

SYLLABUS

Faculty	: Mathematics and science
Study Program	: Biology education
Lecture/Code	: Microbiology/BIO 236
Credits	: 2 unit of semester credit
Semester	: 5
Prerequisites lecture	: Biochemistry, Cell & Molecular Biology
Lecturer	: Anna Rakhmawati, M.Si

I. LECTURE DESCRIPTION :

Microbiology is a lecture that introduces students to brief history of microbiology, microbial diversity and their main characteristics, the impact of microorganisms on human, structure and function of microbial cell, nutrition and metabolism of microorganisms, microbial growth and the control of their growth, microbial genetics, and microbial classification.

II. STANDARD OF COMPETENCE :

Students have understanding of basic concept Microbiology and microorganism also all the aspect and activity of microorganisms.

III. LECTURE PLAN :

Meeting	Basic of competence	Topic	Strategy	Reference
1	Describe of microbial diversity and the impact of microorganisms on human	Introduction to Microbiology : 1. Brief history of Microbiology 2. Microbial diversity 3. The impact of microorganisms on human : a. Microorganisms as disease agent b. Microorganisms and agriculture c. Microorganisms, food, industry, and drugs d. Microorganisms , energy and environment e. Microorganisms and Biotechnology	Lecture, discussion, group project	A:1, 2, 3 B :1, 2
2	Describe structures external and internal to the prokaryotic cell wall also its function	Structure and function of prokaryotic cell (1) : 1. The size, shape, and arrangement of bacterial cell 2. Structure External to cell wall: glycocalyx, flagella, axial filaments, fimbriae and pili 3. Structure Internal to cell wall: Cytoplasmic membrane, cytoplasma, nukleoid, ribosom, inclusions 4. Endospora 5. Cytoplasmic membrane in bacteria and archaea : composition and functions	Lecture, discussion, group project	A:1, 2, 3 B :1, 2

3	Describe cell walls of gram-positive bacteria, outer membrane of gram-negative bacteria, and cell walls of archaea.	Structure and function of prokaryotic cell (2) : 6. cell walls of prokaryotes: a. peptidoglycan b. cell walls of gram-positive bacteria c. atypical cell walls d. outer membrane of gram-negative bacteria e. cell walls of Archaea f. comparison between prokaryotic and Eukaryotic cell	Lecture and discussion	A:1, 2, 3 B :1, 2
4	Explain principles of light and electron microscope also preparation of microbial specimens for microscope	Microscopy and staining: 1. Introduction to microscopy 2. Light Microscope : a. Bright-Field Microscope b. Dark-Field Microscope c. Phase-Contrast Microscope d. Fluorescence Microscope e. Confocal Microscope f. Digital Microscope 3. Electron Microscope a. Transmission Electron Microscope b. Scanning Electron Microscope c. Scanning Tunneling Microscope 4. Principles of staining: a. Gram Staining b. Ziehl-Neelsen Acid Fast Staining c. Special staining: c1. Negative staining c2. Flagella staining c3. Endospore staining	Lecture and discussion	A: 2 B: 2
5	Describe microbial nutrition and mechanisms uptake nutrient by microorganisms	Microbial Nutrition : 1. Nutrients are required by microorganisms 2. Nutrition type of microorganisms 3. Mechanism uptake nutrient by microbial cell: facilitated diffusion, active transport, group translocation, endocytosis 4. Laboratory culture of microorganisms (note: more details on growth microorganisms)	Lecture and discussion	A:1, 2, 3 B :1, 2
6	Connected microbial metabolic pathways of production and utilisation energy	Microbial Metabolism (1): 1. Metabolism 2. Oxidation-reduction reaction 3. The generation of ATP : fosforilasi 3. metabolic pathways of energy production : a. Carbohydrate catabolism : glikolisis; PP; ED b. Cellular Respiration: *) aerobic respiration : TCA, ETC *) anaerobic respiration c. Fermentation	Lecture and discussion	A:1, 2, 3 B :1, 2
7		Microbial metabolism (2): d. Lipid catabolism e. Protein catabolism f. photosynthesis in microorganism	Lecture, discussion, and presentation	A:1, 2, 3 B :1, 2

