

POSTGRADUATE INSTITUTE OF SCIENCE UNIVERSITY OF PERADENIYA



Master of Clinical Biochemistry Degree Programme (SLQF Level 9)

Master of Science (M.Sc.) in Clinical Biochemistry Degree Programme (SLQF Level 10)

1. INTRODUCTION

We are in an era, where investigations are being directed towards revealing derangements of biomolecular events that lead to ill-health and disease. We also see that techniques of diagnosis are being sharpened to be a sensitive and specific, made simple and cost-beneficial. Technological developments and innovations originate in the technologically developed world and with time take root in developing countries. It is an undisputed fact that, we in Sri Lanka, depends solely on foreign technology in diagnostic Clinical Biochemistry, despite us having an enormous potential for developing our own technology to suit our setting.

In the field of Clinical Biochemistry, which is an important discipline in Diagnostic Laboratory Medicine, there is a phenomenal expansion of inputs which cannot be realistically absorbed in to the local health-care delivery system as it exists today. If we were to absorb the new developments into our health care delivery system, we will need to have appropriately educated personnel armed with proper training, to look out for newer innovations, evaluate the feasibility of adopting them in our country setting and be capable of convincing the decision makers about their relevance. Without a challenge or a contest, we should agree that our laboratory-based diagnostic services can be further improved and must be improved to face a new era of health care.

Our universities put out graduates who have the potential for developing the desired skills and attitudes for developing our laboratory-based Diagnostic Services, provided, they are given the education and direction they are expected to possess. The education and training should focus on developing Clinical Biochemists with evaluative, innovative, creative capabilities, in addition to arming them with relevant knowledge. We must ensure that the proposed MSc is not another degree certificate but it means capabilities.

2. OBJECTIVES OF THE PROGRAMME

The expected outcomes of a person with M.Sc. in Clinical Biochemistry are the duties, responsibilities, skills and commitments at a desirable level for effective and efficient running of the Clinical Biochemistry Laboratory.

A M.Sc. qualified Clinical Biochemist should be able to

- * demonstrate a working knowledge in clinical biochemistry.
- * show the highest level of competency in analytical techniques, methodology, upkeep and use of instruments.
- * ensure maintenance of an efficient and an effective laboratory service.
- * update clinical laboratory technology.
- * make necessary developments and improvements to service facilities when and wherever necessary.
- * function in an administrative, supervisory and an advisory capacity.
- * develop methods for maintaining records, data analysis and retrieval using the latest technology.
- * manage the laboratory in the most effective way.
- * critically review the cost economics of the laboratory investigations and services and advice on cost effective strategies for running the laboratory service.
- * supervise the work of medical laboratory technicians.
- * work as a team member with medical and para medical personnel to deliver better health care.
- * undertake research and disseminate information gathered for the development of diagnostic services in clinical biochemistry.
- * plan and develop educational strategies to provide continuing education to all grades of laboratory staff.
- * demonstrate capabilities of continuing education.
- * take part in undergraduate and post graduate medical education.

3. PROGRAMME ELIGIBILITY

Medical, Veterinary, Dental or science graduates, preferably in biological science with chemistry/ biochemistry/ molecular biology as a subject or any other degree acceptable to the board of study. Suitable applicants will be pre-screened by a committee recommended by the Board of Study in Biochemistry and Molecular Biology using a Screening Examination.

4. PROGRAMME FEE

Category	Programme Fee	
	Master of Clinical Biochemistry degree programme	M.Sc. in Clinical Biochemistry degree programme
Local candidates	Rs. 225,000/-	Rs. 325,000/-
Foreign candidates	Rs. 450,000/-	Rs. 650,000/-

Students registered for the Master of Clinical Biochemistry degree programme shall pay the Programme fee in full or in two installments. An additional payment of Rs. 100,000/- (or Rs. 200,000/- for foreign students) should be made at the end of the first year to continue for the M.Sc. in Clinical Biochemistry degree programme. Other payments including registration fee, medical fee, library subscription, examination fee and deposits (science and library) should be paid according to the procedure stipulated by the PGIS. (N.B. The Programme fees given above may be revised as per recommendation of the Board of Management of the PGIS.)

