Subject Code	SN5020
Subject Title	Epidemiological Model Building for Healthcare and Risk Management
Credit Value	3
Level	5
Pre-requisite / Co-requisite/ Exclusion	Nil Students are recommended to have a background knowledge of Epidemiology.
Objectives	To introduce the application of epidemiological model building methods to illustrate spread and control of disease and their use in prediction of disease outbreaks. To use data analysis for interpretation of epidemiological studies with emphasis on control of confounding and logistic regression. To consider the role of the environment with respect to risk management for the prevention of infectious disease.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Consider transmission of disease and how these modes may be described using epidemiological models b) Explain the use of mathematical models of disease spread by use of ordinary differential equations c) Decide on applicability of use of vaccines or other control measures to prevent spread of disease d) Develop SIR and SIS models for vaccines e) Predict the outcome of vaccine use following consideration of particular problems associated with individual infectious diseases f) Predict outbreaks and impact of infectious disease with reference to global surveillance and time order graphs g) Construct confidence intervals for epidemiological risk factors h) Develop and use logistic regression model for multivariate analysis of epidemiological studies i) Integrate the impact of air quality and ventilation systems, and water quality with health impact on airborne infection

Subject Synopsis/ Indicative Syllabus	**Syllabuses:** **1. Transmission of disease** Modes of spread of disease and their description using models. Mathematical models of disease spread using ordinary differential equations. Explanation of use of SIR model Modification of the SIR model to reflect other model(s) of transmission **2. Control of disease** Review control measures on spread of disease with emphasis on vaccine use. Determine effect of control measures on infectious disease models and developing SIR models for vaccines. Consider problems of vaccine use and prioritization of vaccine. Develop SIS models for vaccine use. Consider effect of birth cohort **3. Surveillance of disease** Use of global surveillance, epidemiological data stream networks, use of time-order graphs **4. Epidemiological data analysis** Understanding and using confidence intervals for risk factors, controlling for confounding, use of logistic regression. Laboratory practice using SPSS for analysis of epidemiological data **5. Reduction of risk by maintenance of indoor environment** Understanding the importance of indoor air quality and its health impact. Use of ventilation systems to reduce risk of infection in healthcare. Case study on transmission of airborne infections. Provision of potable water and maintenance of water supplies Reduction of risk of legionella by correct management of water supply systems.

Teaching/Learning Methodology

Learning Approach:

Lectures, tutorials and computing practicing.

Contact Hours:

Lecture	24 hours
Seminar	12 hours
Laboratory	3 hours
Total:	39 hours

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)								
		a	b	c	d	e	f	g	h	i
1. Assignments	60		✓	✓	✓		✓	✓	✓	
2. Test	40	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total	100 %	(Continuous Assessment)								

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Students can evaluate and predict infection risk using basic epidemiological models. They can appreciate the enhancement of building services systems to sustain the healthy indoor environment and understand health risks arising from their operation.

Student Study Effort Required

Class contact:	39 Hrs
Other student study effort:	
▪ Independent self study	30 Hrs
▪ Preparation for seminars	18 Hrs
▪ Student assignments	18 Hrs
Total student study effort	105 Hrs

Reading List and References	**Reading list:** M. J. Keeling and L. Danon (2009) Mathematical modelling of infectious diseases. British Medical Bulletin 92: 33-42 Grassly NC and Fraser C (2008) Mathematical models of infectious disease transmission. Nature Reviews Microbiology 6(6):477-487. Safi MA, Abba B. Gumel AB. (2011) Mathematical analysis of a disease transmission model with quarantine, isolation and an imperfect vaccine. Computers & Mathematics with Applications. 61 (10): 3044–3070 Hethcote HW (2000) The Mathematics of Infectious Diseases. SIAM REVIEW 42(4): 599–653. http://leonidzhukov.net/hse/2014/socialnetworks/papers/2000SiamRev.pdf Jewell NP (2004) Statistics for Epidemiology, Chapman and Hall