

**MASTERS OF  
HEALTH SCIENCE  
(BIOMEDICAL  
SCIENCE)  
COURSEWORK**

# **Masters of Health Science (Biomedical Science)**

## **Coursework Programme**

### **Introduction**

UKM is the first local university to offer the Bachelor of Biomedical Science (Honours) programme which commenced in the 1992/93 academic year. The main feature of the Biomedical Science programme at the undergraduate level is that it is multidisciplinary with knowledge being imparted at the introductory or intermediate stage. The taught-course Masters in Health Science (Biomedical Science) programme at UKM is the first to be offered in Malaysia. It provides opportunities to graduates, especially those in biomedical science, to enhance their knowledge and skill in biomedical sciences. The information given and knowledge gained are more detailed and focused. There are elective modules that are selected by the student according to the student's interest. Students are also required to carry out a laboratory-based research project.

### **Objectives**

Objectives of this programme are:

- To train Biomedical Scientist so that they are equipped with both clinical laboratory and research skills.
- To enable a higher level of research in Biomedical Science.
- To provide opportunities for knowledge enhancement in specialized fields of Biomedical Science.
- To such as Chemical Pathology, Infectious Diseases and Natural Product Toxicology.
- To produce a pool of graduates at Masters level who can contribute to the continuous development of Biomedical Science.
- To be a leading institute for Biomedical Science education thus fulfilling UKM's aim to be recognized worldwide.

## **Total Units**

The total compulsory units that have been set for this programme is 40 units.

## **Language Used**

The language used for delivery of this course is English.

## **Application procedure**

This Masters programme is offered only **once** a year, at the **first semester** of each academic session, which begins in September. Applications can be submitted from April until May every year for the September intake. Students need to apply online via <http://guest.ukm.my>

## **Course Structure**

This is a **full-time** Masters programme conducted over **3 semesters**. The first semester comprises core subjects, followed by the specialization (elective) module in the second semester. In the third semester, students carry out a laboratory research project and write a project paper. This coursework programme includes lectures, seminars, laboratory and field work, posting at hospitals or other sites, group discussions and presentations.

## **Curriculum for Masters of Health Science (Biomedical Science)**

### **Semester I**

*\*\*Compulsory Module: Core Programme*

<b>Code</b>	<b>Course Name</b>	<b>Unit</b>
NNNB6013	Laboratory Techniques in Biomedical Sciences	3
NNNB6034	Laboratory Techniques in Cellular and Molecular Biology	4
NNNB6052	Laboratory Management	2
NNNB6073	Research Methods & Biostatistics	3
<b>Total Units</b>		<b>12 units</b>

### **Semester II**

*\*\*Specialization Modules : each student is required to select **one** specialization module*

#### **(Specialization I: Chemical Pathology)**

<b>Code</b>	<b>Course Name</b>	<b>Unit</b>
NNNB6344	Chemical Pathology	4
NNNB6364	Laboratory Techniques in Chemical Pathology	4
NNNB6384	Data Interpretation in Chemical Pathology	4
NNNB6624	Research Project in Biomedical Sciences I	4
<b>Total Units</b>		<b>16 units</b>

**(Specialization II: Infectious Diseases)**

<b>Code</b>	<b>Course Name</b>	<b>Unit</b>
NNNB6522	Microbial Diseases	2
NNNB6542	Environmental Microbiology	2
NNNB6562	Attachment in Diagnostic Medical Microbiology Laboratory	2
NNNB6543	Human Parasites and Vectors	3
NNNB6523	Laboratory Techniques and Field Work in Parasitology and Entomology	3
NNNB6624	Research Project in Biomedical Sciences I	4
	<b>Total Units</b>	<b>16 units</b>

**(Specialization III: Toxicology)**

<b>Code</b>	<b>Course Name</b>	<b>Unit</b>
NNNB6124	Natural Product Development	4
NNNB6144	Toxicology Laboratory Placement	4
NNNB6164	Toxicology Laboratory Techniques	4
NNNB6624	Research Project in Biomedical Sciences I	4
	<b>Total Units</b>	<b>16 units</b>

\* Each student is required to choose 1 specialization module.

