General Sir John Kotelawala
Defence University

FACULTY OF GRADUATE STUDIES

STUDENT'S HANDBOOK

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

General Sir John Kotelawala
Defence University

P.O. Box 32, Ratmalana, Sri Lanka | www.kdu.ac.lk

FACULTY OF GRADUATE STUDIES

STUDENT'S HANDBOOK

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

General Sir John Kotelawala Defence University

Key Appointments

a. Chancellor

General Gerard Hector de Silva (Retired) RWP VSV USP ndc

b. Vice Chancellor

Major General Milinda Peiris RWP RSP VSV USP ndc psc

MPhil (Ind) PGDM

c. Deputy Vice Chancellor (Defence & Administration)

Brigadier W Chandrasiri RSP USP psc

d. Deputy Vice Chancellor (Academic)

Prof. KAS Dhammika
PhD (Northern University of Malaysia), M.Com (Kelaniya), PGD in Business Statistics (USJP), B.B.Mgt.(HR) (Kelaniya)

e. Dean, Faculty of Graduate Studies

Brigadier RGU Rajapakshe RSP psc
BSc (DS) KDA, MSc (DS) Kelaniya, MASSS (NDU) Washington DC

f. Dean Faculty of Engineering

Eng Capt (Retired) SU Dampage
BSc (Hons) (E E Eng), M Eng (E & T), C Eng, FIE

g. Registrar

Mr VD Kithsiri
Executive Master of Business Administration (USJP), BSc (USJP), Post Graduate Diploma in Management (USJP)

“Education is at the heart of achieving your dreams.”

General Sir John Kotelawala Defence University

Contents

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

Introduction

MSc in Biomedical Engineering Degree is an interdisciplinary Programme, which has been designed to train graduates who are interested in applying modern engineering methods to understand, modify and control biological systems with the goal of improving health and quality of life. Today, understanding and overcoming health-related challenges requires multidisciplinary professionals who thrive in both biomedical and engineering environments. The curriculum of this programme has been designed to provide students with a good grasp of core contents of Biomedical engineering. Also, to foster logical and analytical thinking, independent study, self-motivation and communication skills, awareness of research and developments, and latest trends in the key areas of the field. Graduates of this programme enter the workforce with the knowledge and expertise needed to excel in specialties, including prosthetics, artificial organs, biometrics systems, medical devices manufacture, clinical engineering, rehabilitation, sport medicine, tissue engineering etc.

Objectives

Programme educational objectives describe the career and professional accomplishments and what the programme prepares graduates to achieve in the professional career. These are as follows.

a. Demonstrate technical competence in designing engineering systems, processes, materials to solve complex engineering problems in the field of Biomedical Engineering.

b. Function as effectively as a leader/member in a multidisciplinary team with effective communication skills, highest professional and ethical standards, leadership, and teamwork skills.

c. Demonstrate a thorough understanding of theoretical knowledge and critical awareness of current issues and recent developments in the area of biomedical engineering and/or area of professional practice.

d. Demonstrate commitment to lifelong learning, professional development, self-direction, originality in problem solving and implementation of professional tasks by pursuing research and professional practices.

Intended Learning Outcomes

At the completion of the degree programme a student will be able to,

a. Identify and apply knowledge of engineering sciences, medical sciences, mathematics, computer science, and biological sciences in solving complex biomedical engineering problems.

b. Define the complexity of human biology and anatomy concerning biomedical engineering modeling.

c. Investigate complex problems using research-based knowledge and research methods including design of experiments, analysis, and interpretation of data.

d. Analyze complex biomedical engineering problems, and reach valid conclusions using knowledge of mathematics, natural sciences, and engineering sciences.

e. Design solutions for biomedical engineering problems to meet specific needs with appropriate attitudes, values and considerations for public health, safety,

cultural perspectives, ethical, societal, and environmental concerns.

f. Use and apply appropriate techniques, resources, and modern tools, to complex biomedical engineering problems, with an understanding of the limitations

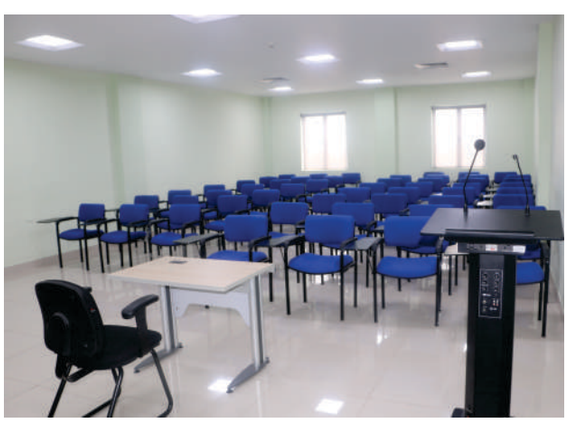
g. Apply ethical principles in biomedical engineering and commit to professional ethics and responsibilities and norms of biomedical engineering practice.

h. Function effectively as an individual, and as a member or leader in teams and multi-disciplinary settings

i. Communicate effectively on complex biomedical engineering activities with the engineering and medical community and with society at large.

j. Demonstrate knowledge and skills in management & economic principles on decision-making, and apply them to own work, as a team member/leader in multidisciplinary environments.

k. Engage in independent and life-long learning in the broadest context of biomedical engineering technological advancements and continuous professional development.