5. THE PROGRAMME STRUCTURE AND DURATION

5.1 Masters Degree by Course Work (SLQF Level 9)

The Master of Clinical Biochemistry degree can be obtained by completing only the course work component.

Course work, comprising of theory courses, laboratory and/or fieldwork and an independent study, shall be conducted over a period of two semesters of 15 weeks each. The total duration of the degree, including examinations, shall be about 12 months. Satisfactory completion of a minimum of 30 credits of course work with a GPA of not less than 3.00 is required for the successful completion of the degree (Students who do not satisfy the above criteria but obtain a GPA in the range 2.75 to 2.99 for course work of 25 credits are eligible for the Postgraduate Diploma in Clinical Biochemistry, and those who obtain a GPA in the range 2.75 to 2.99 for course work of 20 credits are eligible for Postgraduate Certificate).

5.2 Masters Degree (SLQF Level 10)

Completion of 30 credits of Course work as stated in 5.1 with a GPA of not less than 3.00 is a prerequisite for the Masters Degree by Course work and Research. The research project for the degree should be conducted on full-time basis, and completed during the second year. The research component is allocated 30 credits, totaling 60 credits for the entire programme. Therefore, duration of the entire programme shall be 24 months. After successful completion of the research project, the student shall be eligible for the award of the M.Sc. in Clinical Biochemistry degree - SLQF Level 10 (Students who do not complete the research project within the stipulated time period shall be awarded the Master of Clinical Biochemistry degree - SLQF Level 9).

5.3 Extension of the programme for M.Phil. or Ph.D.

After conducting research for a period of six months in the M.Sc. degree programme under 5.2, students who have demonstrated exceptional progress may apply for upgrading the degree status to M.Phil. The student should continue the research project and any additional research work/assignments recommended by the PGIS for a total of two years (60 credits of research) to qualify for the award of the M.Phil. degree.

During the second year of research, students who have demonstrated exceptional and continuous progress may apply for upgrading the degree status from M.Phil. to Ph.D. The student should continue the research project and any additional research work/assignments recommended by the PGIS for another year on full-time basis (to complete 90 credits of research in total) to qualify for the award of the Ph.D. degree.

Master of Clinical Biochemistry Degree Programme (SLQF Level 9)
Master of Science (M.Sc.) in Clinical Biochemistry Degree Programme (SLQF Level 10)

Programme Summary

Course Code	Course	Lecture hrs.	Practical hrs.	No. of Credits
Semester I				
BM 501	Human Biology and Metabolism	20	20	2
BM 502	Analytical Techniques in Clinical Biochemistry	30	30	3
BM 503	Immunology and Endocrinology	20	20	2
BM 504	Haematology	20	20	2
BM 505	Enzymology	10	10	1
BM 506	Functional Tests in Clinical Biochemistry	30	60	4
BM 507	Basic Laboratory management	10	10	1
Semester II				
BM 516	Molecular Genetics*	10	10	1
BM 517	Paediatric Biochemistry and Intensive Care Biochemistry	10	10	1
BM 518	Therapeutic Drug Monitoring and Toxicology*	10	10	1
BM 519	Clinical Nutrition	20	20	2
BM 520	Advanced Laboratory management	20	20	2
BM 521	Biostatistics	15	30	2
BM 522	Clinical Interpretation	25	10	2
BM 599	Independent Study	500 notional hours		5
2nd Year				
BM 699	Research Project**	3000 notional hours (one year duration)		30

*Optional courses - Students are required to obtain 1 credit from among BM 516 and BM 518