**Semester III**

**\*\*Compulsory Module: Research and Thesis writing**

<b>Code</b>	<b>Course Name</b>	<b>Unit</b>
NNNB661C	Biomedical Sciences Research Project II	12
	<b>Total Units</b>	<b>12 units</b>

**Grand total units is 40 units**

## **Synopsis of Courses for Masters of Health Science (Biomedical Science)**

### **NNNB6013 Laboratory Techniques in Biomedical Sciences**

This course covers lectures and practicals on various techniques used in various fields of biomedical sciences. The lectures provide adequate background information on particular techniques in order that the students are able to use these techniques effectively and broadly. Practical classes give students the opportunity to carry out techniques in a hands-on fashion thus enhancing their laboratory skills and also allowing the students to acquire technical skills in specific equipment for research.

### **Basic Readings**

Clynes, M. 1998. Animal cell culture. New York: Springer-Verlag.

Gallagher, S.R. & Wiley, E.A. 2008. Current Protocols in Essential Laboratory Techniques. New York : John Wiley & Sons.

Hay, F.C. & Westwood, O. 2002. Practical immunology. 4th ed.. Oxford: Blackwell Science.

Jones, P. 1995. Gel electrophoresis: Nucleic acids: Essential techniques. New York: John Wiley & Sons.

Journal of Biomedical Science. BioMed Central Publishers.

Malaysian Journal of Medical Sciences. School of Medical Sciences, Universiti Sains Malaysia Publisher.

### **NNNB6034 Laboratory Techniques in Cellular and Molecular Biology**

This course covers lectures and practicals in various techniques in cellular and molecular biology. The lectures give adequate information on specific techniques. A hands-on approach is used in practicals so that students will acquire skills in cellular and molecular biology up to the level of research or diagnosis.

### **Basic Readings**

Ausubel, F.M., Brent, R., Kingston, R.E. & Moore, D.D. 1999. Short protocols in molecular biology. 4<sup>th</sup> ed. New York: Van Nostrand Reinhold.

BMC Microbiology. BioMed Central Publishers.

Journal of Biomedical Science. BioMed Central Publishers.

Sambrook, J., MaCallum, P. & Russell, D. 2001. Molecular cloning: A laboratory manual. Ed. ke-3. New York: Cold Spring Harbour.

Tait, RC. 1997. An introduction to molecular biology. New York: Horizon Scientific Press.

### **NNNB6052 Laboratory Management**

This course encompasses lectures and study-visit to places where diagnostic laboratory management is practiced. This course covers various aspects that allow diagnostic laboratories to be managed efficiently and safely in addition to providing quality services. Students are exposed to procedure in purchase of reagents and equipments; storage of reagents and consumables; quality control, quality assurance and safety in laboratories; management, training and development of laboratory personnel.

### **Basic Readings**

Aamodt, A. 2009. Industrial/organizational psychology : An Applied Approach. 6<sup>th</sup> ed. New York: Wadsworth.

Clinical Laboratory Science. American Society for Clinical Laboratory Science Publisher.

Dent, N.J. & Carson, P.A. 1994. Good laboratory and clinical practices. London: Arnold Publication.

Fischbach, F & Dunning, MB. 2008. A Manual of Laboratory and Diagnostic Tests. 8<sup>th</sup> ed. Lippincott Williams & Wilkins.

Laboratory Medicine. American Society for Clinical Pathology Publisher.

Lehmann, C.A.1998. A Manual of Clinical Laboratory Science. Philadelphia: W.B. Saunders.

Stricoff, R.S. & Walters, D.B. 2011. Handbook of laboratory health and safety. 3<sup>rd</sup> ed. New York: John Wiley & Sons.

**NNNB6073 Research Methods & Biostatistics**

The Biostatistics submodule encompasses lectures, tutorials, assignments and also exercises in biostatistics using computers. The Research Methods submodule covers lectures and seminars in the following topics: principle of field epidemiology; types of research; various activities involved in a research: choosing the research area, deciding on the research questions, scientific collaboration, understanding ethical issues in research involving humans and animals, choosing appropriate statistical tests, preparing a complete research proposal for evaluation by the scientific and the ethics committees, monitoring of research activities and research fund usage; and writing of research results for oral and written communication.