Lecturer Room

Eligibility Criteria

Applicants satisfying the following requirements are eligible for admission:

a. Degree of Bachelor of Science in Engineering, MBBS, Allied health sciences, Physics, Biological Sciences Computer science, Chemistry, Biochemistry of four-year duration or

b. Degree of Bachelor of Science (Defence Studies) in a relevant field with a minimum of three years of appropriate experience as an Engineer as approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

c. A Bachelor of Science Degree (SLQF 5) in a relevant field* from a recognized University; with minimum of three years of appropriate experience in relevant field after obtaining such a degree, as may be approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

d. Associate Membership or above of Institution of Engineers Sri Lanka (IESL) AND a minimum of three years of appropriate experience after obtaining such membership as approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

e. Associate Membership or above of a professional Engineering Institute recognized by Institution of Engineers Sri Lanka (IESL) AND a minimum of three years of appropriate experience after obtaining such membership as approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

f. A Higher Diploma (SLQF 4) in a relevant field with a minimum of five years of appropriate

experience in a relevant field after obtaining such a higher diploma, as may be approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

g. A professional qualification equivalent to SLQF 6 or above of relevant field* as approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU. or

h. Completion of NVQ level 7 of relevant field* and minimum 5 years of experience in the relevant field* as approved by the relevant Board of Studies of Faculty of Graduate Studies at KDU.

Programme Structure

The MSc in Biomedical Engineering is a 2-year programme (60 GPS Credits, 10 NGPA Credits), structured in six fields of specialization (Biomedical Engineering Bio medical implants and instrumentation, biomedical imaging and radiology, Biomedical Data Sciences, Orthotics & Prosthetic designing, Genome and Engineering Biology, Neural Engineering) where independent study and research work is expected to interlace. The program is consisted with three exit points as postgraduate diploma (30 GPA credits; SLQF level 8), MSc by Course work (45 GPA credits; SLQF level 9) and MSc with research (60 GPA credits, SLQF level 10). Lectures and practical sessions are conducted on Saturdays and Sundays from 0830 hrs to 1730 hrs at Faculty of Graduate Studies, General Sir John Kotelawala Defence University. The lectures are also supplemented with online interactions via Moodle.

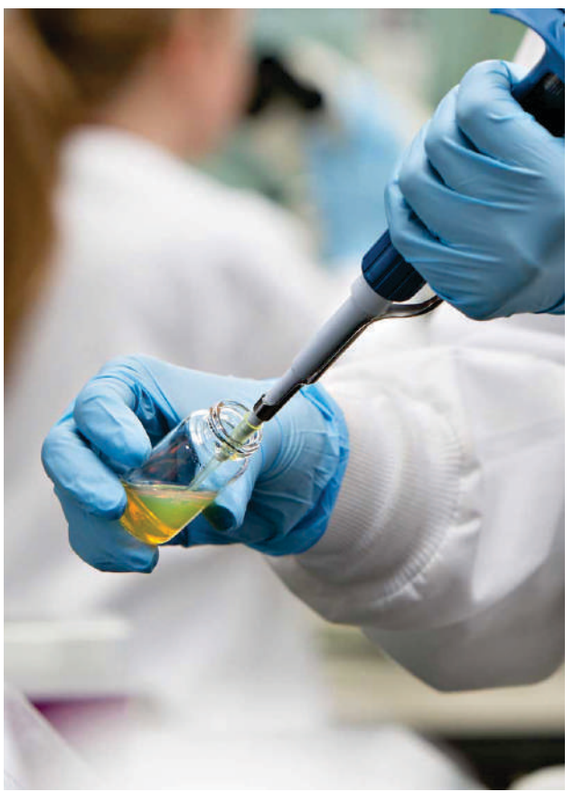
Continuous Assessments

Instructions for Submission of Continuous Assessments

a. FGS expects the highest professional, academic and scholarly standards in student assignments. Therefore, haphazard, incomplete or hurried assignments will not qualify for marking.

b. Marks obtained for assignments will be added to the examination marks; FGS expects the students to work hard, consider these assignments seriously and concentrate on them. Assignments are potentially powerful learning resources for communication.

c. Assignments call for a significant degree of knowledge, analysis and critique. Therefore,



the students must prepare in advance for their assignments thoroughly and well. Assignments should not be completed in a rush.

d. Students must try out different drafts and work hard on them.

e. There are no extensions on assignment submission dates. Students are responsible for submitting their assignments on due date.

Specifications for Assignments

a. Students must always use only A4 size paper to compliance their assignments.

b. Leave a 1" Margin on all four sides.

c. Students must type or word process their assignment answers. If a student is unable to do so, he / she must write the answer very neatly and legibly. Assignments with illegible handwriting will not be marked.

d. We recommend the 11/2" line spacing formats.

e. Students must be creative in approaching and answering questions.

f. If a student uses another author's idea, he / she must cite that author / publication with references.