** Compulsory for M.Sc. in Clinical Biochemistry (SLQF Level 10).

6. PROGRAMME CONTENTS

PROGRAMME CONTENTS FOR CH 599 AND CH 699

Code	BM 599
Title	Independent Study
Credits	5
Compulsory/ Optional	Compulsory
Time allocation	500 notional hours
Aims	The overall aim is to familiarize the student with concepts and methods involved in scientific research. Specific aims: 1. To learn the scientific process in the conduct of research. 2. To develop skills to write a review paper and a scientific research proposal. 3. To develop skills to make a presentation. 4. To carry out a case study in Clinical Biochemistry related problem.
Intended Learning Outcome	At the end of the successful completion of the course module, students will be able to, 1. Conduct an independent review of literature on a selected topic in the area of Clinical Biochemistry 2. Write a formal scientific report conforming to the guidelines provided. 3. Transfer the knowledge gained through (1) and (2) above in the form of a presentation. 4. Complete a research proposal conforming to the guidelines provided. 5. Explain the ethics in scientific writing and undertaking research.
Content	<i>Review paper:</i> Review of literature; Development of the review paper in concise and professional manner and logical presentation of results that have been reported, writing the abstract, compilation of the list of references. <i>Proposal writing:</i> Interpretation and critical evaluation of results of published research; Formulation of research problem: Concise literature review, justification, time frame, identification of resources, budgeting, etc. <i>Seminar:</i> Presentation of literature and data collected on given topic; Preparation of abstract, preparation of slides. <i>Case study:</i> Presentation of the results and conclusions of the case study.

Assessment criteria: Continuous Assessment

Component	% marks
Review paper	20
Proposal writing	10
Case study	40
Seminar	30

Recommended Texts:

1. Backwell, J., Martin, J. (2011) A Scientific Approach to Scientific Writing, Springer.
2. Postgraduate Institute of science (2016) Guidelines for Writing M.Sc. Project Report/M.Phil. Thesis/Ph.D. Thesis

Code	BM 699
Title	Research Project
Credits	30
Compulsory/ Optional	Compulsory
Prerequisites	GPA of 3.00 at M.Sc.(Course Work)
Time allocation	3000 notional hours

Aims	The overall aim is to prepare the student to conduct a research independently. Specific aims: 1. To train students to apply scientific method in scientific research. 2. To train students to generate researchable hypotheses. 3. To train students to plan, design and conduct scientific research. 4. To train students to gather reliable scientific data, analyze and interpret. 5. To develop skills in scientific writing.
Intended Learning Outcomes	At the end of the successful completion of the course students will be able to, 1. Apply the scientific method. 2. Design a research project. 3. Complete a research project. 4. Describe ethical issues in scientific research. 5. Explain the patenting process in research. 6. Make presentations at national/international conferences. 7. Produce a thesis conforming to the requirements of the PGIS. 8. Write manuscripts for publication in refereed journals.
Content	The students will conduct sufficient amount of laboratory/filed work on a chosen research topic under the guidance provided by an assigned supervisor/s, make a presentation of research findings at a national/international conference, and produce a thesis.

Assessment criteria

Continuous Assessment	End-semester examination
30%	Oral examination (20%) Thesis (40%) Conference presentation (10%)

Recommended Texts:

1. Backwell, J., Martin, J. (2011) A Scientific Approach to Scientific Writing, Springer.
2. Postgraduate Institute of science (2016) Guidelines for Writing M.Sc. Project Report/M. Phil. Thesis/Ph. D. Thesis

CONTENTS OF OTHER COURSES

BM 501: Human Biology and Metabolism (2 Credits)

Organisation of tissues in the body, digestive system, circulatory system, cardiovascular system, hepatobiliary system, urinary system, musculoskeletal system, nervous system, reproductive system.

BM 502: Analytical Techniques in Clinical Biochemistry (3 Credits)

Spectrophotometry, enzyme linked immuno sarbant assay (ELIZA), radio immuno assay (RIA), Dry chemistry Chromatography, Electrophoresis, Ionmetry Centrifugation, Microscopy

BM 503: Immunology and Endocrinology (2 Credits)

Immunology (*Lectures - 10h, Practical - 10h*): Basic Immunology, Immuno -diagnostic methods, Immunocytochemistry

Endocrinology (*Lectures - 10h, Practical - 10h*): Biochemical endocrinology, Clinical endocrinology, Diagnostic endocrinology

BM 504: Haematology (2 Credit)

Blood components, Red cell metabolism and Anemia, Plasma proteins, Hematological Disorders, Blood bankin,

BM 505: Enzymology (1 Credit)

Basic enzymology, Clinical enzymology

BM 506: Functional Tests (5 Credits)

System Based Tests (*Lectures - 25h, Practical - 50h*): Body fluids, Respiratory, Circulatory, Gastrointestinal, Urinary, Reproductive, Endocrine, Nervous, Musculoskeletal Systems, Tumour Markers.