**Basic Readings**

- Allen, P & Bennett K. 2008. SPSS for the health and behavioural sciences, 1<sup>st</sup> Ed. Australia: Cengage Learning.
- Bartlett, J.E., Kotrlik, J.W. & Higgins, C.C. 2001. Organizational Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning and Performance Journal*. Vol 19 (1):43-50.
- Brownson, R.C. & Petitti, D.B. 1998. *Applied epidemiology: Theory to practice*. Oxford: Oxford University Press.
- Dawson, B & Trapp, G. 2004. *Basic & Clinical Biostatistics*. 4<sup>th</sup> edition. Boston: Lange Medical Books/McGraw-Hill.
- Mappes, T.A. & De Grazia, D. 1996. *Biomedical ethics*. 4<sup>th</sup> edition. New York: McGraw-Hill.
- Milton, J.S. 1999. *Statistical methods in the biological and health sciences*. 3<sup>rd</sup> edition. New York: McGraw-Hill.
- Tabachnick, B.G. & Fidell, L.S. 2006. *Experimental Design Using ANOVA*. Duxbury Press.



**NNNB6344 Chemical Pathology**

This course contains lectures, projects and self-learning packages. It emphasises the diseases understanding related to chemical pathology and various tests that are routinely performed. Students are also taught about the laboratory management in chemical pathology laboratory.

**Basic Readings**

Burtis, C.A. & Ashwood, E.R. 2011. *Tietz textbook of clinical chemistry*. 4<sup>th</sup> ed.

Philadelphia: W.B. Saunders Co.

Duben-Engelkirk J.L., Fody E.P. & Bishop, M.L. 2000. *Clinical chemistry*. Ed. ke-4.

Philadelphia; Lippincott Williams & Wilkins.

Marshall. W.J. & Bangent. S.K. 2008. *Clinical biochemistry; Metabolic and clinical aspects*. 2<sup>nd</sup>.ed.Edinburgh

Churchill Livingstone. Murray. R.K. Granner D.K. Mayes. P.A.&Rodwell V.W. 2012. *Harpers biochemistry*. 29<sup>th</sup>.ed.London.

McGraw-Hill medical. Scriver, C.R. 2001. *The metabolic and molecular bases of inherited disease*.ed.ke 8 New York; McGraw-Hill

**NNNB6364 Laboratory Techniques in Chemical Pathology**

This course contains practical sessions and demonstrations on various tests performed in chemical pathology laboratories to detect diseases. This course also emphasise the concept and rationale of a test being conducted, methods for detecting laboratory errors, and interpretation of results. The students will also be attached to a chemical pathology laboratory at a selected hospital for a designated period of time.

**Basic Readings**

Burtis, C.A & Ashwood. E.R. 2011. *Tietz textbook of clinical chemistry*. 5<sup>th</sup> ed.

Philadelphia: W.B. Saunders Co.

Estridge, B.H., Reynolds A.P & Walters, N.J.2007. *Basic medical laboratory techniques*. 5<sup>th</sup> ed. Albany USA.

Delmar-Thomson Learning, Godkar, P.B Estridge, B.H. Reynolds, A.P. 2007. Basic  
*Clinical Laboratory Technique*. 5<sup>th</sup> Ed. New York.

Delmar Cengage Learning. McPherson, R.A. Pincus, Mr. 2011. *Henry's Clinical  
Diagnosis and Management by Laboratory Methods*. Philadelphia

Saunders. Varcoe J.S 2011. *Clinical biochemistry: techniques and instrumentation: A  
practical course*. Melbourne: World Scientific Publishing.

Journal of Clinical Pathology. British Medical Journal Publishers.

Journal of Clinical Chemistry .American Association of Clinical Chemistry Publisher

### **NNB6384 Data Interpretation in Chemical Pathology**

This course contains case study, seminars, and presentation of various chemical pathology cases. Students are taught in interpreting chemical pathology laboratory result and to correlate them with patients; medical problems. Furthermore, students will undergo laboratory placements at selected chemical pathology laboratory in order to enhance their knowledge.