Do's

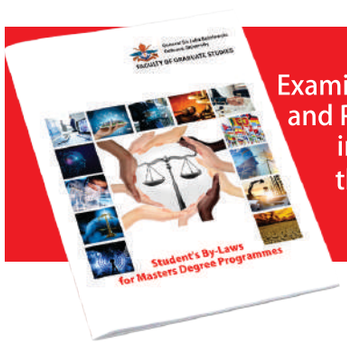
a. Always enclose every single assignment in a separate folder.
b. Fill in the following details on the first page of the folder.

- Registration Number
- Name
- Course Code and Title
- Semester
- Name of the Resource Person

c. Always submit your assignment to the Staff at the Faculty of Graduate Studies.
d. Always submit your assignment on or before the last date of submission.
e. You may have your assignment handed over by someone else on your behalf.

Don'ts

a. Never hand over any assignment to unauthorized staff members at KDU personally known or unknown to you.
b. Never mail assignments, unless specified.
c. Never use one folder for more than one assignment.



Examination Offences and Punishments as indicated in the By-Laws

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

Specimen of Assignment Cover Page

ANATOMY AND HISTOLOGY

BM5113

TOPIC OF THE ASSIGNMENT
NAME OF THE STUDENT

REGISTRATION NO: KDU/…….
LECTURER: …….

NAME OF THE DEGREE

PROGRAMME NO…. – YEAR …. – SEMESTER ….

Declaration Form

1. I declare that this assignment is my own work.
2. I have acknowledged ideas of other authors (if any) following the standard acknowledgement practice.
3. I am aware of the consequences of cheating and malpractice.
4. I am willing to answer any query raised by any Academic Staff Member in relation to this report at any time during the course.
5. I understand that the decision relating to mark on this report is purely based on my performance and that it is first and final.

Date: D D M M Y Y Y Y

_____
Signature

_____
Name

Specimen Letter for handing over Assignments

(Address)

_____

_____

(Your Ref)_____

DEAN
FGS
KDU

SUBMISSION OF _____ *(Subject Name)*

1. Assignment of _____ (Module) or *(Research)* is forwarded herewith for *(making / approval)* please.

_____
(Signature)

_____
(Name in upper case)

_____
(Rank)

_____
(Registration No)

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

Course Syllabus

The first and second semesters are composed of mandatory modules (30 GPA credits, 7 NGPA credits).This is followed by third semester of either elective modules and an individual project relevant to field of specialization; or an independent study with research project (15 GPA credits and 3 NGPA) and the thesis in the final semester (15 GPA Credits). This structure forms a coherent line of study and provides students with both the depth and breadth of knowledge needed to specialize in their field. In addition, candidates must be able to spend a considerable amount of time for self-studies, homework, assignments, field visits, discussions, guest lecturers etc., throughout the program.

MSc in Biomedical Engineering Programme – Summary of the Course Delivery Plan

Semester 1 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
BM5103	Biomedical Science[1,2,3]	3	C	New
BM5113	Anatomy and Histology	3	C	New
BM5123	Biomedical Instrumentation, Medical Devices, and Safety	3	C	New
BM5133	Advanced Mathematics	3	C	New
BM5143	Biomaterial	3	C	New
Adaptive Module (Min. Req. One Module)[2]				
BA5103	Basic Electronics and Electrical Engineering	3	E	New
BA5113	Signals and Control Systems	3	E	New
BA5123	Analog and Digital Electronics	3	E	New
BA5133	Fluid Mechanics	3	E	New
Core I (Min. Req. One Module)[3]				
BC5103	Advanced Bioinformatics (Assignment - mini project)	3	E	New
BC5113	Micro and Nanofluidic Devices (Assignment - mini project)	3	E	New
BC5123	Bio nanotechnology (Assignment - mini project)	3	E	New
BC5133	Drug Delivery and Pharmacology (Assignment - mini project)	3	E	New
BC5143	Sport Medicine (Assignment - mini project)	3	E	New

MSc in Biomedical Engineering Programme – Summary of the Course Delivery Plan

Semester 1 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
Orientation Workshops / Projects (Min. Req. One Project)				
BW5104	Electrical and Electronic Based Project	4	E (NGPA)	New
BW5114	Control Systems based Design Project	4	E (NGPA)	New
BW5124	Computer-based DSP Project	4	E (NGPA)	New
BW5134	Biomechanics and Prosthetics related Project	4	E (NGPA)	New
	Total Credits for Semester 1	**15 – GPA and 4 – NGPA**		

[1] Students from the Electronic, Electrical, Computer and Mechatronics Engineering, should take Biomedical Science Module.
[2] Students from the biology background, should take one adaptive module.
[3] Students from the Biomedical Engineering background should take one core I module.

Semester 2 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
BM5203	Biochemistry	2	C	New
BM5213	Cell and Tissue Engineering[4,5,6]	3	C	New
BM5223	Biomechanics	3	C	New
BM5232	Advanced Programming and Data Analytics	2	C	New
BM5242	Advanced medical imaging techniques and analytics	2	C	New
BM5253	Hospital Engineering, Safety and Management	3	C	New
BM5263	Research methodology and Group Projects	3	C (NGPA)	New
Adaptive Module (Min. Req. One Module)[5]				
BA5203	Wireless and Data communication	3	E	New
BA5213	Biomedical Digital Signal Processing	3	E	New
BA5223	Analog Signal Processing and Filtering	3	E	New
BA5233	Applied Mechanics (Static and Dynamics)	3	E	New