Awareness of other disciplines (*Lectures - 5h, Practicals - 10h*): Laboratories of Microbiology, Parasitology & Pathology.

BM 507: Basic Laboratory management (1 Credit)

Laboratory Environment (*Lectures - 2h, Practical - 2h*): Laboratory arrangement, Laboratory resources and information.

Safety measures (*Lectures - 4h, Practical - 4h*): Waste disposal, Laboratory management, Administration, Patient care, Ethics.

Biological Samples (*Lectures - 4h, Practical - 4h*): Collection (labelling, request form, patient & container preparation, processing Transport, Storage, Washing and disposal.

BM 516: Human Molecular Genetics (1 Credit)

Human genetics, Polymerase chain reaction and other techniques, Molecular diagnostic methods.

BM 517: Paediatric Biochemistry and Intensive Care Biochemistry (1 Credit)

Paediatric Biochemistry (*Lectures - 4h, Practical - 4h*): Screening of the genetic disorders in neonates, Special paediatric biochemical tests.

Intensive Care Biochemistry (*Lectures - 6h, Practical - 6h*): Fluid and electrolyte balance, Blood gases, Other critical care tests .

BM 518: Therapeutic Drug Monitoring and Toxicology (1 Credit)

Therapeutic Drug Monitoring (*Lectures - 6h, Practical - 10h*): Drug metabolism (anti-epileptic, aminoglycosides, antiasmatic, cardiacglycosides, etc.), Analysis of drug levels in body fluids.

Toxicology (*Lectures - 4h*): Basic toxicology, Agrochemical poisoning, Plant toxins, Animal toxins, Analytical Toxicology

BM 519: Clinical Nutrition (2 Credits)

Basic Principles of Nutrition, Nutritional deficiencies, Nutritional requirements in disease, Diet therapy, Paediatric nutrition, Geriatric nutrition.

BM 520: Advanced Laboratory Management (2 Credits)

Standardisation and use of instruments, Maintenance of equipment, Trouble shooting, Purchasing of laboratory wares, Automation, Laboratory monitoring.

BM 521: Biostatistics(2 Credits)

Statistical Analysis and Quality Control (*Lectures - 10h, Practical - 10h*): Basic statistics, Normal biochemical values, Statistical analysis of laboratory results, Quality control

Computing and Data Handling (*Lectures - 5h, Practical - 20h*)

BM 522: Clinical Interpretation & Ward Classes (2 Credits)

Clinical Interpretation of Laboratory Results (*Lectures - 25h*): Case reports; Medicine, Surgery, Gynaecology & Obstetrics, Paediatrics and Psychiatry

Ward Classes (*Lectures - 10h*): Medicine, Surgery, Gynaecology & Obstetrics

6. PROGRAMME EVALUATION

Evaluation of course work is done as per guidelines stipulated in the PGIS Handbook. Scheme of evaluation of the five-credit independent study (CH 599) and the Research Project (CH 699) is given in Section 6 above.

