**
Patient's right, code of ethics for radiological technologist, service mind, health care team, etiquette and communication with Thai and foreign patients, practice in communication, patient safety transfer, practice in safety patient transfer, infection control, practice in infection control, vital sign assessment, practice in vital sign assessment, first aid and basic life support, practice in first aid and basic life support, patient care in radiology department, radiological service management
- MTRD 375 Clinical Practice in General Radiographic Technique 3 (0-18-3)**
Clinical practicum in general radiographic technique as the role of radiological technologist, patient care, patient positioning, utilization of x-ray imaging system, and related equipment, quality control, information technology and medical image processing in general radiography, interdisciplinary collaboration
- MTRD 376 Research Methodology and Seminars in Radiological Technology 1 (1-0-2)**
Introduction to research methodology, searching, literature reviews, statistical analysis, research ethics in human beings, plagiarism, seminars in radiological technology
- MTRD 377 Sectional Radiological Imaging 2 (2-0-4)**
The relationship between anatomy and sectional images in the transverse, sagittal, and coronal planes of head, neck, thorax, abdomen, pelvis and extremities on standard procedures in computed tomography, magnetic resonance imaging and ultrasound
- MTRD 378 Contrasted Radiological Procedures 2 (2-0-4)**
Instrumentation and tools for special radiological procedures, contrast media and adverse effects, patient preparation and care, techniques in fluoroscopic procedures, diagnostic and therapeutic angiography, cardiac catheterization, and quality administration

MTRD 379 Introduction to Medical Mammography and Ultrasonography 1(1-0-2)

Basic physics and instrumentation of mammography and ultrasonography. Anatomy of the breast and pathology, imaging techniques, ultrasonography and MRI of the breast. Imaging methods and scanning techniques in abdominal imaging, breast and thyroid, reproductive organs, obstetric ultrasonography, vascular ultrasound, musculoskeletal ultrasound

MTRD 381 Pathology 3 (3-0-6)

General and systemic pathology, etiology/causes and mechanism of diseases, lesion, functional change, clinical feature, complication, consequence of diseases, and prognosis

MTRD 382 Computed Tomography for Radiological Technologist 2 (2-0-4)

Basic physics concepts, instrumentation, data acquisition, image reconstruction, post-processing, imaging procedures and imaging protocols in head and neck, spine and musculoskeletal system, abdomen, pelvis and other special applications, pathologic correlation

MTRD 383 Magnetic Resonance Imaging for Radiological Technologist 2 (2-0-4)

Basic physics concepts, instrumentation, data acquisition, image reconstruction techniques, post-processing, imaging procedures, and imaging protocols in head and neck, spine and musculoskeletal system, abdomen, pelvis and other special applications, pathologic correlation

MTRD 384 Clinical practice in Special Radiographic Technique 3 (0-18-3)

Clinical practicum in special radiographic techniques as the role of radiological technologist, patient care, special techniques in contrasted procedures, computed tomography, observation of special techniques in interventional radiology, mammography, ultrasonography and magnetic resonance imaging, daily quality control, image processing in special radiographic techniques, interdisciplinary collaboration

MTRD 385 Instrumentation in Nuclear Medicine 3 (2-2-5)

Overview of radiation physics, components and principles of radiation detectors, counting system, nuclear medicine imaging systems, three dimensional image reconstructions, PACS in nuclear medicine, advanced technology of software and imaging systems, introduction to artificial intelligence and Monte Carlo simulation in nuclear medicine, practice in systems of counting and nuclear medicine imaging, practice in 3D image reconstruction, practice in quantitative analysis, basic image processing, and PACS in nuclear medicine

MTRD 386 Nuclear Medicine 3 (3-0-6)

Radiopharmaceuticals, radionuclide production, quality control of radiopharmaceuticals, clinical nuclear medicine, dosimetry and statistics in nuclear medicine, radiation safety in nuclear medicine.

**MTRD 387 Imaging Technique and Quality Control of Instrumentation 3 (2-2-5)
in Nuclear Medicine**

Imaging technique, patient positioning, image acquisition protocol, image reconstruction protocol, application of image processing and quantitative analysis in clinic, practice in imaging protocol setting, quality control of instrumentation, practice in daily quality control of instrumentation, image quality, practice in assessment of image quality, image artifact

MTRD 388 Clinical Practice in Nuclear Medicine 3 (0-18-3)

Clinical practice in nuclear medicine in the role of radiological technologist, daily quality control of instrument, patient positioning, imaging protocols, image display, image processing, quantitative analysis, radiation protection in nuclear medicine, working with multidisciplinary team

MTRD 471 Radiobiology 2 (2-0-4)

Basic cell biology, interactions of radiation on living organisms, cellular and molecular response ionizing radiation, reaction of radiation to cells, tissues and organs, acute and late reactions of radiation, radiation effect on genetics and major organs, radiation effects of embryo and fetus, tumor and cancer biology, biomolecular principle and application of radiobiology in radiotherapy

MTRD 472 Instrumentation in Radiotherapy 2 (2-0-4)

Types, components and functions of radiotherapy machines such as kilovoltage and megavoltage equipment, particle beam therapy units, brachytherapy units, simulators, integrated treatment devices, computerized treatment planning system, beam modifiers, patient positioning and immobilization devices, radiotherapy imaging and application of image guided radiation therapy devices, the role of the radiation therapists in the quality assurance in radiotherapy