#### **Basic Readings**

Burtis, C.A., Ashwood, E.R. 1994. *Tietz textbook of clinical chemistry* Ed. Ke-2  
Philadelphia

W.B Saunders Co. Kaplan, L.A & Pesce, A.J. 1996. *Clinical Chemistry: Theory  
analysis and correlation*. Ed. Ke-3. St. Louis

Mosby. Mayne, P.D. 1994. *Clinical chemistry in diagnosis and treatment*. London Arnold.

Livingstone, Skoog, D.A .Holler, F.J Nieman, T.A 1997. *Principles of instrumental analysis*.  
London Harcourt Publishers.

Walmsley, R.N. & White, G.H. 1994. *A guide to diagnostic clinical chemistry*. Ed. ke-3. \  
Oxford: Blackwell Scientific.

**NNNB6522 Microbial Disease**

This course covers lectures, seminar presentations and practical on various topics in microbial pathogenesis. The lectures provide adequate background information on particular infectious agents so that the students are able to use these knowledge effective and broadly. Assignment include a long essay and seminar presentation. Some practical classes give students the opportunity to carry out techniques in a hands-on fashion thus enhancing their laboratory skills in particular areas.

**Basic Readings**

Mims, C., Dockrell HM, Goering RV, Roitt I, Wakelin, D. and Zuckerman M. 2005.

*Medical microbiology*. 3rd edition. Philadelphia: Elsevier Limited

Benerke, E.S. & Rogers, A.L.. 1996. *Medical mycology and human mycoses*. California:

Star Publishing Company.

Collier, L., Balows, A. & Sussman, M. 1998. *Topley & Wilson's micro biology &*

*microbial infections*. Ed. ke-9. New York: Oxford University Press.

Neal Nathanson. 1997. *Viral pathogenesis*. New York: Lippincott-Raven.

**NNNB6562 Attachment In Diagnostic Medical Microbiology Laboratory**

Students will be taught how to identify bacteria of medical importance in a class practical session. Students will then be attached to a bacteriology or serology laboratory with the aim of learning the processing of clinical specimens in order to obtain accurate laboratory diagnosis..

**Basic Readings**

Cowan, J and Steel, C. 2004. *Manual for the Identification of Medical Bacteria*. 3<sup>rd</sup> ed.

Cambridge.

University Press Konnerman, F 2006. *Colour Atlas and textbook of Diagnostic Microbiology*.

6nd ed. Baltimore

Lippincott, Williams & Willkuns.. Rose, N.R., Hamilton R.G & Detrick, B. 2002.

*Manual of clinical laboratory immunology*, 6<sup>th</sup> ed. Washington D.C

American Society for Microbiology Press . O'Conner, L.2006. *Diagnostic Bacteriology Protocols*.

2<sup>nd</sup> ed. New Jersey

Humana Press. Yap, K.L., A.H. Aziz and M.Salleh M.Yasin, 1999. *Mikrobiologi Makmal*.

Penerbit UKM.

### **NNNB6542 Environmental Microbiology**

This course covered lectures, group presentations and practicals (laboratory and field works). The topics covers are current concepts and principles of environmental microbiology; water-borne pathogens; microbial air contamination; soil microorganisms; microbiology of water contamination (fresh and marine), biodegradation of dangerous chemical compounds; eutrophication. Students will also learn how microbial ecology has been exploited by humans to rehabilitate land contaminated with toxic wastes, and water contaminated with agricultural, industrial and household residues, and the use of microbiology in solid waste management. Laboratory activities include water quality test and techniques and a numeration of water and soil microbes.

### **Basic Readings**

Jones, D.R., Board, R.G., Fredrick, A.S. 1992. *Identification Methods in Applied and Environmental Microbiology*. Oxford: Blackwell Science.

Lightfoot, N.F. & Maier, E.A. 1998. *Microbiological analysis of food and water:*

*Quideline for quality assurance*. Amsterdam: Elsevier Science.

Mitchell, R. 1994. *Environmental Microbiology*. New York: Wiley, John & Sons.