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

MSc in Biomedical Engineering Programme – Summary of the Course Delivery Plan

Semester 2 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
Core I (Min. Req. One Module)[6]				
BC5203	Neuromorphic Engineering (Assignment - mini project)	3	E	New
BC5213	Micro and Nanofluidic Devices (Assignment - mini project)	3	E	New
BC5223	Frontiers of Nanotechnology (Assignment - mini project)	3	E	New
BC5233	Applied Biomedical and Health Informatics (Assignment - mini project)	3	E	New
	Total Credits for Semester 2	**15 – GPA and 3 – NGPA**		

[4] Students from the Electronic, Electrical, Computer and Mechatronics Engineering, should take Biochemistry Module.
[5] Students from the biology background, should take one adaptive module.
[6] Students from the Biomedical Engineering background should take one core I module.

Semester 3 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
Core I (Min. Req. One Module)[6]				
BM6103	Independent Study& Project (Scientific Writing, Technical Skills, and Competencies)	3	C (NGPA)	New
Five Elective Course Modules (3x5=15 credits)[7] or BM6930 Scientific Research (30 credits)[8]				
Elective 1: Biomedical implants and instrumentation (Select One Module)				
BI6103	Bioelectronics and Biosensors	3	E	New
BI6113	Advanced Sensors and Instrumentation	3	E	New
BI6123	Frontiers of Nanotechnology	3	E	New
BI6133	Biomedical Implant Devices	3	E	New
BI6143	Neural implants and Interfaces	3	E	New

MSc in Biomedical Engineering Programme – Summary of the Course Delivery Plan

Semester 3 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
Elective 2: Biomedical Imaging and Radiology (Select One Module)				
BR6103	Advanced Bio signal Processing	3	E	New
BR6113	Diagnostic Radiology and Nuclear Imaging	3	E	New
BR6123	Non-Ionizing Radiation Imaging	3	E	New
BR6133	Neuroimaging and image analysis	3	E	New
BR6143	Cardiovascular imaging	3	E	New
BR6153	Advanced radiotherapy equipment	3	E	New
Elective 3: Biomedical Data Sciences (Select One Module)				
BD6103	Data Modeling and Computer Simulation of Physiological Systems	3	E	New
BD6113	Advanced Bioinformatics	3	E	New
BD6123	Applied Biomedical and Health Informatics	3	E	New
BD6133	Neuromorphic Engineering	3	E	New
Elective 4: Orthotics & Prosthetic Design (Select One Module)				
BP6103	Advanced Biomaterials in Prosthetics and Orthotics	3	E	New
BP6113	Rehabilitation Engineering	3	E	New
BP6123	Green Technology and Safety (Health, Industry, and Environmental)	3	E	New
BP6133	Environmental, Occupational Health and Public Safety	3	E	New
BP6143	Advanced Biomaterials for implants	3	E	New
Elective 5: Genome, Bioengineering and Neural Engineering (Select One Module)				
BG6103	Molecular Biotechnology	3	E	New
BG6113	Bio nanotechnology	3	E	New
BG6123	Neural Signal Analysis	3	E	New
BG6133	Computational Neuroscience	3	E	New
BG6143	Neuron avigation systems	3	E	New
	Total Credits for Semester 3	**15 – GPA and 3 – NGPA**		

[7] Path 1 - Student can select 5 Elective Modules and Master Thesis with 15 GPA credits.
[8] Path 2 - Student can select one-year full time Scientific Research with 30 GPA Credits

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

MSc in Biomedical Engineering Programme – Summary of the Course Delivery Plan

Semester 4 Modules				
Code	**Course Name**	**Credit Value**	**Status (Compulsory / Optional)**	**Existing/ New**
BM6915	Master Thesis (Research Component)	15	C	New
	Total Credits for Semester 4	**15 – GPA**		
	Total Credits for MSc Programme	**60 – GPA and 10 – NGPA**		

Lecturer Panel

Prof Wimal Abeyewickreme
Ph.D (Medical Entomology, Liverpool), MSc (Tropical Medicine Bangkok), BSc (Applied Sciences, Hon), Diploma in Applied Parasitology and Entomology (D.A. P & E, Kualar Lumpur)

Dr LKDCR Karunathilaka
Senior Lecturer in Surgery, Consultant Othopedic Surgeon MCh (Trauma & Orth) EDIN (Edinburgh,UK) MRCS (The Royal College of Surgeons of England), MS surgery (Colombo) MBBS (Peradeniya)

Dr AD De Silva
Senior Lecturer
PhD (Pennsylvania State University College of Medicine, USA), B.S. (Truman State, USA)

Dr WDD De Silva
Senior Lecturer
MBBS (Sri Jayawardenapura), MD Surgery (Colombo), FRCS (England), Dip. Laparoscopic Surgery (Strasbourg)

Dr Nishantha Kumarasinghe
Senior Lecturer in Anatomy
PhD in Behavioural Sciences in Relation to Medicine (Newcastle, Australia), MBBS (Sri Jayawardenapura)

Dr TV Sanjeewanie
Senior Lecturer
MBBS, MD (Otorhinolaryngology), DOHNS (England)

Dr ME Balasooriya
Senior Lecturer
PhD (Colombo), Msc (Peradeniya), MBBS (Peradeniya), MD (Anaesthesiology), Bsc (Peradeniya), MS (USA)