		4. metabolic pathway using energy: Biosynthesis of polysaccharides, lipid, amino acid and protein, purin-pirimidin		
8		Midterm examination		
9	Describe physical and chemical requirements for microbial growth and explain about culture media	Microbial growth (1): 1. Requirements for microbial growth: physical and chemical 2. Culture media : a. Chemically defined media b. Complex media c. Selective and differential media d. Enrichment culture e. Anaerobic growth media & methods	Lecture, discussion, and group project	A:1, 2, 3 B :1, 2
10	Explain basic principles of bacterial populations growth and measuring microbial growth	Microbial growth (2): 3. growth of bacterial populations: a. Growth terminology b. bacterial reproduction and generation time c. microbial growth cycle d. measuring microbial growth : direct and indirect e. mathematics of exponential bacterial growth 4. Continuous culture : chemostat	Lecture and discussion	A:1, 2, 3 B :1, 2
11	Explain basic principles of controlling microbial growth	Controlling microbial growth : 1. physical methods of microbial control 2. chemical methods of microbial control 3. Antibiotics 4. Antiviral drugs 5. Antifungal drugs 6. bacterial resistance to antimicrobial	Group presentation and discussion	A:1, 2, 3 B :1, 2
12	Explain regulation of bacterial gene expression by operon model	Microbial Genetics (1): 1. Structure and function of genetic material 2. bacterial chromosome and plasmid 3. the flow of genetic information 4. Regulation of bacterial gene expression a. operon model of gene expression b. negative control on transcription: repression and induction c. positive control on transcription	Lecture and discussion	A:1, 2, 3 B :1, 2
13	Explain transfer of material genetics on prakaryote	Microbial genetics (2): 5. Mutation, mutan and mutagen 6. prokaryote genetic transfer 7. Mobile DNA	Group presentation and discussion	A:1, 2, 3 B :1, 2
14	Describe viruses characteristic and impact of viruses on living creatures	1. General characteristics of viruses 2. Viral replication 3. Viral diversity 4. Subviral entities 5. Impact of viruses on living creatures	Lecture, discussion, and group project	A:1, 2, 3 B :1, 2

15	Explain the position of microbial phylogeny on three-domain system and describe microbial characteristics for classification and identification	Microbial classification : 1. Study phylogenetic hierarchy: three-domain system 2. main microbial characteristics for classification and identification: morphological, differential staining, biochemical test, serology, DNA Base composition, DNA fingerprinting, etc.	Lecture, discussion, and group project	A:1, 2, 3 B :1, 2
16		Final examination		

IV. References :

A. Compulsory :

1. Madigan,M.T., Martinko,J.M.Dunlap,P.V.,Clark,D.P.2009. *Brock, Biology of Microorganisms*, 12th ed. Pearson Benjamin Cummings, San Francisco, USA.
2. Prescott,L.M.,Harley,J.P. and Klein,D.A.2002. *Microbiology*, 5th ed. McGraw Hill Companies,Inc.
3. Tortora,G.Y.,Funke,B.R. and Case,C.L.2007. *Microbiology an Introduction*.9th ed.Pearson Benjamin Cummings, San Francisco,USA.

B. Suggested :

1. Atlas, R.M. 1997. *Principle of Microbiology*, 2 nd, Wm C Brown Publishers, USA
2. Black, J.G. 2008. *Microbiology, Principles and Explorations*, 7th ed. John Wiley & Sons, Inc. Asia.
3. Cano, R.J. and J.S.Colome. 1986. *Microbiology*.West Publishing Company, St.Paul,USA

V. Evaluation :

No.	Evaluation component	Score (%)
1	Attendance (75% minimum presence)	10
2	Participation	20
2	Assignment	20
3	Midterm examination	20
4	Final examination	30
	Total	100

Lecturer

Anna Rakhmawati, M.Si