Pepper, I.L., Gerba, C.P. & Brendecke J.W.1995. *Environmental Microbiology A Laboratory Manual*. New York: Academic Press.

Rochelle, P.A. 2001. *Environmental molecular microbiology: protocols and applications*.

Norfolk, UK: Horizon Scientific Press

**NNNB6543 Human Parasites and Vectors**

This course include lectures, seminars and scientific paper review. Course contents covers important parasitic diseases due to changes in human activities. This course also covers some aspects of entomology associated with human health such as insects as vectors of microbes and parasites, forensic entomology and vector control.

**Basic Readings**

Baker, J.R. (2002) *Advances in Parasitology*. Academic Press.

Hirst S. *Trends in Parasitology (Formerly Parasitology Today)*. Elsevier Sciences London

Service, M.W (2001) *Encyclopedia of Arthropod-transmitted Infections of Man and Domesticated Animals*. CABI Publishing New York.

Strickland, T (2002). *Hunters Tropical Medicine 8<sup>th</sup> Edition Philadelphia*.

WB Saunders Company. Heelan JS & Ingersoll FW (2002). *Essentials of Human Parasitology*. New York

Delmar Thompson Learning. *Annals of Tropical Medicine & Parasitology*. Liverpool School of Tropical Medicine Publisher.

Transactions of the Royal Society of *Tropical Medicine and Hygiene*. The Royal Society of Tropical Medicine and Hygiene Publishers.

**NNNB6523 Laboratory Techniques and Field Work in Parasitology & Entomology**

This course is designed to give student the skills necessary to perform parasitological and entomological examinations in the clinical laboratory and also in the field. This course consists of laboratory, visits and field trip to expose the students to the key elements of the course. Complementing NB 6543, the course is a fast-paced excursion through the world of protozoan, helminthic and arthropods important to humans.

**Basic Readings**

Baker J.R 2002 *Advances in Parasitology*. Elsevier Academic Press.

Hirts, S *Trends in Parasitology (formerly Parasitology Today?)*. London. Elsevier Science

Service, M.W. 2001. Encyclopedia of Arthropod-transmitted Infections of Man and Domesticated Animals. CABI Publishing New York.

Chemical methods for the control of vectors and pests of public health importance. Eds: Chavasse & Yap. WHO Pesticide Evaluation Scheme. WHO/CTD/WHOPES/97.2,

### **NNNB6124 Natural Product Development**

This course consists of lectures, seminar (library project/ literature review on various examples of natural products) and visits to natural product research institute (ethnobotany, bioassay laboratory, phytolab and processing plant). It comprises of natural products background and sources and their methods of sampling. Identification, extraction and purification. At the same time, concepts of toxicity associated with the use of natural products and toxicity settings would also be included. In addition, development of natural products as drugs, nutraceuticals and cosmeceuticals and their quality assurance are also emphasized. The course content also covers legal and regulatory aspects natural products and herbal medicine safety assessment and monitoring the products in the market.

### **Basic Readings**

Klaassen, C.D. (2008) Casarett and Doull's Toxicology-*The Basic Science of Poisons*. 7<sup>th</sup> Edition.

McGraw-Hill. Beck-Sickinger, A. & Weber, P. (2002) Combinatorial, *Strategies in Biology and Chemistry*, West Sussex.

Wiley. Dewick, P.M (2009) *Medicinal Natural Products: A Biosynthetic approach*. 2<sup>nd</sup> Edition

Wiley. Dewick, P.M (2001) *Medicinal Natural Products: A Biosynthetic approach*, 2<sup>nd</sup> Edition

Wiley. Niesink, R.J.M., de Vries, J. & Hollinger, M.A (1996) *Toxicology Principles and Applications*. CRC Press.

**NNNB6164 Toxicology Laboratory Techniques**

This course consists of lectures and practical sessions on selected topics on biological activities and toxicological profiles of natural products. Methods of sampling, identification, extraction and purification and in vivo toxicity testing of natural products in drug discovery and development are also introduced.