7. TEACHING PANEL

- Prof. C.N.R.A. Alles, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
B.V.Sc (Perad.), Ph.D (TMDU, Japan); Specialization: Biochemistry
- Dr. N.C. Bandara, Postgraduate Institute of Science, University of Peradeniya
B.Sc (Perad.), M.Sc. (New Orleans), Ph.D. (New Orleans); Specialization: Organic Chemistry & Toxicology
- Mr. L.H.D. Bandusoma, Deputy Director, Sri Lanka Accreditation Board, No. 104/A, Kitulwatte Road, Borella
B.Sc. (Japura), MSc. (Food Science & Technology) (Japura); Specialization: Food Science and Technology, Accreditation of laboratories
- Dr. B.K.T.P. Dayanath, Consultant Chemical Pathologist, North Colombo Teaching Hospital, Ragama
M.B.B.S. (Colombo), Dip. Path, MD (Chem. Path), MAACB (Australia), BPS (Basic Pathological sciences) Australia; Specialization: Pathology, Accreditation of laboratories
- Dr. J.K. Dissanayake, Dept. of Anatomy, Faculty of Medicine, University of Peradeniya
M.B.B.S (Perad.), PG. Dip (Perad.), M.Phil (Perad.); Specialization: Human Anatomy
- Ms. C. Ediriweera, Deputy Director, Sri Lanka Accreditation Board, No. 104/A, Kitulwatte Road, Borella
B.Sc. (Pune, India), M.Sc. (Applied Microbiology) (Kelaniya), Diploma in Food Quality Assurance; Specialization: Applied Microbiology, Accreditation of laboratories
- Dr. P.H.P. Fernando, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
B.V.Sc. (Perad.), Ph.D. (Kahoshima/Japan); Specialization: Biochemistry
- Dr. W.I.T. Fernando, Dept. of Biochemistry, Faculty of Medicine, Peradeniya
B.V.Sc (Perad.), M.Phil (Perad.), Ph.D (Perad.); Specialization: Biochemistry & Enzymology
- Dr. B.L. Goonapienuwala, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
M.B.B.S (Perad.), M.Phil (Perad.); Specialization: Biochemistry
- Dr. S. Iddamaldeniya, Veterinary Research Institute, Gannoruwa
B.V.Sc (Perad.), M.Phil (Perad.); Specialization: Biochemistry
- Dr. A. Kariyawasam, Dept. of Physiology, Faculty of Medicine, University of Peradeniya
B.D.S (Perad.), Ph.D (Toronto); Specialization: Human Physiology
- Dr. K. Maduwage, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
M.B.B.S (Perad.), M.Phil (Perad.), Ph.D (University of Newcastle, Australia); Specialization: Clinical Pharmacology/Biochemistry
- Dr. D.K.K. Nanayakkara, Nuclear Medicine Unit, Faculty of Medicine, University of Peradeniya
M.B.B.S (Perad.), M.Phil (Newcastle, UK), Ph.D. (Perad.), FANMB: Specialization: Nuclear Medicine
- Dr. L.S. Nawarathna, Department of Statistics and Computer Science, Faculty of Science, University of Peradeniya
B.Sc. (Perad.), M.Sc (Texas), PhD (Texas); Specialization: Statistics
- Prof. H.K.I. Perera, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
B.V.Sc (Perad.), M.Phil. (Perad.), Ph.D (Glas.), F.S.C.V.S (SL); Specialization: Biochemistry & Molecular Biology
- Prof. P.A.J. Perera, Professor Emeritus, University of Peradeniya
B.Sc. (Cey.), Ph.D. (Glas.); Specialization: Biochemistry
- Prof. V. Pinto, Dept. of Anaesthesiology and Critical care, Faculty of Medicine, University of Peradeniya

M.B.B.S (Perad.), M.D (Colombo), F.R.C.A (UK) F.C.A.R.C.S.I (Ireland); Specialization: Anaesthesiology and Critical care
 Prof. J.G.S. Ranasinghe, Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya
B.V.Sc. (Perad.), M.Phil (Miyazaki, Japan), Ph.D (Kagoshima, Japan); Specialization: Biochemistry
 Dr. N.D. Senasingha, Veterinary Research Institute, Gannoruwa
B.V.Sc (perad.), M.V.M. (New Zealand), M. Sc. (Perad.); Specialization: Biosecurity
 Prof. R. Sivakanesan, Professor Emeritus, University of Peradeniya
B.V.Sc (Cey.), Ph.D. (Hull), F.S.C.V.S (SL); Specialization: Microbial Biochemistry & Enzymology, Molecular Biology

9. RECOMMENDED TEXTS AND JOURNALS

Texts:

1. *Clinical Biochemistry* Gaw et al. (1995) Churchill Livingstone ISBN 0-443-04481-3
2. *Biochemistry: Molecules, Cells & the Body* Dow, Jocelyn (1995) Addison - Wesley ISBN 0-201-63187-3
3. *Illustrated Text Book of Clinical Biochemistry* Marshall, William J. (1995) Mosby, Wolfe ISBN 0-723421900
4. *Biochemistry for the Medical Science, An Integrated Case Approach* Higgins, S.J.(1994) Longman Current Affairs ISBN 0-582-10129-8
5. *Lippincott's Illustrated Reviews in Biochemistry* Champe Pamela C. (1994) Raven Publ. ISBN 0-397-510918
6. *Harper's Biochemistry* Murray, R K. (1996) Appleton & Lange ISBN 08385-36115
7. *Text Book of Biochemistry* Devlin, T. M. (1997) Wiley (John) & Sons Ltd ISBN 0-471-15451-2
8. *Tietz Text Book of Clinical Chemistry* Burtis, Carl A (1994) WB Saunders Co ISBN 0-7216-4472-4
9. *Clinical Chemistry* Kaplan, L. A (1996) Mosby ISBN 0-8151-5243-4
10. *Varley's Practical Clinical Biochemistry* Gowenlock, AH (1988) Heinemann Medical Books ISBN 08-493-01564
11. *Methods in Enzymology vol 246* Abelson J.N. (1995) Academic Press Inc.(Lon) Ltd ISBN 0-12-182147-1
12. *Clinical Studies in Medical Biochemistry* Glew, R.H. (1997) Oxford Uni.Pres, N.Z. ISBN 0-19-509929-x
13. *Biochemistry & Disease Bridging Basic Sciences & Clinical Practices* Cohn, R.M. (1996) Williams & Wilkins, U.S. ISBN 0-683-02049-8
14. *Biochemistry, A Case Oriented Approach.* Montgomery (1996) Mosby ISBN 0-8151-6483-1
15. *Clinical Biochemistry for Medicine* Laker (1995) W.B. Saunders & Co. ISBN 0-7020-1690-x
16. *Clinical Biochemistry: Metabolic and Clinical Aspects* Marshall, W.J.(1995) Churchill Livingstone ISBN 0-443-04341-8
17. *Tietz Fundamentals of Clinical Chemistry* Burtis C.A. (1995) Saunders (WB) Co Ltd ISBN 0-7216-3763-9
18. *Advances in Clinical Chemistry Vol 31* Spiegel H.E.(1994) Academic Press Inc.(Lond) Ltd. ISBN 0-12-010331-1
19. *Clinical Chemistry in Diagnosis & Treatment* Mayne, P (1994) Arnold ISBN 0-340-57647-2
20. *Clinical Chemistry* Bishop (1996) Lippincott (JB) Co. U.S. ISBN 0-397-55167-3
21. *Clinical Chemistry, Concepts and Applications* Shauna C Anderson Susan Cockayne Saunders Company WB. ISBN 0-7216-3372-2
22. *Clinical Biochemistry in Diagnosis and Treatment (6th edition)* Philip D Mayne(1994) Edward Arnold ISBN 0 340 57647 2
23. *Clinical Laboratory Medicine* Richard C. Tilton, Albert Balows, David C. Hohnadel (1992) Mosby Year Book, Inc. ISBN 0-8016-5873-X

24. *Techniques in Diagnostic Human Biochemical Genetics (A laboratory manual)* Frits A Hommes
A John Wiley & Sons ISBN 0-471-56076-6
25. *Human Nutrition and Dietetics* R. Passmore & M.A. Eastwood ELBS ISBN 0-443-039194
26. *Practical Clinical Biochemistry (Vol. 1, 2) (5th edition)* Harold Varley, Alan H Gowenlock and
Maurice Bell (1976)
27. *Nutrition Essentials and Diet Therapy(6th edition)* Charlotte M. Poleman and Nancy J
Peckenpangh W.B. Saunders Co. ISBN 0-7216-7281-7
28. *Biochemistry, Genetics and Physiology (Volume 3)* Geoffrey Zubay (1983) Wm C Brown
Publishers ISBN 0-697-14880-7
29. *Clinical Chemistry Principles and Techniques (new edition)* Richard J Henry, M.D. (1964)
Harper and Row publishers
30. *Methods Recommended for Essential Clinical Chemical and Haematological Tests for
Intermediate Hospitals Laboratories: Working Group Assessment of Clinical Technologies* (1986)
WHO

Journals:

Annual Reviews of Biochemistry

Annual Reviews of Physiology

Annual Reviews of Nutrition

Trends in Biological Sciences (TIBS)

Clinical Chemistry

British Medical Journal

Lancet

Clinics of North America

PROGRAMME COORDINATORS

Prof. Kumudu Perera

Department of Biochemistry

Faculty of Medicine

University of Peradeniya

Email - kumudup@pdn.ac.lk

Dr. Irushika Fernando

Department of Biochemistry

Faculty of Medicine

University of Peradeniya

Email - irushikawit@yahoo.com