



UNIVERSITI TEKNOLOGI MARA

BCT422: BIOMASS RESOURCES

Course Name (English)	BIOMASS RESOURCES APPROVED
Course Code	BCT422
MQF Credit	3
Course Description	Biomass refers to living biological material which can be used as fuel or for industrial production. Most commonly biomass refers to plant matter grown for use as biofuel but also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It is usually measured by dry weight. The term "biomass" is especially useful for plants, where some internal structures may not always be considered living tissue, such as the wood (secondary xylem) of a tree. Biomass is grown from several plants, including bamboo, rattans, kenaf, jute, flax, hemp, sisal, corn stalk, wheat straw, sugarcane, and etc. The particular plant used is usually not very important to the end products, but it does affect the processing of the raw material. Production of biomass is a growing industry as interest in sustainable fuel sources is growing. This course introduces different biomass materials which include wood resources, agricultural tree crops and residues and non-wood fiber crop materials. The types, characteristics, assessment and management of these materials will be covered in this course.
Transferable Skills	Demonstrate ability to understand issues and challenges in biomass resources and suggest effective solutions
Teaching Methodologies	Lectures, Lab Work, Field Trip, Discussion, Small Group Sessions
CLO	<p>CLO1 Define biomass resources and explain the different types of these resources and their measurement and estimation methods</p> <p>CLO2 Write and explain the different between plants, trees, shrubs and herbs and between gymnosperms vs. angiosperms, monocots vs. dicots, and evergreen vs. deciduous.</p> <p>CLO3 Verbally, visually (pictures) and discuss methods of tree identification based on vegetative characters.</p> <p>CLO4 State, write, describe and categorize tree species from the family for Dipterocarpaceae and Non-Dipterocarpaceae</p> <p>CLO5 Assess and discuss of the importance of non-wood forest products and tree crops for commercial fibers.</p> <p>CLO6 Demonstrate methods for biomass resource estimation techniques.</p> <p>CLO7 Demonstrate and experiment field inventory techniques used for biomass resource assessments.</p>
Pre-Requisite Courses	No course recommendations
Topics	
1. Introduction to the course 1.1) Course contents	
2. Introduction to biomass resources 2.1) Types of Biomass	
3. Biomass resources – agricultural tree crops 3.1) Development of rubber and rubberwood in Malaysia	
4. Assessments of biomass resources 4.1) Stand level biomass estimation	
5. Inventory and monitoring of biomass resources 5.1) Modelling biomass using regression	

6. Plant identification based on vegetative characters 6.1) Identification of forest trees - forest and leaf characters
7. Tree species identification - Dipterocarpacea 7.1) Genera and species for the family of Dipterocarpaceae
8. Tree species identification - Non-Dipterocarpaceae 8.1) Family, genera and species for Non-Dipterocarpaceae
9. Non-woody biomass crops and their botanical identification 9.1) Rattan, bamboo and non-woody crops

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Individual Project	Herbarium collection	5%	CLO4
	Quiz	Quiz on rubber and rubberwood development	5%	CLO2
	Test	Test 1	15%	CLO1 , CLO2 , CLO3
	Test	Test 2	15%	CLO4 , CLO5 , CLO6
	Written Report	Trip reports	10%	CLO4

Reading List	Recommended Text
	<ul style="list-style-type: none"> • Suratman, M.N 2011, <i>Remote sensing imagery for rubber plantation monitoring.</i>, UiTM Press [ISBN: 9789673633265] • John Wyatt-Smith, K. M. Kochummen 1999, <i>Pocket Check List of Timber Trees</i>, Malayan Forest Records No. 17 Ed. [ISBN: 9839592947] • Symington, C.F and P.S. Ashton & S. Appanah and H.S. Barlow 2004, <i>Foresters' manual of dipterocarps</i>, 2nd Ed., Forest Research Institute Malaysia Kuala Lumpur [ISBN: 9832883008]
Reference Book Resources	<ul style="list-style-type: none"> • Adnan Mohamad 2003, <i>Pokok-pokok untuk tanaman bandar</i>, 2nd Ed. Ed., na, na na [ISBN: 9832181518] • P. K. Balan Menon, Ani Sulaiman, S. C. Lim 2000, <i>Structure and Identification of Malayan Woods</i>, Malayan Forest Records No. 27 Ed., na, na FRIM [ISBN: 9832181577] • Bolton, A.J. 1995, <i>The potential of plant fibers as crop for industry use</i>, Outlook on Agriculture, 24(2) Ed., na, na na [ISBN: 00307270] • Chih Min Boo, Sharon Y. J. Chew, Jean W. H. Young 2000, <i>Plants in Tropical Cities</i>, na Ed., na, na na [ISBN: 9789810880712] • na 2000, <i>Progress in new crops.</i>, na Ed., na, na na [ISBN: 9789535101] • Harold Ernest Desch, J. M. Dinwoodie, <i>Timber</i>, McMillan Press [ISBN: 9780333257524] • Capelle, A., J. Janick 1996, <i>Hemp: Specialty crop for the paper industry Progress in new crops</i>, na Ed., na, ASHS Press Arlington, VA [ISBN: 978038209024] • Jörg Müssig 2010, <i>Industrial Applications of Natural Fibres</i>, 7 Ed., na, Wiley na [ISBN: 9780470695081] • Pusat Penyelidikan Hutan (Malaysia) 2000, <i>Tree flora of Malaya</i>, 1,2,3.4 Ed., Volumes I, II, III and IV., FRIM FRIM [ISBN: 9679762025] • James M. Dempsey 1975, <i>Fiber Crops</i>, na Ed., na, University Press of Florida na [ISBN: 9780813004495]

Article/Paper List	This Course does not have any article/paper resources
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Other References	<ul style="list-style-type: none"> • Website nana, na, na http://www.hort.purdue.edu/newcrop/default.html • Website nana, na, na http://www.agf.gov.bc.ca/resmgmt/fppa/re_fguide/commodi • Website nana, na, na http://www.senr.bangor.ac.uk/research/themes/agroforestry
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- Website *nana*, na, na
http://www.bamboo-identification.co.uk/html/common_gen
- Website *nana*, na, na
<http://www.tfbc.frim.gov.my/default.asp>
- Website *nana*, na, na
<http://www.rimbundahan.org/home.html>
- Website *nana*, na, na
<http://floraofsingapore.wordpress.com>
- Website *nana*, na, na
<http://www.asianplant.net>
- Website *nana*, na, na
<http://www.iucn.org>