Lt Col (Dr) WMMS Bandara
Senior Lecturer in Biochemistry
PhD (Colombo), Msc (Peradeniya), MS(USA), Bsc (Peradeniya)

Dr DSP Pullaperuma
Senior Lecturer
Consultant anesthetist
MBBS (Colombo), MD (Colombo), FRCA (UK)

Dr KDW Wijenayake
Senior Lecturer – Surgery
MBBS(Colombo), MS (Sri Lanka), MRCS (England)

Dr Pandula Athaudaarachchi
PhD (Cantab), MBBS (1st Class Hons), MRCP (UK), CCT (UK), FRCPG (UK), FRCPE (UK), FESC

Dr T I Withanawasam
MBBS, Diploma and MD (Transfusion Medicine)
13. Dr Anuji Upekshika Gamage
MD (Community Medicine) (Colombo), MSc (Community Medicine) (Colombo), MSc (Health Economics and Policy) (Australia), Grad. Cert in Economics (Australia), MBBS, FRSPH

Dr Anuji Upekshika Gamage
MD (Community Medicine) (Colombo), MSc (Community Medicine) (Colombo), MSc (Health Economics and Policy) (Australia), Grad. Cert in Economics (Australia), MBBS, FRSPH

Prof (Eng) TL Weerawardane
PhD (Mobile Communication), Master of Information & Communication Technology (Bremen, Germany), BSc (Hons) in Electrical Engineering (Moratuwa)

Dr KMGP Premadasa
Senior Lecturer
PhD (UK), MSc (UK), BSc (Peradeniya)

Dr PPCR Karunasekara
Senior Lecturer
PhD (Italy), MSc (Ireland), MSc (Netherlands), BSc (Moratuwa)

Dr SK Wijayasekara
PhD (CU, Thailand), MSc in Telecommunications (AIT, Thailand), BSc (Hons) in IT (SLIIT)

Dr RMPS Bandara
PhD, BSc Eng (Moratuwa), M. Eng (Moratuwa), AMIE (Sri Lanka)

Eng SU Dampage
MEng, BSc (E&E Eng) Hons

Capt (L) KK Dadallage RSP, USP, psc
MSc (EEng), BSc (Hons) EEng, CEng.MIE(Sri Lanka), CEng.MIE(India)

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING

Mr Shehan Priyanga Fernando
MPhil. (Moratuwa), BSc Eng (Moratuwa)

Mr WLPK Wijesinghe
Lecturer (Probationary)
MSc in Applied Electronics (Colombo), BSc (Colombo)

Maj PWMK Perera
Lecturer (Confirmed)
PhD (Reading) in HUST (China), MSc Molecular and Applied Microbiology (Peradeniya), BSc (Sp) in Applied Sciences (Sabaragamuwa)

Mr EHADK Hewadikaram
Senior Lecturer
MPhil (Colombo), MSc (USA), BSc (Colombo)

Ms PN Karunanayaka
Senior Lecturer
MSc (Moratuwa), BSc Eng (Moratuwa)

Ms ADP Perera
Senior Lecturer
MPhil (Peradeniya), MSc in Exercise & Sport Science (Peradeniya), BSc (Hons) (Colombo), CTHE (Certificate of Teaching in Higher Education) & PGCME (Post Graduate Certificate in Medical Education) (Colombo)

Dr (Ms) Vijitha Ramanathan
Senior Lecturer
PhD in Physics (Cape Town), MSc in Medical Physics (Peradeniya), BSc Hons in Physics (Jaffna)

Dr CB Ranaweera
Senior Lecturer
PhD in Biochemistry (USA), MSc Molecular Medical Microbiology (UK), BSc (Hons) Biomedical Sciences (UK)

Dr Wasana Edirisrachchi
Senior Lecturer
PhD in Imaging Medicine (Tianjin), BSc (Hons) Radiography (Peradeniya)

Dr (Ms) Amila Abeysekara
Senior Lecturer
PhD in Chemistry (Kansas State, US), MSc (Sri Jayawardenapura), B. Pharm (Sri Jayawardenapura)

Mr ARN Silva
Senior Lecturer
Microbiology Reading PhD, MSc Medical Microbiology (UK), BSc Biomedical Sciences (UK)

Dr SP Senanayake
Senior Lecturer
PhD in Exercise Physiology (UK), MPH (Australia), BSc B.Med (Human Physiology) (Australia), CTHE (KDU)

Dr KDK Peshala Kumari
PhD in Biochemistry (Sri Jayawardenapura), BSc (Hons) Human Biology (Sri Jayawardenapura)

Dr (Ms) Thamarasi Senaratne
PhD, M.Sc (Medical Microbiology), BSc (Chemistry special with Biotechnology)

Note: Lecturer panel subject to change as per the University requirements.