**Basic Readings**

Torrance, P.F (2000) *Biomedical Chemistry: Applying Chemical Principles to the Understanding and Treatment of Disease*.

Wiley, Klaassen, C.D (2008) *Casarett and Doull's Toxicology-The Basic Sciences of Poisons*. 7<sup>th</sup> Edition. McGraw-Hills. Beck-Sickinger.

A & Weber, P. (2002) *Combinatorial Strategies in Biology and Chemistry*.

Wiley. Dewick, P.M (2009) *Medicinal Natural Products: A Biosynthetic approach*, 3<sup>rd</sup> ed

Wiley. Niesink, R.J.M., de Vries, J. & Hollinger, M.A (1996) *Toxicological Principles and Application*. CRC Press.

**NNNB6144 Toxicology Laboratory Placement**

The course consists of industrial placement for students to gain practical experience for a period of four weeks (4-8 hours a day), in an approved organisation such as research or industrial laboratory mentioned. The practical training is under the supervision of a researcher or supervisor in any related natural product field. For example, the posting is at Melaka Biotechnology Corp. (MBC) / Standards & Industrial Research Institute of Malaysia (SIRIM) / National Pharmaceutical Control Bureau (NPCB).

**Basic Readings**

Klaassen, C.D. 2008. *Casarett and Doull's Toxicology - The Basic Science of Poisons*. 7<sup>th</sup> ed. New York : McGraw-Hill.

Tringali, C. 2011. *Bioactive Compounds from Natural Sources: Natural Products as Lead Compounds in Drug Discovery*. 2<sup>nd</sup> ed. London : CRC Press.

Dewick, P.M. 2009. *Medicinal Natural Products: A Biosynthetic approach*. 3<sup>rd</sup> ed. New Jersey : John Wiley & Sons.

Barceloux, D.G. 2008. *Medical Toxicology of Natural Substances: Foods, Fungi, Medicinal Herbs, Plants, and Venomous Animals*. New Jersey : John Wiley & Sons.

Devlin, T.M. 2010. *Textbook of Biochemistry with Clinical Correlations*. 7<sup>th</sup> ed. New Jersey : John Wiley & Sons.

### **NNNB6624 Research Project in Biomedical Sciences I**

This course involves lectures and tutorial sessions to guide students on writing and presenting a research proposal for a biomedical research project. Students will present their proposal at the end of the semester, and will be assessed on the following content :

- Literature Review
- Research question
- Research objective
- Methodology and flowchart
- Proposal write up
- Proposal presentation
- Ethics approval (optional)

### **Basic Readings**

Ogden, T.E & Goldberg, I.A. 2002. *Research Proposals*. 3<sup>rd</sup> ed. New York: Academic Press.

Friendland, A.J & Folt, C.L. 2009. *Writing Successful Science Proposals*. 2<sup>nd</sup> ed. Yale University Press.

Glasmann-deal, H. 2009. *Science Research Writing: A Guide for Non-Native Speakers of English*. London : Imperial College Press.

Hofmann, A. 2009. *Scientific Writing and Communication: Papers, Proposals, and Presentation*. Oxford University Press.

Ambrose, H.2009, *Handbook of Biological Investigation*. 7<sup>th</sup> ed.



Glass, D.J. 2006 *Experimental Design for Biologists*. Cold Spring Harbor Laboratory Press.

### **NNNB661C Biomedical Science Research Project II**

Project which has been selected and approved by the Department is performed under the guidance of one or more supervisors. The results are then presented in a research report and examined in an oral presentation.

### **Basic Readings**

Alwards, E.C. 2000. *Research paper step by step ; simplified method of learning the research process*.

Westhampton, Mass : Pine Island press.

Asfahl, C.R. 2003. *Industrial Safety and Health Management*, 5th ed. New Jersey :  
Pearson Prentice Hall..

Crowl, D.A. & Louvar, J.F. 2002. *Chemical Process Safety : Fundamentals with Applications*. 2nd ed. New Jersey:

Pearson Prentice Hall  
Goetsch, D.L. 2005. *Occupational Safety and Health for Technologist, Engineers and Managers*. 5th ed. New Jersey : Pearson Prentice Hall.