**MTRD 473 Radiation Dosimetry and Treatment Technique 3 (3-0-6)
in Radiotherapy**

Principles of the radiation dosimetry, recommendations for radiation quantities, radiation dosimeters, method of radiation measurements, principle of treatment planning and patient dose calculation, dose distribution in patients with brachytherapy, and external beam, patient specific QA, treatment verification using image guided radiation therapy, external radiation therapy for photons, electrons and other particles, radiation protection in radiotherapy

MTRD 474	Radiotherapeutic Technique and Clinical application for Upper Body	2 (2-0-4)
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Types and staging of cancers, signs and symptoms, incidence and risk factors, diagnostic and treatment of cancer by radiation, complications from radiotherapy treatment, patient positioning and immobilization, simulation techniques, treatment planning techniques, application of image guided radiation therapy, radiation treatment techniques, patient care and advice given to patients during the radiotherapy treatment of central nervous system malignancies, head and neck cancer, lung cancer, breast cancer, upper gastrointestinal cancer

MTRD 475	Radiotherapeutic Technique and Clinical application for Lower Body	2 (2-0-4)
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Types and staging of cancers, signs and symptoms, incidence and risk factors, diagnostic and treatment of cancer by radiation, complications from radiotherapy treatment, patient positioning and immobilization, simulation techniques, treatment planning techniques, application of image guided radiation therapy, radiation treatment techniques, patient care and advice given to patients during the radiotherapy treatment of lower abdomen cancer, sarcoma, pediatric malignancies, haematological malignancies and other kinds of cancer, treatment cancer of emergency conditions

MTRD 476 Clinical Practice in Radiotherapy 3 (0-18-3)

Clinical practice in radiation therapy under supervision of radiation therapists and medical physicists such as patient positioning, immobilization, simulation, treatment planning, treatment verification, treatment by external beam therapy and brachytherapy units, care of the patients during the radiation treatment including radiation protection, quality assurance in radiotherapy machines in the role of a radiation therapist

MTRD 477 Senior Project 1 (0-6-1)

Basic methodology of interesting research, literature reviews, data collection, method, data analysis and conclusion, writing term papers and presentations

MTRD 481 Law for Radiological Technology 1 (1-0-2)

The healing arts practices act, related laws in medicine and public health, the compliance risk and legal responsibility, the ministerial regulation on maintaining the code of ethics for radiological technologists

MTRD 482 Moral and Code of Ethics in Radiological Technology 1 (0-3-1)

Compassion, caring, empathy, sympathy, respect, the uses of the code of ethics based on virtue and ethical standards, practice compassion

MTRD 483 Radiation Safety Management in Radiology 1 (1-0-2)

Radiation safety management in radiology, roles and responsibilities of radiological technologists in preventing danger caused by radiation, emergency planning and preparation for accidents in radiation, security in the transport of radioactivity material, radioactive waste management, law and regulation on radiation safety, radiation safety officer

MTRD 484 Integrative Knowledge and Professional Skills in Radiological Technology 3 (0-18-3)

Internship in radiology department by integrating professional knowledge and skills for performing quality control, utilization of radiological instruments and equipment, information technology and medical image processing, patient care and service, working with multidisciplinary team, as the role of radiological technologist

Elective Professional Courses

MTRD 291 Basic Molecular Technique and Its Application in Radiological Technology 1 (1-0-2)

Basic molecular techniques, understanding of fundamental molecular mechanism and interaction as well as applications related to radiological technology

MTRD 292 Introduction to Python Programming for Radiological Technologists 1 (1-0-2)

Python installation, variables, data types, string, list, tuple, dictionary, string formatting, function, module, file, folder, image display using OpenCV, image display using matplotlib, creating histogram from an image file, reading DICOM file

MTRD 293 Nuclear Technology and Its Application 2 (1-2-3)

Basic principle of research reactor application and its safety, radioisotopes and radiopharmaceuticals for medical applications, food irradiation, gamma irradiation sterilization for medical devices, gemstone irradiation and measurement of its radioactivity, radiation dosimeter calibration, carbon-14 dating, radioactive waste management, practice in use of instrumentation in nuclear technology

MTRD 391 Innovation in Radiology 2 (2-0-4)

Description of innovation and innovator, innovation management, related conceptual frameworks in innovation development, current innovation trend, innovations and related technologies in radiological technology, innovation project in the radiological technology

MTRD 392 Application of Artificial Intelligence in Radiological Technology 2 (2-0-4)

Principle of Artificial Intelligence, application of artificial intelligence and advanced techniques in medical image processing in radiological technology

MTRD 491 Application of Database System in Radiological Technology 2 (2-0-4)

Database system, data types, database design, table design, data retrieval, data filtering, data presentation, report design, Graphical User Interface (GUI) design, desktop database system, web-based database system

**MTRD 492 Molecular Technology and Applications in Medical Imaging 2 (2-0-4)
and Radiation Therapy**

Concept of molecular technology, such as molecular nanotechnology, application of molecular nanotechnology in medical imaging, application of molecular nanotechnology in combination with radiation for therapy, other related technologies in imaging and therapy