Lecture Room

Conference Room

Reference Reading

Module	Recommended Readings
Biomedical Science	Tortora G.D, Funke B.R. & Case C.L. Microbiology – An Introduction, Benjamin Cummings, New York, 10th Edition. Prescott L.M, Microbiology, Mc Graw Hill, New York, 5th Edition. Cown and Steel's manual for the identification of Medical Bacteria, Edited by G.I. Barrow, R.K.A. Feltham(Latest edition). Molecular Cell Biology. 7th Edition, (2012) Lodish H., Berk A, Kaiser C., K Reiger M., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA. Molecular Biology of the Cell, 5th Edition (2007) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA. Alberts, Bruce, et al. "Molecular Biology of the Cell (Garland Science, New York, 2002). Biology 8th edition. Neil Campbell et al., Pearson 2012.
Human Anatomy and Histology	Ross and Wilson Anatomy and Physiology in Health and Illness 12th Edition. (Hardcopy).(https://medicalstudyzone.com/download-ross-and-wilson-anatomy-and-physiology-inhealth-and-illness-pdf-free/). Junqueira's Basic Histology: Text And Atlas, Sixteenth Edition. (Hardcopy).(https://www.medicosrepublic.com/junqueiras-basic-histology-text-and-atlas-14th-editionpdf-free-download/). Online materials: https://www.visiblebody.com/learn/ https://anatomypubs.onlinelibrary.wiley.com/doi/10.1002/ase.1465
Advanced Mathematics	William W. Guo, 2nd Ed, 2015, "Advanced Mathematics for Engineering and Applied Sciences". Eugene Demidenko, 2019, "Advanced Statistics with Applications in R", ISBN : 978-1-118-3879. Harendra Singh, Jagdev Singh, Sunil Dutt Purohit, Devendra Kumar, 1st Ed, "Advanced Numerical Methods for Differential Equations (Mathematics and its Applications)", ISBN: 978-0367473112.

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING
Reference Reading

Module	Recommended Readings
Biomedical Digital Signal Processing	A.V. Oppenheim and R.W. Schafer, Discrete-Time Signal Processing, Prentice Hall, 2010. R.M. Rangayyan, Biomedical Signal Analysis, IEEE Press,2015. E.N. Bruce, Biomedical Signal Processing and Signal Modeling, John-Wiley & Sons, 2005. J.G. Proakis and D.G. Manolakis, Digital Signal Processing, Prentice Hall, 1996.
Fluid Mechanics	Textbook of Fluid Mechanics Er R K Rajput S Chand; 3rd edition 1998. Engineering Fluid Mechanics H. Yamaguchi Springer 2008. Fluid Mechanics for Engineers Meinhard T. Schobeiri Springer 2010.
Biochemistry	Lippincott's Illustrated Reviews: Biochemistry : Pamela C. Champe , Harvey, Richard A. and Ferrier, Denise R. Lippincott Williams & Wilkins 3rd Edition 2005. Biochemistry: Lubert Stryer; Jeremy Berg; John Tymoczko; Gregory Gatto 9th Edition 2019. Lehninger Principles of Biochemistry : David L. Nelson; Michael M. Cox Jan 2000 DOI:10.1007/978-3-662-08289-8.
Applied Mechanics	Beer, F.P., Johnston Jr, E.R., Mazurek, D.F., Cornwell, P.J., Eisenberg, E.R. and Sanghi, S., 1977. Vector mechanics for engineers (Vol. 1). Tata McGraw-Hill Education. Nelson, E., Best, C., McLean, W. and Potter, M., 2010. Schaum's Outline of Engineering Mechanics: Statics. McGraw-Hill Education. Khurmi, R.S. and Khurmi, N., 2006. A textbook of engineering mechanics. S. Chand Publishing.
Basic Electronics and Electrical Engineering	Mann Russell, 2000, "Introductory AC Circuit Theory", ISBN: 9780868400730. Clay Rawlins, 2000, 2nd Ed "Basic AC Circuits,", ISBN : 9780672270253. Sedra Smith, 7th Ed, "Microelectronic Circuits", ISBN: 9780190853464.

Reference Reading

Module	Recommended Readings
Biomedical Instrumentation, Medical Devices and Safety	R. S Khandpur and Raghbir Khandpur, "Biomedical Instrumentation: technology and applications". Leslie Cromwell,2nd Ed, "Biomedical instrumentation and measurements" ,ISBN: 978-0130764485. John G. Webster, 5th Ed "Medical instrumentation application and design" , ISBN:978-1-119- 45733-6.
Biomaterials	Vasif Hasirci and Nesrin Hasirci, ISBN: 978-1-4939-8856-3, (2018), Fundamentals of Biomaterials, Springer. Joon Park and R.S. Lakes, ISBN: 978-0-387-37880-0, (2007), Biomaterials, Springer. William Murphy, Jonathan Black and Garth Hastings, ISBN: 978-1-4939-3305-1, (2016), Handbook of Biomaterial Properties.
Cell and Tissue Engineering	Ratner, B. D., Hoffman, A., Schoen, F.J., and Lemons, J.E. (2012) Biomaterials science: an introduction to materials in medicine. 3rd Ed. Oxford: Academic. Palsson, B., and Bhatia, S. (2016) Tissue Engineering. Chennai, India: Pearson Education. Lanza, R. P., Vacanti, J., and Langer, R. S. (2014) Principles of Tissue Engineering. 4th Ed. Amsterdam: Elsevier/Academic Press. Li, S., L'Heureux, N., and Elisseeff, J. (2014) Stem Cell and Tissue Engineering. Singapore: World Scientific Publishing Co Pte Ltd. by Clemens Van Blitterswijk, Jan De Boer Tissue Engineering Hardcover. Ian Freshney R. Culture of Animal Cells. A manual of basic techniques
Biomechanics	CR Ethier and CA Simmons, Introductory Biomechanics from Cells to Organisms, Cambridge University Press, 2007. Basic Orthopaedic Biomechanics and Mechano-Biology, VC Mow and R Huiskes (Ed.), 3rd Edition, Lippincott Williams & Wilkins, 2005. M Nordin and VH Frankel, Basic Biomechanics of the Musculoskeletal System, Wolters Kluwer/Lippincott Williams& Wilkins, 2012.

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Reference Reading

Module	Recommended Readings
Biomechanics	D. A. Winter , Biomechanics and Motor Control of Human Movement, John Wiley & Sons, Inc., 2009. Krishnan B. Chandran, Stanley E. Rittgers and Ajit P. Yoganathan, Biofluid Mechanics: The Human Circulation, CRC Press, 2012
Advanced programming and data analytics	Rex A Barzee, ISBN: 0983384029, (2011), "Advanced Programming Techniques", Maia LLC. Peter Seibel, ISBN: 978-1430219484, (2009), "Coders at Work: Reflections on the Craft of Programming", Apress. Steve McConnell, ISBN: 978-0735619678, (2004), "Code Complete: A Practical Handbook of Software Construction", Microsoft Press.
Advanced medical imaging techniques and analytics	OHSAS 18001Guide to implementing Health & Safety Management System IEE Regulation Guide Book NQA Warwick House 2009. Introduction to health Physics Hermen Cember 4th ed. Mc Graw Hill 2008. Hospital safety manuals and guidelines. HTA- Course materials would be made available during the course.
Bioelectronics and Biosensors	Ajit Sadana and Neeti Sadana, 2011," Handbook of Biosensors and Biosensor Kinetics" ISBN: 9780444532626. Jagriti Narang, C.S. Pundir, 2017 "Biosensors An Introductory Textbook", ISBN: 9789814745949. Jeong-Yeol Yoon, "Introduction to Biosensors: From Electric Circuits to Immunosensors", ISBN: 9781441960214.
Advanced Sensors and Instrumentation	Olfa Kanoun and Nabil Derbel, ISBN: 978-3-030-71225-9, (2021). Advanced Sensors for Biomedical Applications, Springer. Chandran Karunakaran, Kalpana Bhargava and Robson Benjamin, ISBN: 978-0-12-803100-1, (2015). Biosensors and Bioelectronics, Elsevier.
Advanced Bio signal Processing	R.M. Rangayyan, Biomedical Signal Analysis, IEEE Press, 2016. M. Akay, Biomedical Signal Processing, Academic Press, Inc., 2012. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley & Sons, 1996.

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Module	Recommended Readings
Advanced Biomaterials in Prosthetics and Orthotics	S. Sethuraman, U.M. Krishnan, A. Subramanian, ISBN: 978-1-4987-4373-0, (2017), Biomaterials and Nanotechnology for Tissue Engineering, CRC Press. Muhammad Sohail Zafar and Zohaib Khurshid, ISBN: 9780128196274, (2020), Dental Implants, Woodhead Publishing. B. Basu, D. Katti and A. Kumar, ISBN: 978-0-470-19340-2, (2009), ADVANCED BIOMATERIALS Fundamentals, Processing and Applications, Wiley.
Neural Implants and Interfaces	Neural Engineering, B He, Springer, 2013.
Diagnostic Radiology and Nuclear Imaging	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control, Euclid Seeram, Elsevier – Health Sciences Division, 2008. The Essential Physics of Medical Imaging, Bushburg et al., 3rd Ed., William & Wilkins, 2011.
Non-Ionizing Radiation Imaging	Catherine Westbrook, John Talbot, "MRI in Practice", 5th Edition, Wiley-Blackwell, 2018.
Neuro imaging and Image Analysis	Functional Magnetic resonance Imaging, by SA Huettel, AW Song and G Mccarthy. Handbook of Functional MRI Data Analysis, by RA Poldrack, JA Mumford and TE Nichols.
Advanced Bioinformatics	A Textbook of Bioinformatics: Information-theoretic Perspectives of Bioengineering and Biological Complexes. Perambur S Neelakanta world scientific 2020. Advanced Bioinformatics and Computational Biology Katarzyna Hupert-Kocurek, Jon M. Kaguni Koros Press Limited 2017.
Data Modeling and Computer Simulation of Physiological Systems	Mathematical and computer of physiological systems Vincent C. Rideout Prentice Hall 1991. Physiological Control Systems: Analysis, simulation and estimation Michael C K Khoo Wiley 2001.

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Reference Reading

Module	Recommended Readings
Applied Biomedical and Health Informatics	Applied Bioinformatics: An Introduction Paul M. Selzer Springer 2007. Biomedical informatics : computer applications in health care and biomedicine Edward Hance Shortliffe; James J Cimino Springer 2014. Principles of Biomedical Informatics Ira J. Kalet Elsevier 2013.
Rehabilitation Engineering	RA Cooper, An introduction to Rehabilitation Engineering, CRC Press, 2006. D Farina, W. Jensen and M. Akay, Introduction to Neural Engineering for Motor Rehabilitation, Wiley-IEEE press, 2013.
Green technology, Environmental and Occupational Health and Public safety	Occupational Safety and Health Fundamental Principles and Philosophies Charles D. Reese CRC Press 2017. Guide to Environment Safety and Health Management Frances Alston Emily J. Millikin CRC Press 2015.
Molecular Biotechnology	Tortora G.D, Funke B.R. & Case C.L. Microbiology – An Introduction , Benjamin Cummings, New York, 10th Edition. Prescott L.M, Microbiology, Mc Graw Hill, New York , 5 th Edition. Cown and steel,s manual for the identification of Medical Bacteria, Edited by G.I. Barrow, R.K.A. Feltham (Latest edition). Kuby Immunology, Judy Owen , Jenni Punt , Sharon Stranford., 7th edition (2012), Freeman and Co., NY. Cellular and Molecular Immunology, Abul Abbas, Andrew H. Lichtman, Shiv Pillai 9th Edition 2017 Elsevier. Glick, B.R. and Pasternak, J.J. (2009) Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th edition, ASM Press. Cooper, G. M. And Hausman, R. E. (2013) The Cell: A Molecular Approach, 6th edition, Sunderland, MA: Sinauer Associates, Inc. Brown, T.A. (2010) Gene Cloning & DNA Analysis, 6th edition, Wiley-Blackwel.

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Module	Recommended Readings
Bio nano technology	A Rathinasamy, C Parameswari, V Ponnuswami. ISBN-10: 9390175356 (2020). An Introduction to Nanotechnology. New India Publishing Agency- Nipa (September 24, 2020). Cherry Bhargava, Amit Sachdeva. ISBN 9780367536732 (2020). Nanotechnology Advances and Real-Life Applications.CRC Press. Das, Malay K, Pathak, Yashwant V. ISBN: 978-981-15-6255-6 (2020). Nanomedicine and Nano Safety. Springer Singapore Mikhail Y. Berezin. . ISBN: 978-1-118-12118-4 (2014). Nanotechnology for Biomedical Imaging and Diagnostics: From Nanoparticle Design to Clinical Applications Wiley Publishes.
Neuromorphic Engineering	Elishai Ezra Tsur, ISBN: 978-1-003-14349-9, (2021), Neuromorphic Engineering; The Scientist's, Algorithm Designer's, and Computer Architect's Perspectives on Brain-Inspired Computing, CRC Press. Richard F. Lyon and Tor Sverre Lande, ISBN: 9780585280011, (1998), NEUROMORPHIC SYSTEMS ENGINEERING Neural Networks in Silicon, Springer.
Neural Signal Analysis	S Sanei and JA Chambers , EEG Signal Processing, John Wiley & Sons Ltd, 2007.
Computational Neuroscience	P Dayan and LF Abbott , Theoretical Neuroscience, MIT Press, 2005. C Koch, Biophysics of Computation: Information Processing in Single Neurons, Oxford Uiversity Press, 2004. https://www.cnsorg.org/model-database
Neuro navigation Systems	Wolfgang Seeger and Josef Zentner, ISBN: 978-3-7091-6101-2, (2002), Neuronavigation and Neuroanatomy, Springer. Related Journal Articles in Neuronavigation Imaged- Based Localization Techniques.

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Course Fee Structure

Item	Amount (Full Time / Part Time)	
	Military/Police/MOD	Civil
Tuition Fee	Rs. 500,000.00	Rs. 500,000.00
Registration Fee - 3 Years (Initial Registration)	Rs. 4,000.00	Rs. 5,000.00
Library Fees	Rs. 2,000.00	Rs. 2,000.00
Refundable Library Deposit	Rs. 10,000.00	Rs. 10,000.00
Refundable Mess Deposit	Rs. 2,000.00	Rs. 2,000.00
Study Pack	Rs. 2,500.00	Rs. 2,500.00
Total	**Rs. 520,500.00**	**Rs. 521,500.00**

Registration Renewal Fee

1st Year after initial registration - Rs. 12,500/=
2nd Year after initial registration period - Rs. 25,000/=
Continuation to another additional year under any circumstances - Rs. 100,000/=

Repeat Examination Fee

For entire semester - Rs. 2,500/=
For one subject - Rs. 1,000/=
Repeat Thesis Defence
Viva-Voce Fee - Rs. 11,500/=

Note:

1. **FGS will be compelled to not permit the students who are unable to pay the course fee to sit for semester examinations.**
2. **Course fee and other payments mentioned in above subject to change as per the University Board of Management decisions.**

How to Apply

Legal officers of the Tri-services and Police should apply through their Service Commanders and the Inspector General of Police, respectively; and public and private sector personnel through their heads of departments. The application should be addressed to the Dean, Faculty of Graduate Studies. All applicants are required to pass an aptitude test conducted by KDU.

Contact Persons:

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Annex A

E- Library Policy

1. Only visit approved Internet sites.
2. Never give out your personal information.
3. Inform the authority if you see something uncomfortable or inappropriate.
4. Never download irrelevant anything without permission.
5. Leave your workspace as you found it.
6. Print only if you have permission.
7. Never change any settings without permission.
8. Touch the mouse and keyboard gently.
9. Do not eat or drink near devices.